

Maternal Mortality Ratio in Sri Lanka: towards a single digit

D. Attygalle¹

Brief Report (i)

Sri Lanka is different among the developing nations in that it has been able to achieve and maintain human development outcomes that are highly contrasting to the level of its per capita income. We are a country with low maternal mortality and low fertility. The pride in these achievements and the importance given to the topic is reflected in the number of orations, articles, books and chapters published on the problem. Looking in to the future it is appropriate to ask the question “can Sri Lanka reach a single digit Maternal Mortality Ratio (MMR)?” and if so what needs to be done to reach this goal.

It is documented that during an hour, around 40 women would die worldwide of a cause attributed to motherhood (1). However in Sri Lanka, we are more fortunate - 40 women would die over a period of about 105 days. The reduction in maternal mortality and factors that brought about these changes has been well documented.

At this point of time it is appropriate, to look into the future and ask the question “How long would it take for Sri Lanka to reach a single digit MMR?” In examining this possibility it is important to understand the extent of the current problem.

Although deaths have been registered in Sri Lanka from the end of the 19th Century, it is well documented that there is underreporting of maternal mortality by the Registrar General's Department due to various reasons. It has been shown that maternal mortality data from the maternal death investigations have more complete coverage. The observed difference between the two sources is probably due to the increasing efficiency of the maternal death review process in identifying maternal deaths.

In this review article maternal mortality data published by the Ministry of Health is used primarily from the Medical Statistics unit of the Ministry of Health, data from Registrar General's Department (RG) and other published data are also used (2). The most recent published figure available in Sri Lanka is for the year 2008. There were 135 maternal deaths giving a MMR of 34.6 per 100,000 live births (3).

The maternal mortality ratio captures the probability of a woman dying once she gets pregnant and is a reflection of the obstetric risk. A more comprehensive indicator which will capture the reduction in risk associated with declining fertility is the life time risk of a maternal death. The calculation of life time risk is conceptualised in three different ways (4).

The concept of life time risk presented here represents the risk of a maternal death during a woman's reproductive life time. It is calculated that the life time risk for the period 2002-2004 is 0.102%. This calculation is based on MMR which has been shown to yield the most accurate results and using life tables for years 2000-2002, the assumption being that the 2000-2002 life table values are applicable for the period 2002-2004. It is observed that although the MMR of Eastern Asia is similar to that of Sri Lanka, the life time risk in Sri Lanka is higher (5,6). This is reflected in the comparatively higher fertility in Sri Lanka (7).

The characteristics of women who died due to maternal causes during the period 2001-2007 from the published data shows that the risk of a maternal death increases with increasing age. The highest MMR was observed among women over 35 years of age with a 3.2 times higher likelihood of dying as compared to a younger mother. Although this age group accounts for 11.4 % of the total births in the country, 25% of maternal deaths occur in this age group (2,8).

The MMR increases with increasing parity. The risk of a maternal death is 2.2 times higher in 3rd pregnancy and above as compared to a mother in her first pregnancy. In this context it is important to examine the stated desire for children among these women. Information available from the Demographic and Health Survey of 2006/2007 shows that there is a marked interest to control the number of births after the second child; 62.6 % of women did not want any more children. However, only 50% of women who had 3 or more children and did not want any more, adopted a permanent method of family planning (7,9).

During national maternal death investigations, unmet need in family planning in women is assessed by the team investigating the death. During the period 2001-2005, the pregnancy was unplanned and often unwanted among 39% of the mothers who died (6,10). The more significant finding is that in women over 35 years of age who died, the unmet need was higher being on average 52% over the five year period and that in maternal deaths of higher parities i.e in those having more than 4 children, the unmet need was 85%.

Among the maternal deaths, 37% have occurred during the antenatal period, 4% during the intra natal period and 58% during the post natal period. Of all postnatal maternal deaths, 61% occurred between the 2nd and 42nd day after delivery (3,6).

1. Consultant Community physician

Correspondence : dattygalle@unicef.org

It is important to note that, during the period 2001-2005, only 2% of women delivered at home (3,10). Four percent of the maternal deaths were among women who delivered at home. In 2006, approximately 7000 mothers delivered at home and the MMR in these women was 100 per 100,000 LB. In the Family Health report 2008-2009, births taking place at home is reported to be low as 0.3%. Even though the number of home deliveries have come down the risk to the individual mother remains the same.

It is observed that direct obstetric causes still account for the bulk of the deaths. The indirect causes appear to gain increasing importance accounting for about a quarter of the deaths. The cause specific mortality ratios for the period 2001-2007 shows a declining trend in postpartum haemorrhage (PPH) and pregnancy induced hypertension (PIH). MMR due to septic abortion have remained more or less the same while the MMR due to cardiovascular disease has fluctuated (3,6).

More recent data for the years 2005-2007 shows that PPH is the leading cause of maternal mortality, accounting for 17% of the deaths. Seventy nine percent (78.5 %) of these mothers delivered in hospitals. It is important to note that a little over a fifth (21.5%) of these deaths is in mothers who have delivered at home or on the way to hospital. The risk of PPH in a mother who has delivered outside a health facility is 3.6 times that of a mother delivering in hospital. Furthermore, 60% of these deaths due to PPH occurred within the first 24 hours and 40% between 2nd to 42nd day.

MMR due to cardiovascular disease has increased and ranked second accounting for 13% of the deaths. The commonly observed underlying conditions are Rheumatic heart diseases and congenital heart diseases (6). Maternal death due to septic abortion accounts for 10% of maternal deaths and rate had remained static over the past decade. Hypertensive disorders in pregnancy accounts for 9% of the deaths, and a steady decline in deaths due to this condition was observed (3,8).

Post partum haemorrhage, pregnancy induced hypertension, septic abortions and heart diseases complicating pregnancy account for only 50% of the deaths. Ectopic pregnancies, reproductive tract sepsis due to causes other than abortion and other medical conditions such as liver disease are the next set of important causes that need attention. Amniotic fluid embolism is being increasingly diagnosed clinically in recent times.

The three delay model conceptualized by Thaddeus and Maine (1994) is an indicator of access to care and

has been modified for use in Sri Lanka to include the field health care component including family planning. The model identifies three phases in access to care, delay in seeking care, delay in reaching care and system failures. It should be noted that a single mother may fall into more than one category; hence the sum of the 3 categories exceeds 100% for any given year.

Over the last five years a considerable proportion, (74%) of mothers experienced the third delay. The third delay is directly associated with health service provision, both preventive and curative components. The high percentage experiencing a third delay is unacceptable in a setting where 84% of births occur in specialist institutions and 95 % antenatal coverage.

It is also noted that 59% of mothers experienced the first delay which is due to poor awareness about risk conditions and the danger symptoms. This high figure is unacceptable given the high literacy rate among women and the high levels of contact with services. It is encouraging to note that proportion of mothers who have received optimal care has shown a marginal increase during the period 2005-2007. However it is important to note that 70% of deaths were identified as has having suboptimal care.

It is important to review the district disparities of the MMRs. The average maternal mortality ratios for the period 2001-2008 were calculated for purposes of analysis.

The three districts namely Nuwara Eliya, Badulla, and Ratnapura, which account for only 12 % of births, account for nearly 18 % of all maternal deaths. The high mortality rates observed may be attributed to many factors. One of the often discussed fact is the high estate population in these districts: 45% in Nuwaraeliya and 20% in Badulla and Ratnapura.

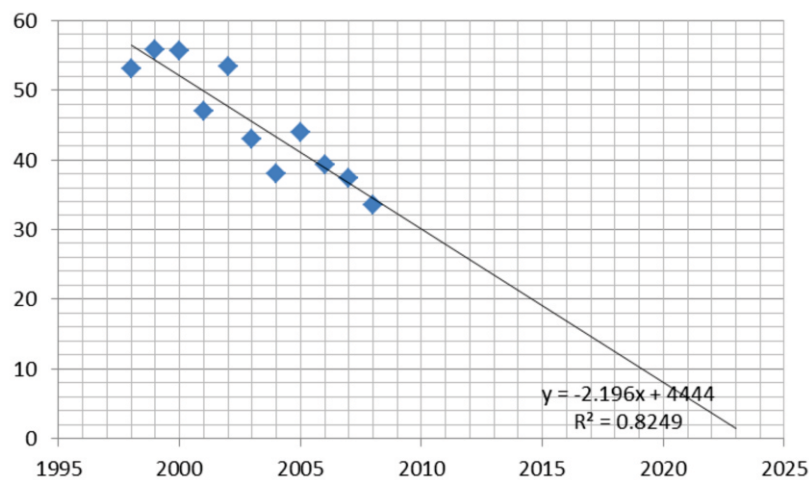
However, it is important to note that the decline in mortality in the estate sector during the 11 year period from 1995-2006 is 42% compared to the national decline of 28%. It is seen that 21% of deaths are from the districts of Northern and Eastern provinces. These districts account for only 12% of live births. The districts in these Provinces had MMR varying from 48 per 100,000 LB in Killinochchi, 73 per 100,000 LB in Batticaloa, 63 per 100,000 LB in Vavuniya and 62 per 100,000 LB in Ampara including Kalmunai.

It is seen that there are fluctuations and an overall increasing trend in the data up to 1997. This is probably due to improvements in the reporting

system. Therefore, only the data after 1997 were used in the trend analysis.

at a higher rate of decline in the first few years. Assuming that the live births would remain close to

Figure 1: Time trend towards a single digit

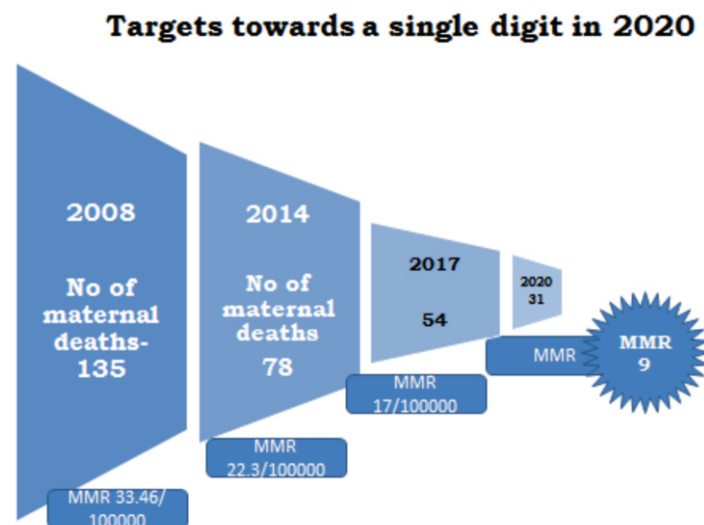


A linear model was decided upon because the best goodness of fit estimates were obtained with a linear model compared to other non linear models that were explored. The regression model (figure 1) shows that if the current trend was to continue a single digit MMR of 9 per 100,000 LB would be a reasonable expectation by 2019-2020.

the current values, possible targets to work towards could be 78 deaths in 2014, 54 deaths in 2017 and 31 in 2020 as shown in the above figure.

An important strategy in this respect would be to work towards reducing the district differentials in MMR. The challenge is to bring resources together to serve those in greatest need.

Figure 2:



The average rate of decrease of MMR over the next 12 years would be 2.2 per 100,000 LB. Assuming that the number of births will remain close to current values, as predicted by demographic models, there should be an overall reduction of approximately 8-10 deaths per year, if the target is to be achieved. However it is reasonable to expect that the rate of decline MMR will slow down with progressive decrease in the ratio. Therefore it is reasonable to aim

Health related factors as well as non health factors such as political; socio economic and cultural determinants influence these differences. It is noted that the causes of maternal deaths do not vary greatly between the districts.

The figure 8 shows the possible district targets to work towards if the national target set above is to be achieved.

Figure 3: District differentials in MMR from 2001 -2008

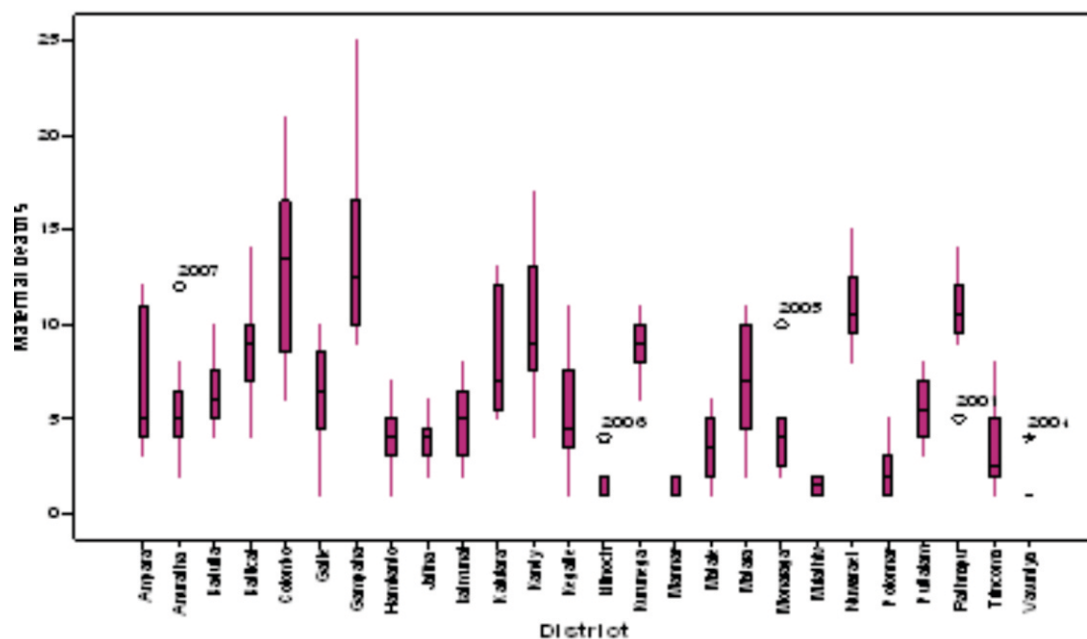
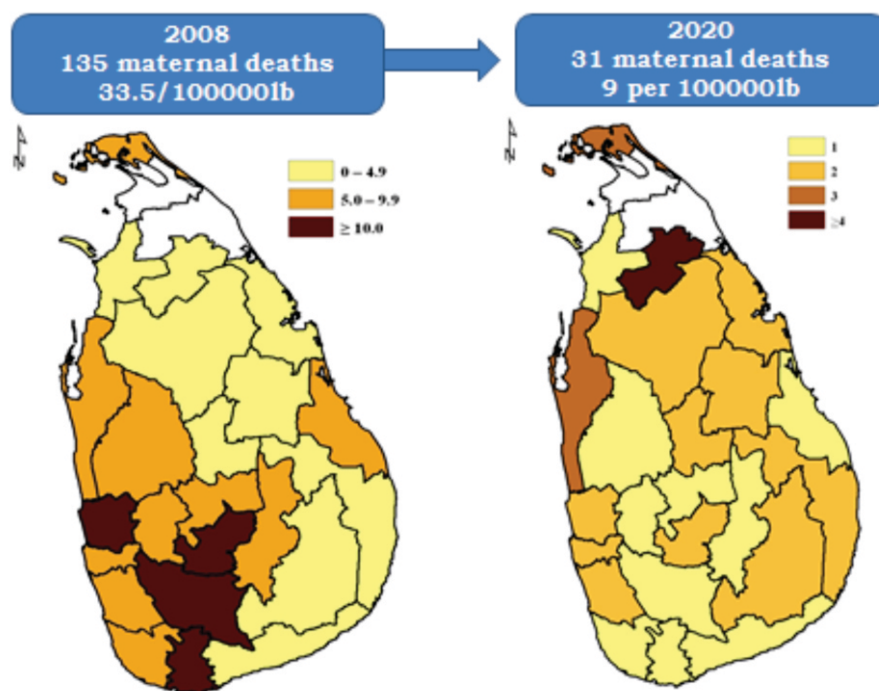


Figure 4: District targets



The few factors that may influence the district differentials in MMR were examined using multiple non linear panel data regression. A log-log model with random effects was used.

Table 1: Multiple Regression Analysis

Explanatory Variables (Independent variables)	Dependent Variable (Maternal Deaths per 100,000 live births) (Log)	
	Coefficient	Probability
Economic		
Poverty Head Count Ratio (Log)	0.160	0.045*
Health		
VOG per 10000 live births (Log)	-0.45	0.000**
PHM per 10000 live births (Log)	-0.034	0.843
Education		
Female Primary Completion rate (Log)	-0.082	0.879
Number of districts used in the analyses	17	
Number of panel years	05	
Year fixed effects	NO	
District fixed effects	NO	
R-square	68%	

Note: *Significant at 5%, ** significant at 1%

MMR for the years 2000, 2002, 2004 and 2008 from 17 districts, excluding those of the North and East were used as the dependent variable. The independent variables used were poverty head count ratio, specialist obstetricians per 10000 live births, PHM per 10000 live births, and female primary education completion rates.

In interpreting the model, the data limitations experienced in the analysis have to be taken into account. For the dependent variable, data for the districts in the Northern and Eastern provinces were not available. The independent variables explored were limited due to unavailability of data in a form that could be used in the model.

The poverty head count ratio, and the number of specialist obstetricians per 10000 births were the two factors that were found to be statistically significant. The random effects were not significant suggesting

that no other external factors related to time and districts contributed for model significance.

The model suggests that if we were to keep all other variables constant we will have to reduce the poverty head count ratio to 1% to achieve a single digit MMR. This may not be feasible in the present context as the average poverty head count ration in 2006-07 was 15.2%, the expected reduction by 2015, being 10%.

There is no doubt that socio-economic development will hasten our progress towards a single digit MMR. However, we cannot wait for maternal mortality to improve following socio-economic development. The second factor that the model identified as important was the number of Specialist obstetricians per 10,000 births. This reflects the fact that improvement in clinical care has an important role to play in further reduction in MMR from the current situation. The average number of Obstetricians in

government services at present is three per 10,000 LB while the model predicts seven per 10,000 LB as being needed to achieve a single digit. While we plan for this increase there is much that can be achieved through equitable distribution of available resources and optimising the quality of care (11).

There is inequity in distribution of specialists Obstetricians in the country. In the high mortality districts the number of specialist per 10,000 LB varies from 0 to 2.5, whereas in the low mortality districts it varies from two per 10,000 to 5.5 per 10,000 LB.

The statistical significance of availability of Visiting Obstetrician and Gynaecologists (VOG) in the model may also be interpreted as a proxy indicator of emergency obstetric care (EMOC) in a district and highlights the importance of focusing on providing universal access to comprehensive emergency care.

The first of these is the availability of at least five facilities per 500,000 population providing EMOC, at least one which should be providing comprehensive emergency care. We have achieved this at the national level and also at district; however according to the current information in 2010 of Medical Statistics Unit shows that districts of Mannar, Mulativu, and Kilinochchi has not achieved the above recommended values. The next indicator to consider is accessibility of services taking into consideration geographic terrain and transport facilities. This information is currently not available. To consider a facility as providing Comprehensive EOC, nine signal functions should be provided 24 hours a day, 7 days a week (24/7). In our country all stations that have a specialist obstetrician is capable of providing all 9 signal functions. However, it is noted that in 41% of institutions where VOGs are posted there is only one VOG, thus making it impossible to provide 24/7 cover. It is important that institutions with specialists be provided with supportive services such as Intensive Care Unit and high dependency beds, laboratory, anaesthetic and blood transfusion services.

The proportion of all births delivered by caesarean section (CS) is a morbidity indicator that is used in the assessment of EMOC functions. The acceptable level for this indicator is considered as 5-15% of all births at regional or national level. The global survey conducted in 2008 showed that the caesarean section rate in Sri Lanka is as high as 31% (12). However, the determinants of CS are multiple and complex and it is necessary to study the factors pertaining to the local situation.

Of the other indicators used to assess EMOC functions we do not have data on case fatality rates, and the proportion of women with complications

treated in an institution with Comprehensive EMOC. Data shows that only 18% of births occur in government facilities without specialist care. Each year this amounts to 40-50 thousand births. Therefore, provision of quality intranatal care and basic EMOC at these institutions is fundamental. It should be made mandatory that only medical personnel with obstetric experience are posted to these settings or such experience should be provided before assuming duties.

The descriptive statistics presented earlier points to the fact that improving the quality of care and reducing the third delay is likely to result in substantial reductions in MMR. The implementation of national guidelines and protocols already developed as well as establishing quality standards in obstetric care and monitoring these are priorities. A process of regular action oriented clinical audits would be invaluable.

Providing emergency services is a team effort. In this respect it is important to carry out group training for EMOC so that each member of the team know and understand their function during an emergency.

Importance should also be given to reducing deaths due to delay in recognition of complications and danger signs. The four main causes of maternal death account for nearly 50% of deaths. Minimising deaths due to PPH and PIH would be very important in moving towards a single digit. In preventing deaths due to heart disease and other medical conditions the establishment of referral facilities for shared care through multidisciplinary teams is of utmost importance.

Deaths due to abortion have not changed much over time and can only be reduced through reductions in unplanned pregnancies. Provision of easily accessible permanent methods or temporary methods that does not need frequent visits to health care providers is important in this respect. This approach would also help reduce maternal deaths among women in older age groups and with high parities. Calculation of attributable risk fractions show that 7.8% of maternal deaths could be prevented through prevention of births exceeding the third parity. Restricting fertility to those under the age of 35 years would result in a decrease of 20% of MMR (13).

It is important to note that the four leading causes account for the 50% of maternal death while the remaining are due to a multitude of causes. Among them amniotic fluid embolism and sepsis other than due to abortion and medical conditions complicating pregnancy are important. It must be noted that facilities for accurate diagnosis of these conditions are essential.

One of the pre requisites of the progress towards a single digit is monitoring and evaluation of interventions. Good quality data made available in a timely fashion is essential for this. While making every effort to improve the coverage of maternal death investigations, steps must be initiated to improve the vital registration system.

There is a considerable amount of information available from the maternal death investigations. This data needs to be analysed in detail, presented and discussed ensuring anonymity, in a wide forum of stakeholders and fed into fine tuning of services. With decreasing number of maternal deaths it is timely to examine the feasibility of introducing a confidential inquiry into maternal deaths. This would help to identify sensitive but crucial areas which will help improvements in clinical care services.

Equitable distribution of physical and human resources, ensuring timely and 24/7 access to EMOC for every woman who experiences a complication, re-focusing services to improve quality of care, creating awareness of the process of motherhood and promoting the concept of planned pregnancy are measures that will help us to go a long way along this journey. No woman should die giving life. It is a social injustice that is not acceptable. We have come a long way and we have a long journey ahead. May our country move towards this goal as early as possible.

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