Preventable stillbirths and neonatal deaths in Malaysia: An analysis of the under-five mortality surveillance data 2015–2017

Norain Ahmad, DrPH[1,2], Rosnah Sutan, PhD[1], Azmi Mohd Tamil, MPH[1], Rozita Ab Rahman, MPH[3]

[1]Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, Bandar Tun Razak Cheras, Kuala Lumpur, Malaysia, [2]Bachok District Health Office, Bachok, Kelantan, Malaysia, [3]Family Health Department Division, Ministry of Health, Putrajaya, Malaysia

ABSTRACT

Introduction: The under-five mortality (U5M) trend in Malaysia significantly declined from 30.0 per 1000 live births (1980) to 8.0 per 1000 live births (2004), and the trend plateaued over the next two decades. Stillbirths and neonatal deaths were the major contributors to U5M. Scarce literature addressing factors associated with preventable U5M in Malaysia. The objective of this study was to describe preventable stillbirths and neonatal mortality, the associated factors and recommendation for improvement.

Materials and Methods: The U5M surveillance data from 2015 to 2017 was retrieved for Malaysian cases of stillbirths and neonatal deaths with multiple pregnancies as exclusion. Stillbirth and neonatal death cases were analysed descriptively for socio-demographic and clinical characteristics. Logistic regressions were performed to identify the associated factors.

Results: There were 15,444 cases selected for analysis, of which 55% of stillbirths and 45% of neonatal deaths. There were 21% of preventable deaths (U5M) and the major contributing causes of preventable stillbirths and neonatal deaths were classified as perinatal death (82.5%), infectious and parasitic diseases (4.1%) and congenital malformations (3.5%). The birth weight (aOR 6.03, 95% CI: 4.14–8.79), hypertensive mother (aOR 1.88, 95% CI: 1.66–2.12) and instrumental delivery (aOR 1.64, 95% CI: 1.16–2.31) were significantly associated with preventable stillbirths and neonatal deaths. Higher household income (>RM3000 per month) was noted as a protective factor (aOR 0.79, 95% CI:0.69,0.89). Mothers with ethnicities other thanBumiputera, single mothers and housewives were identified as the group of mothers with higher odds of poor perinatal services. Among the 3242 cases of preventable stillbirths and neonatal deaths with a complete documented level of adequacy and quality of healthcare, the most frequently identified factors were due to insufficient antenatal care (ANC) (20.4%), non-compliance with medical advice (12.3%) and unsuitable place of delivery (8.6%).

Conclusion: Increasing trend of preventable stillbirths and neonatal deaths was noted over 3 years (2015–2017), and one-fifth was related to insufficient ANC service-related factors. Remedial measures in improving the quality of ANC services with an emphasis on the targeted high-risk maternal socio-demographic group (other Bumiputera, older antenatal mothers, nonmarried, poor family income neglected family) and enhancing ANC competency skills among the healthcare provider through adequate training are required to decrease preventable stillbirths and neonatal deaths in Malaysia.

INTRODUCTION

Under-five mortality (U5M) rate is a primary indicator of the health status of a population. It was defined as the probability of a child dying between birth and exactly 5 years of age.[1] It was further categorised based on age classification, i.e., neonatal death, perinatal death and toddler deaths. Stillbirth is defined as births after 28 completed weeks or more of gestation without any sign of life during delivery.[2] Perinatal mortality refers to stillbirths and deaths of infants aged less than 1 week and meanwhile, neonatal death is defined as deaths of infants less than 28 days.[2] The global U5M rate declined by 61%, from 93 deaths per 1,000 live births in 1990 to 37 in 2020.[1] In Malaysia, the U5M rate decreased from 18 per 1000 live births in 1990 to 6 per 1000 live births in 2009.[2] However, rates have plateaued at 5.3 (stillbirth death rate), 8.3 (perinatal death rate) and 4.5 per 1000 live births (neonatal death rate) for the year 2020.[3-5]

Stillbirths and neonatal mortality have been linked to poor intrauterine conditions, insufficient healthcare services, poor socio-economic levels, and certain biological factors. It was found that antenatal and intrapartum complications, birth defects, infections, and maternal comorbidities, especially hypertension and diabetes, were the most common causes of stillbirths.[6,7] Preterm birth, intrapartum-related complications such as birth asphyxia, infections, and birth defects were the most common causes related to neonatal deaths.[7,8] Based on the U5M report,[5] the causes of stillbirths and neonatal deaths were related to conditions from the perinatal period, including congenital malformations, certain parasitic and infections, respiratory disease, nervous system and injuries, poisons and other external factors. Among these preventable

deaths, 44% were reported in 2006, declining to 30% in 2019.[4,5]

Stillbirths were labelled as the 'forgotten catastrophe' and a global problem with significant disparities in rates as high as 23 times in the worst-affected countries.[9-11] Studies have shown that neonatal mortality is a significant subset of U5M globally.[11,12] Therefore, the Sustainable Development Goal (SDG) 3.2 aims to reduce the U5M rate to less than 25 per 1000 live births globally by 2030.[11] Current epidemiological knowledge of U5M rate helps to assess, prepare and monitor public health programs, especially for maternal and child health. The Malaysian U5M surveillance system collects the succumbed cases' characteristics and the health services factors. Up to present knowledge, scanty published literature came from Malaysia's U5M surveillance data. This study aims to describe the preventable stillbirths and neonatal deaths of Malaysia's U5M data from 2015 to 2017 and determine the associated factors and recommendations to improve maternal and child healthcare services in Malaysia.

MATERIALS AND METHODS

Study Design
This is a descriptive analysis of the Malaysia's U5M surveillance data for the years 2015–2017.

Study Setting
All U5M including stillbirth and perinatal death reported in Malaysia.

Case Definition
The U5M is defined as any child death from birth to age five, including the stillbirths notified to the Ministry of Health using the Stillbirth and U5M Form SU5MR-1/2012.[12] The inclusion criteria set were only the stillbirths and neonatal deaths were retrieved for data analysis. We excluded multiple pregnancies, non-Malaysians, and major incomplete cases.

Variables and Outcomes
The outcome measured was factors associated with the preventable cause of stillbirths and neonatal deaths. The preventable death was divided into (1) deaths through medical intervention, which includes modifiable factors that may have contributed to the death such as delayed referral, delayed diagnosis and treatment, inadequate management and (2) deaths due to non-medical conditions such as drowning, choking, teenage pregnancy, and non-accidental injury. Whereas non-preventable deaths refer to death due to life-limiting diseases, such as lethal congenital malformation and inborn error metabolism. The undetermined deaths referring to a situation when accurate/appropriate classification of death cannot be determined by the investigation committee members. The independent variables were socio-demographic (maternal age, ethnicity, education level, marital status) and clinical characteristics of the mother or baby (medical condition, birth weight, types of delivery).

Data Management and Analysis
All verified data were recorded in a line list of U5M. Statistical Package for the Social Sciences (SPSS) software version 22 was used for data analysis. The trend of stillbirths and neonatal deaths, causes of death and service-related factors were described descriptively. Socio-demographic, clinical characteristics of preventable stillbirths and neonatal death were analysed using univariate and multivariate analysis to examine factors that best predicted preventable stillbirths and neonatal deaths in Malaysia.

Ethical Approval
The present study obtained approval from the Medical Research and Ethics Committee Ministry of Health Malaysia (NMRR-19-426-46153(IIR) and the University Kebangsaan Malaysia Research Ethics (JEP-2019-283).

RESULTS
There were 18,013 stillbirths and neonatal deaths in the U5M dataset from 2015 to 2017. However, only 16,977 cases were identified after the exclusion of multiple pregnancies, non-Malaysians and cases with major incompleteness. Out of 16,977 deaths, 100% of deaths occurred in hospitals, 55% were stillbirths and 45% were neonatal deaths. The incidence rate of stillbirth was 5.98, 6.09 and 5.98 per 1000 births in 2015, 2016 and 2017, respectively. The neonatal death rate was 5.07, 4.86 to 5.02 per 1000 births for the same reported years. Further data cleaning, only 15,444 cases were written as preventable or not preventable and 15,094 cases were documented as hospital death or non-hospital death (Table I).

Causes of Stillbirths and Neonatal Deaths in Malaysia
3242 cases of preventable stillbirths and neonatal deaths were analysed. The conditions from the perinatal period (82.5%) was the commonest causes of preventable deaths followed by specific infectious and parasitic disease (4.1%), congenital malformation (3.5%), unknown (3.2%) and respiratory (2%) (Figure 1). Specific infectious and parasitic diseases showed an increment from 0.63% in 2015 to 3.4% in 2017.

Factors Associated with Preventable Stillbirths and Neonatal Deaths in Malaysia
Table II depicts factors associated with preventable stillbirths and neonatal deaths. The birth weight (aOR 6.03, 95% CI:4.14–8.79), hypertensive mother (aOR 1.88, 95% CI:1.66–2.12) and instrumental delivery (aOR 1.64, 95% CI:1.16–2.31) were significantly associated with preventable stillbirths and neonatal deaths. The household income of RM3001 and above (aOR 0.79,95% CI:0.69,0.89) was noted as a protective factor.

Adequacy and Quality of Healthcare Influencing Preventable Stillbirths and Neonatal Deaths
Insufficient ANC (20.4%), non-compliance with medical advice (12.3%) and unsuitable place of delivery (8.6%) were associated with preventable stillbirths and neonatal deaths (2015–2017) (Table III)

Association Between Health Services Factors and Maternal Characteristics
Table IV depicts the association of perinatal care service factors for preventable stillbirths and neonatal deaths reported for 2015–2017. Maternal ethnicity of 'Other Bumiputera' and 'Other Malaysian', aged 36 years old and

Table I: Characteristics of stillbirths and neonatal deaths in Malaysia (2015–2017)

Characteristics	Year		
	2015, n (%)	2016, n (%)	2017, n (%)
Preventable or not preventable (n=15,444)			
Preventable	808 (16.2)	1099 (22.1)	1335 (24.4)
Not preventable	4067 (81.5)	3747 (75.3)	4057 (74.1)
Undetermined	89 (1.8)	71 (1.4)	80 (1.5)
Unknown	29 (0.6)	61 (1.2)	1 (0)
Type of death (n=15,094)			
Hospital death	5221 (99.9)	5019 (100)	4850 (100)
Non-hospital death	4 (0.1)	0	0
Category of death by age (n=16,997)			
Stillbirth	3137 (54.3)	3116 (55.8)	3060 (54.5)
Stillbirth rate*	5.98	6.09	5.98
Neonatal death	2640 (45.7)	2471 (44.2)	2553 (45.5)
Neonatal death rate*	5.07	4.86	5.02

*Per 1000 births.

Table II: Factors associated with preventable stillbirths and neonatal mortality (2015–2017)

Variables	Regression coefficient[a]	Adjusted OR[b]	95% CI	Wald	p value
Birth weight					
500–999 g	0	1			
1000–1499 g	0.43	1.53	(1.29,1.82)	4.87	<0.001
1500–2499 g	0.63	1.88	(1.63,2.18)	8.52	<0.001
2500–4000 g	1.08	2.95	(2.56,3.39)	15.19	<0.001
4001 g and above	1.80	6.03	(4.14,8.79)	9.35	<0.001
Household income					
RM3000 and below	0	1			
RM3001 and above	-0.24	0.79	(0.69,0.89)	-3.72	<0.001
Maternal hypertension					
No	0	1			
Yes	0.63	1.88	(1.66,2.12)	10.11	<0.001
Type of birth					
Spontaneous vaginal delivery	0	1			
Instrumental delivery	0.49	1.64	(1.16,2.31)	2.82	0.005

[a]Adjusted; [b]Backward method was applied; Interacting variables were omitted from the mode; Mean VIF = 1.13, no multi-collinearity issues in the model.

Table III: Level of substandard care based on criteria of preventable death[12]

Adequacy and quality of healthcare (Level of substandard care)	Yes	No	Not Applicable
Insufficient antenatal care provided/unbooked (n=2879)	662 (20.4%)	2074 (64%)	141 (4.3%)
Delay/lack of referral/consultation for high-risk pregnancy (n=2873)	148 (4.6%)	2294 (70.8%)	430 (13.3%)
Not adherence to medical advice/treatment including follow-ups (n=2861) 398 (12.3%)	1973 (60.9%)	490 (15.1%)	
Misinterpretation of test during ANC (n=2859)	23 (0.7%)	2282 (70.4%)	553 (17.1%)
Unsuitable place of delivery (n=2864)	280 (8.6%)	2233 (68.9%)	351 (10.8%)
Inadequate intrapartum monitoring (n=2847)	62 (1.9%)	2052 (63.3%)	733 (22.6%)
Delay/lack in referral/consultation during intrapartum (n=2849)	77 (2.4%)	2117 (65.3%)	655 (20.2%)
Inadequate/inappropriate resuscitation/stabilisation (n=1305) 63 (1.9%)	1134 (35%)	108 (3.3%)	
Failure to transfer to appropriate care (n=1307)	91 (2.8%)	1077 (33.2%)	139 (4.3%)
Delay/lack consultation from senior/specialist (n=1306)	40 (1.2%)	1143 (35.3%)	123 (3.8%)
Family neglect or ignorance, (n=1308)	105 (3.2%)	1057 (32.6%)	146 (4.5%)
Healthcare provider staffing ratio not meeting MOH norms (n=1309)	24 (0.7%)	1152 (35.5%)	133 (4.1%)
Inadequate equipment (n=1296)	44 (1.4%)	1121 (34.6%)	131 (4%)

above, single mothers and housewives were identified as higher odds of poor perinatal health services (p<0.05). 'Other Malaysian' is defined as Malaysian other than Malay, Chinese and Indian that is made up of mostly Orang Asli, Bumiputera Sarawak and Bumiputera Sabah. High household income per month (>RM5000) and formal education (tertiary level) were noted as protective factors for preventable stillbirths and neonatal deaths (p<0.05).

DISCUSSION
The Malaysian child healthcare services were established under the National Rural Health Development Programme14 that clearly outlines a clinical management pathway between primary and tertiary hospitals for effective paediatric care. The neonatal retrieval teams were implemented in neonatal intensive care planning to support preterm and small gestational age foetus management.[15,16] The monitoring continued during the post-delivery period

Table IV: Association between health services factors and maternal characteristics (n=?)

		Regression coefficient (B)	Adjusted odds ratio	95% CI	Wald	p
Insufficient ANC supplied/unbooked[a]						
Maternal ethnicity	Malay	0	1			
	Other Bumiputera	0.461	1.586	1.12,2.24	6.901	0.009
	Other Malaysian	-1.637	0.194	0.05,0.80	5.173	0.023
Maternal age	18 years old and below	0	1			
	36–42 years old	0.657	1.929	1.04,3.58	4.328	0.037
	43 years old and above	1.927	6.867	2.605,18.10	15.183	<0.001
Marital status	Married	0	1			
	Unmarried	2.718	15.152	10.41,22.05	201.766	<0.001
	Widow/divorced	3.135	22.999	6.23,84.89	22.145	<0.001
	Unknown	1.914	6.78	3.00,15.31	21.221	<0.001
Household income	RM1000 and below	0	1			
	RM1001-RM5000	-0.574	0.563	0.34,0.94	4.935	0.026
	RM5001-RM7000	-0.867	0.42	0.20,0.87	5.443	0.020
Unsuitable place of delivery[b]						
Maternal ethnicity	Malay	0	1			
	Other Bumiputera	0.444	1.559	1.04,2.34	4.627	0.031
	Other Malaysian	-3.317	0.036	0.002,0.78	4.496	0.034
Maternal age	18 years old and below	0	1			
	Unknown	3.696	40.282	2.71,599.19	7.2	0.007
Marital status	Married	0	1			
	Unmarried	1.866	6.465	4.42,9.45	92.799	<0.001
	Widow/divorced	1.986	7.283	2.13,24.90	10.024	0.002
	Unknown	1.431	4.181	1.85,9.46	11.801	0.001
Failure to transfer to proper care[c]						
Maternal occupation	Working mother	0	1			
	Housewife	0.575	1.777	1.11,2.86	5.658	0.017
Family neglect or ignorance[d]						
Maternal ethnicity	Malay	0	1			
	Other Bumiputera	1.223	3.398	1.32,8.73	6.458	0.011
Maternal education	No formal education	0	1			
	Tertiary education	-1.526	0.217	0.06,0.75	5.859	0.016
	Unknown	-1.728	0.178	0.03,0.92	4.233	0.04
Marital status	Married	0	1			
	Unmarried	0.993	2.698	1.37,5.33	8.19	0.004
	Widow/divorced	3.006	20.21	1.14,357.75	4.204	0.04

[a] Backward method was applied, interacting variables were omitted from the model, mean VIF =1.32, no multi-collinearity issues in the model, correctly classified percentage 85.2%
[b] Backward method was applied, interacting variables were omitted from the model, mean VIF = 1.29, no multi-collinearity issues in the model, correctly classified percentage 90%
[c] Backward method was applied, interacting variables were omitted from the model, mean VIF = 1.15, no multi-collinearity issues in the model, correctly classified percentage 92.7%
[d] Backward method was applied, interacting variables were omitted from the model, mean VIF =1.30, no multi-collinearity issues in the model, correctly classified percentage 92.5%

with postnatal home visits by primary care midwives, routine health examinations by medical doctors, immunisations, child development and health monitoring in the primary care clinics to improve under-five outcomes.[17]

There are two databases under the Ministry of Health to collect data on U5M which are the Rapid Reporting System of Perinatal and Neonatal Deaths and the National Neonatal Registry.[18,19] The process of auditing the U5M including the stillbirths is documented based on level of care and time allocation. Having a regular monthly meeting at the district level and a 3-monthly meeting at the state level will ensure complete and finalise information of the death cases submitted for national reporting.[18] The quality assessment of the auditing system for U5M is determined by appointed committee members that consists of a paediatrician, obstetrics and gynaecology specialist, family medicine specialist, public health physician and related staff. They will be responsible for determining the causes of death, classifying the death into preventable or non-preventable death, determining the remedial action, and disseminating the findings.[18] The standard is at par with other countries on perinatal and U5M investigation of deaths.[1,11,13]

The U5M database system was separated into a notification and an investigation system to ensure the validity of the data collection process. The flow process was integrated at each healthcare level, from the district and state health officials to the national level. The International classification of disease (ICD) 10 coding was used for certification of death in the U5M reporting system to help in making international comparison. The U5M reporting format (SU5MR-I/2012) was used to distinguish stillbirths from U5M notifications to avoid duplication of reporting.
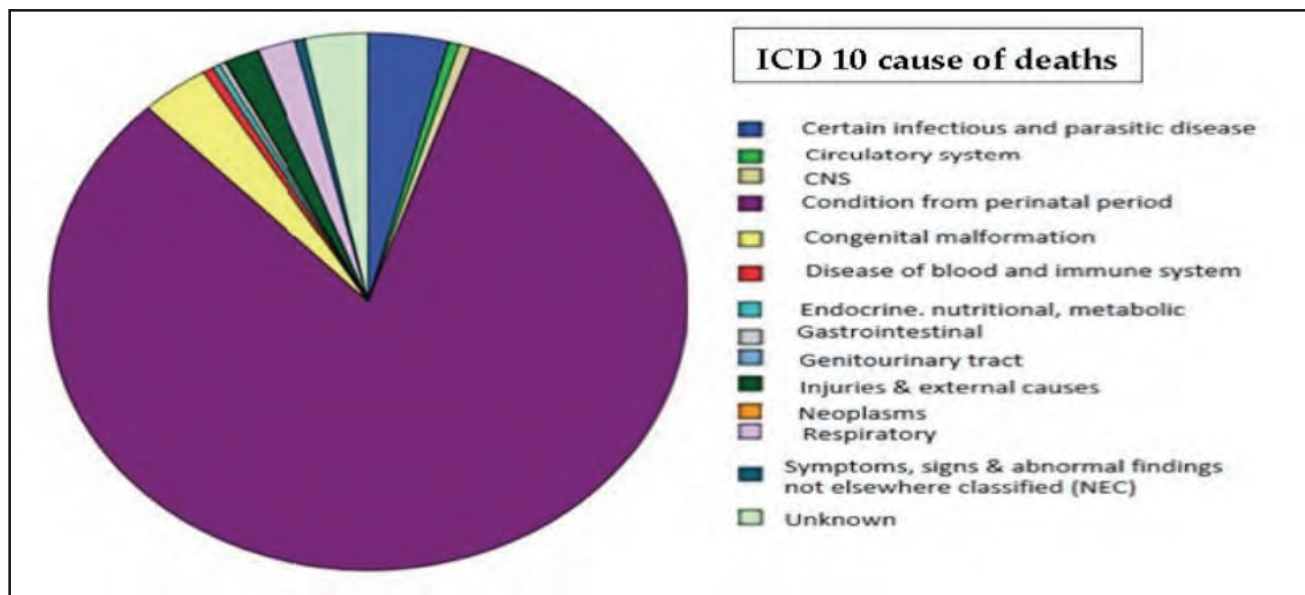
ICD 10 cause of deaths

- Certain infectious and parasitic disease
- Circulatory system
- CNS
- Condition from perinatal period
- Congenital malformation
- Disease of blood and immune system
- Endocrine. nutritional, metabolic
- Gastrointestinal
- Genitourinary tract
- Injuries & external causes
- Neoplasms
- Respiratory
- Symptoms, signs & abnormal findings not elsewhere classified (NEC)
- Unknown

Fig. 1: Causes of preventable stillbirths and neonatal deaths in Malaysia, 2015–2017 (n=3242 cases)

The stillbirths rate calculated in the present study ranges from 5.98 to 6.09 per 1,000 births which are slightly higher from data reported by Statista20 ranging from 4.4 to 5.4 per 1,000 births. Similar pattern was seen for the neonatal death rate, which was found higher i.e. ranging from 4.86 to 5.07 per 1,000 live births compared to rate reported by the Department of Statistics Malaysia (DOSM) which showed ranging from 4.2 to 4.4 per 1,000 live births.[21,22] The difference is due to the method of data collation by the organisation and reporting. However, the trend seems to be plateaued compared to the post-independence era until the early 2000s. This study identified that the annual preventable stillbirths and neonatal deaths in Malaysia increases from 16% (in 2015) to 24% (in 2017). This is an alarming trend for Malaysian health services as child survival is one of importance health indicator for SDG monitoring.

The Lancet series on 'Ending preventable stillbirths' indicated that maternal and child healthcare quality improvement is necessary to prevent stillbirths and neonatal deaths.[13] Preventable means that death can be avoided by proper and adequate care, either by medical intervention or non-medical intervention.[23,24] Although the factors associated with preventable U5M are known, the references for Malaysia are scarce.[18] Determining the factors might help the health provider to improve the health services delivery to the targeted population. This study selected only stillbirths and neonatal deaths from the U5M group as they have a similar cause of death that is influenced by intrauterine and early-life conditions.[24]

Causes of Preventable Stillbirths and Neonatal Deaths in Malaysia
An U5M study in Malaysia5 in 2006 found that Most of the deaths (61.8%) occurred in the first year of life, and only 38.1% of preventable deaths occurred in hospital settings and these were caused primarily by patient and family factors (58%). Using a similar U5Msurveillance dataset, a report published for data collected in 2016 showed preventable U5M

decreased to 31%, and the three most common causes were conditions originating in the perinatal period (27.5%); injuries, poisoning and external causes (17.0%); and certain infectious and parasitic diseases (14.5%).[19] Present study focussed only for stillbirths and neonatal deaths found that the preventable deaths for stillbirths and neonatal deaths were in increasing trend (16% to 24% over the period of 2015 to 2017). The major contributing causes of preventable stillbirths and neonatal deaths were classified as perinatal death (82.5%), infectious and parasitic diseases (4.1%) and congenital malformations (3.5%) which saw similar pattern as reported earlier.[5,19]

Studies within the last decade indicate that neonatal birth weight is the most common predictor of infant survival.[23-25] The lower an infant's birth weight, the higher the risk of mortality and morbidity. Conversely, mortality among normal birth weight babies is preventable. Inadequate foetal monitoring, sepsis or intrapartum unpreparedness causing asphyxia are preventable. In addition, maternal comorbidities such as hypertension cause adverse health outcomes for infants.[26] However, these conditions can be managed successfully if we can stabilise any women with a history of hypertension during the pre-pregnancy care clinic. Provision of good ANC share with mother to empower them on monitoring maternal weight gain, blood pressure, urine protein, diabetic screening, early urinary infections and administering intrapartum antibiotics for Group B Streptococcus. These antenatal management strategies ensure that infants are protected from life-threatening elements. Prevention of neonatal mortality is also associated with household income.[27] People with a household income above the poverty line have better health literacy and health-seeking behaviours. Studies show that increased health literacy and health-seeking behaviours reduces U5M. Implementation of first 100 days of life and Approach to Unwell Child Under Five Manual were parts of efforts to improve the trend of U5M in Malaysia.[28]

Service Factors Related to Preventable Stillbirths and Neonatal Death

Many countries, including Malaysia, practice shared care approach for pregnant women. Primary health care clinic is the first contact for pre-pregnancy and antenatal health screening. Using risk assessment checklist, cases were grouped as high and low risk and managed according to level of care and type of personnel and were assessed at every antenatal visit.[14,17] Although almost 97% of pregnant women make four or more antenatal visits as recommended by WHO, high-frequency antenatal visits alone are insufficient to lower infant mortality rates.[27] Furthermore, it is crucial to address the 3% of pregnant women with insufficient antenatal visits. The frequency of ANC check-ups is not representative of the quality of patient care. A study found that about half of all pregnant mothers were still not getting the desired ANC score documentation required.[30] It was reported that high-risk pregnancies with a lower ANC scores, influencing maternal and child health outcomes.[29-31]

Patient factors remain a significant contributor to preventable stillbirths and neonatal deaths. The preventable U5M in Malaysia found that 50–55% of deaths were caused by patient and family factors in 2008.[5] Consequently, non-compliance with medication and medical advice and delays in seeking treatment were identified as common patient factors that need to be addressed. Therefore, health education is essential for information dissemination, promoting awareness that can influence mother's attitude and behaviour for accessing antenatal care.[31]

In this study, we found that mothers from 'Other Bumiputera', 'other Malaysian', maternal age above 35 years old, housewives and single mothers have a higher risk of getting poor perinatal care service. Therefore, identifying early-risk groups of mothers for active health education intervention and monitoring can prevent adverse pregnancy outcomes. The maternal and child health programme is designed to be accessible and easily engaged even by the minority groups with limited accessed. Providing of mobile clinic for mother and child check-up in their village and area is known as the best to reach the need.[31] A comprehensive and effective pre-pregnancy care, which includes a family planning programme, were provided to guide the mother towards safer pregnancy and birth when they are ready and in a good health condition. Strengthening social supports by collaboration with social welfare, non-governmental organisation and community participation should be established to support single mothers, low income households during pregnancy and delivery.[32-34] Using digital health for empowerment and surveillance monitoring will help in broadening and efficiency of services provided.

Despite of low percentage of preventable stillbirth and neonatal death reported in the present study, it is critical to address the issues, particularly on service-related factors among preventable deaths. Remedial measures in improving the quality of ANC services with an emphasis on the targeted high-risk maternal socio-demographic group as found significant in this study such as other Bumiputera, older

antenatal mothers, nonmarried, poor income family and neglected family. This group needs to be monitored closely by the medical doctor for proper health empowerment on the importance of ANC an early identification for referrals. Studies in Indonesia and Africa found that the mortality reporting system required constant re-evaluation and improvement to preserve information quality.[33,34]

More targeted intervention needs to be conducted to embark the modifiable non-service-related factors by upscaling health competency training among the healthcare providers. Revamping training module as digital education and promoting continues medical education for healthcare providers are important to improve healthcare quality and avoid substandard care in maternal and childcare.

LIMITATIONS

A well-maintained mortality reporting system is vital for epidemiological surveillance and sustaining good quality health services. The Malaysian U5M data collection system was established almost two decades ago and should be improved over time. However, deficiencies persist within this system, such as incomplete data reporting, with up to 60% missing data. Understandably, a child's delivery and death are significant events resulting in incomplete data retrieval from the mother. Due to such high vulnerability, monitoring perinatal health and children's epidemiological surveillance indicators is essential. In present study, the missing data were managed by the listwise deletion approach with an expectation of data missing completely at random (MCAR), representing a randomly drawn sub-sample of the original data as written in earlier publication.[33]

CONCLUSIONS

The U5M trends in Malaysia remained almost static for the years 2015–2017 with an increasing trend of preventable stillbirths and neonatal deaths. Healthcare service factors found related to preventable stillbirths and neonatal death. Providing a comprehensive yet targeted maternal and child health services is crucial in improving the equity of health and preventing delay in identification, referral and appropriate management. Revisiting the training capacity and approaches using digital education in strengthening the healthcare provider competency in managing ANC cases is timely. Enhancing health promotion to increase health literacy, increase awareness in practicing health lifestyles and early screening for non-communicable diseases are important to all women especially before there are entering their reproductive age.

ACKNOWLEDGEMENTS

REFERENCES

1. World Health Organization. Under-five mortality rate. [cited 2022 Oct 14]. Available from: https://www.who.int/data/nutrition/nlis/info/under-five-mortality-rate
2. Department of Statistics Malaysia. Vital Statistics Tie Series Malaysia 1963-1998. 2001. 285 p.
3. UNICEF. Under-five mortality. 2021 [cited 2022 Oct 14]. Available from: https://data.unicef.org/topic/child-survival/under-five-mortality/
4. BPKK. Laporan Tahunan 2019. Putrajaya. 2020. [cited 2022 Oct 14]. https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/47-bpkk/684-final-laporan-tahunan-bpkk-2019-primer-n-keluarga-25-ogos-2020-compressed?Itemid=0
5. Lan WS, Imam H. A study on under five deaths in Malaysia 2006. Kuala Lumpur 2008. [cited 2022 Oct 14]. Available from https://www.crc.gov.my/wp-content/uploads/documents/report/StudyOnUnder5DeathsinMsia_2006.pdf
6. Joseph KS, Kramer MS. The fetuses-at-risk approach: survival analysis from a fetal perspective. Acta Obstetricia et Gynecologica Scandinavica 2018; 97(4): 454-65.
7. Zhu X, Niu H, Wang H, Li X, Qi T, Ding W, et al. High risk pregnancy associated perinatal morbidity and mortality: A second birth population-based survey in Huai'an in 2015. BMC Pregnancy Childbirth 2019; 19(1): 1-15.
8. Ngoc NTN, Merialdi M, Abdel-Aleem H, Carroli G, Purwar M, Zavaleta N, et al. Causes of stillbirths and early neonatal deaths: Data from 7993 pregnancies in six developing countries. Bull World Health Organ 2006; 84(9): 699-705.
9. Sankar MJ, Natarajan CK, Das RR, Agarwal R, Chandrasekaran A, Paul VK. When do newborns die? A systematic review of timing of overall and cause-specific neonatal deaths in developing countries. J Perinatol 2016; 36(S1): S1-11.
10. Mengesha HG, Sahle BW. Cause of neonatal deaths in Northern Ethiopia: A prospective cohort study. BMC Public Health 2017; 17(1): 1–8.
11. UNICEF. A neglected tragedy the global burden of stillbirths. 2020 [cited 2021 May 8]. [cited 2022 Oct 14]. Available from: https://data.unicef.org/resources/a-neglected-tragedy-stillbirth-estimates-report/
12. Family Health Development Division MOH. Guideline on classification of under-five mortality into preventable and unpreventable death. 2017. [cited 2022 Oct 14]. Available from: https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/20-sektor-kesihatan-kanak-kanak/447-preventable-26-5?Itemid=0
13. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional , and national causes of child mortality in 2000-13 , with projections to inform post-2015 priorities: an updated systematic analysis. The Lancet 2015; 385(9966): 430–40. [cited 2022 Oct 14].
14. Fadzil F, Jaafar S, Ismail R. 40 years of Alma Ata Malaysia: Targeting equitable access through organisational and physical adaptations in the delivery of public sector primary care. Primary Health Care Res Dev 2020; 21: 1-8.
15. Boo NY, Pong KM. Neonatal resuscitation training program in Malaysia: Results of the first 2 years. J Paediatrics Child Health 2001; 37(2): 118-24.
16. Boo NY. Neonatal resuscitation programme in Malaysia: An eight-year experience. Singapore Med J 2009; 50(2): 152-9.
17. BPKK. Manual Perkhidmatan Kesihatan bagi Anggota Kejururawatan di Perkhidmatan Kesihatan Awam bagi Anggota Kejururawatan di Perkhidmatan Kesihatan Awam. Vol. 15. 2016. [cited 2022 Oct 14]. Available from https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/18-sektor-kesihatan-ibu/409-manual-perkhidmatan-kesihatan-ibu-anak-bagi-anggota-jururawat-di-perkhidmatan-kesihatan-awam-2016?Itemid=0
18. National Stillbirth and Under Five Mortality Technical Committee MOH. Guidelines for stillbirth and under-five mortality. 2013. [cited 2022 Oct 14]. Available from https://hdokpps.weebly.com/uploads/4/2/8/1/42813715/guideline_for_under_5_mortality.pdf
19. Choo HL, Abdul Manaf AM. A study on under five deaths in Malaysia in the year 2016. Putrajaya 2020. [cited 2022 Oct 14]. Available from https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/20-sektor-kesihatan-kanak-kanak/698-technical-report-of-under-five-deaths-in-malaysia-2016-compressed?Itemid=0
20. Statista. Stillbirth rates in Malaysia from 2011 to 2020. [cited 2022 Oct 14]. Available from: https://www.statista.com/statistics/641958/malaysia-stillbirth-rates/
21. DOSM. Vital Statistics, Malaysia 2015. Department of Statistics Malaysia. 2016.
22. Ho MK. Department of Statistics Malaysia Press Release. Department of Statistics Malaysia 2018; 5-9.
23. Wilcox AJ. On the importance-and the unimportance-of birthweight. Int J Epidemiol 2001; 30(6): 1233-41.
24. Pirhadi M, Dehnavi ZM, Torabi F. The relationship between small for gestational age (SGA) at birth and developmental delay in children aged 4 to 60 months. Int J Pediatrics-Mashhad 2018; 6(11): 8595-603.
25. Shah NM, Shah MA, Khalaf AA, Mustafa MM, Al-Sayed A. Searching for socioeconomic risk factors in perinatal mortality in Kuwait: A case control study. Soc Sci Med 2000; 51(4): 539–50.
26. Kassar SB, Melo AMC, Coutinho SB, Lima MC, Lira PIC. Determinants of neonatal death with emphasis on health care during pregnancy, childbirth and reproductive history. Jornal de Pediatria 2013; 89(3): 269–77.
27. Dewey KG. Reducing stunting by improving maternal, infant and young child nutrition in regions such as South Asia: Evidence, challenges and opportunities. Maternal Child Nutrition 2016; 12: 27-38.
28. BPKK. Training Manual on Approach to Unwell Children. Vol. 18. [cited 2022 Oct 14]. Available from https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/20-sektor-kesihatan-kanak-kanak/702-20200819-atucu5-20191018-fa-edit-11-11-2020-compressed?option=com_jdownloads
29. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. ISBN 978 92 4 1549912.2016. [cited 2022 Oct 14]. Available from http://apps.who.int/iris/bitstream/handle/10665/250796/9789241549912-websupplement-%20eng.pdf;jsessionid=D74DF9F2550E689BE3A7B748E9C15EBA?sequence=8
30. NHMS. National Health And Morbidity Survey 2016 : Maternal And Child Health (MCH) [Internet]. Vol. 2, Kementerian Kesihatan Malaysia. 2016. [cited 2022 Oct 14]. Available from: http://www.iku.gov.my/images/IKU/Document/REPORT/2016/NHMS2016ReportVolumeII-MaternalChildHealthFindingsv2.pdf
31. Yeoh PL, Hornetz K, Shauki NIA, Dahlui M. Assessing the extent of adherence to the recommended antenatal care content in Malaysia: Room for improvement. PLoS ONE. 2015; 10(8): 1-15.
32. Azreena E., Suriani I, Muhamad Hanafiah Juni FP. Factors associated with health literacy among Type 2 diabetes mellitus patients. Int J Public Health Clinical Sci 2016; 3(6): 50-64.
33. Bamford LJ, McKerrow NH, Barron P, Aung Y. Child mortality in South Africa: Fewer deaths, but better data are needed. South African Med J 2018; 108(3a): 25.
34. De Bernis L, Kinney MV, Stones W, Ten Hoope-Bender P, Vivio D, Leisher SH, et al. Stillbirths: Ending preventable deaths by 2030. The Lancet 2016; 387 (10019): 703-16.