

# The Prevalence of Childbirth Adverse Events (AEs) and Related Factors among Yemeni Mothers and Newborns, Al-Sadaka Teaching Hospital, Aden, Yemen: A Hospital-based Cross-sectional Study

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## Authors' contributions

*This work was carried out in collaboration among all authors. Author IAN developed the study idea, data collection and writings. Author AAB supervised the analysis of the database and contribute in drafted the manuscript, writing and editing. Author AH initiate the work and edited the manuscript and supervised the bulk of the work. All authors were involved in the interpretation of the data and writing the manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

**Background:** The main objective of this study is to assess the prevalence of adverse events (AEs) and its related factors among mother and newborns during labor in Al-Sadaka Teaching Hospital, Aden City.

**Methods:** A cross-sectional hospital-based study conducted at Al-Sadaka Teaching Hospital, Aden City among 2526 pregnant women who were consented and eligible to be included in the study. Quantitative data were collected over the study time (180 days on 3-time shifts) by interviewer administered questionnaire and a direct observation of the obstetric interventions during childbirth. Descriptive statistics were performed using the SPSS program and a p-value of <0.05 was considered significant at 95% Confidence Interval (CI).

**Results:** A total of 322 adverse event episodes were identified among both mothers and newborns with a prevalence of 12.7% (322/2526) in the study setting. Almost, the majority of the reported

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AEs were found among mothers (83.2%). Factors such as prolonged second stage labor was found strongly associated with nulliparous mothers during childbirth ( $P=0.001$ ), while asphyxia and meconium aspiration as an AEs among newborns were found associated with the performance of episiotomy intervention during childbirth and fundal pressure ( $P=0.027$ ,  $P=0.019$ , respectively).

**Conclusions:** Prevalence of AEs among mothers and newborns were high in comparison to the international standard. Further nationwide study was recommended to investigate the different factors associated with AEs in health care services in Yemen and to avoid harmful practices as a key mechanism for improving mother safety.

*Keywords: Adverse events; childbirth; labor; women; newborn.*

## ABBREVIATIONS

*Ads* : Adverse events;

*WHO* : World Health Organization;

*PS* : Patient safety

## 1. BACKGROUND

Nowadays, adverse events (AEs) in medical field affects all processes of health care systems and levels of care from curative to preventive, as well as from the public to the private sectors. Therefore, reducing medical errors has become an international concern [1]. Patient safety (PS) is also becoming a global public health problem affecting all types of health care systems. In the other side, patient safety is challenged by culture of denial and blame as well as inconsistent reporting and learning [2]. The World Health Organization (WHO) estimates that tens of millions of patients worldwide suffer disabling injuries or death every year due to unsafe medical practices and care [3].

Pregnancy and childbirth are widely recognized as risk factors for developing different types of adverse events either for mother or her newborn, including deaths as a fearful outcome. Studies have found that at least 88-98% of maternal deaths can be prevented if good quality emergency obstetric care is available [1]. Most maternal deaths occur between the third trimester and the first week after the end of pregnancy as a consequence of hemorrhaging, obstructed labor, infection, and eclampsia [4]. Every day in 2017, approximately 810 women died from preventable causes related to pregnancy and childbirth resulting from lack of skilled health care personnel for antenatal, delivery and postnatal care [5]. The vast majority of maternal deaths are due to direct obstetric complications such as hemorrhage, sepsis, complications of abortion, hypertensive disorders of pregnancy, prolonged/obstructed labor, ruptured uterus and ectopic pregnancy [6].

There is very little evidence about the burden of unsafe care in developing countries, where there is likely to be an even greater risk of harm to patients due to limitations in infrastructure, technologies and human resources [6]. Studies conducted by the World Health Organization in developing countries suggest that patients are placed in great danger of medical device adverse events owing to poorly maintained or improperly replaced medical equipment [7]. In Yemen for example, pregnancy and childbirth are “life-threatening events” [8]. Maternal deaths account for 42% of all female deaths among women of reproductive age (15-49 years). Moreover, there is scarcity of research related to adverse events during childbirth in the country. According to the United Nations Development Programme Human Development Index in 2017, Yemen is considered as one of the least developed countries in the world with poor socioeconomic status and challenging health services, and a high maternal mortality ratio of 164 per 100,000 births [9].

The situation of unsafe practice in developing countries and countries in economic transition including Eastern Mediterranean Region (EMR) countries such as Yemen, merits particular attention in which at least one adverse event occurred in 8.2%, with a range of 2.5–18.4% per country [7]. However, the prevalence of adverse events among pregnant women during childbirth was not yet precisely known in Yemen and to fill this gap, a robust research should be conducted in this field. Therefore, the main objective of this study is to assess the prevalence of adverse events (AEs) and its related factors among mother and newborns during labor in Al-Sadaka Teaching Hospital, Aden City.

## 2. METHODS

### 2.1 Study Design and Setting

A hospital-based cross-sectional study was conducted in Al Sadaka Teaching Hospital, Aden

governorate with a total population of 589,419 people. This hospital is the largest specialized obstetric facilities in the southern governorates of Yemen, with a total of 708 beds and an average caseload of 6000 deliveries annually [10]. Moreover, the hospital is located in an area of high population gathering from different adjacent governorates where the people get access easily to reach to the hospital. In addition, this hospital provides a comprehensive range of services including primary, secondary as well as tertiary obstetrics, gynecology and pediatrics care.

## 2.2 Participants

All the 2526 pregnant women at full term in labor attending Al Sadaka teaching hospital with vertex presentation, singleton fetus, and in active labor who consented were become eligible to be included in the study, however, actual analysis was done for the 322 pregnant women who showed adverse events. Any woman with abnormalities of labor such as none vertex presentation, multiple pregnancy, preterm or post term pregnancy, intrauterine death before starting labor, previous lower segment cesarean section, premature rupture of membrane, and those with pregnancy complication or disease during pregnancy were excluded.

## 2.3 Sampling and Recruitment

It was reported elsewhere that 8.4% of the total women using a health-care institutions would be under the risk of having adverse effect during the childbirth [11]. According to the assumption from annual report of the hospital, 6000 women were annually admitted to Al-Sadaka hospital for delivery, and thus, it was expected to meet a sample size of 312 childbirth with adverse events, using the power of 80%, 95% confidence interval, and a margin of error of 3.4%.

Different sources of data collection were used and assessed: patient's file, registration books, observation of the staff performance especially in delivery and post- delivery rooms, in addition to a face to face interview with pregnant women. Moreover, an observational checklist was used as a tool for data collection in this study with a main focus on assessing the quality of health care provided during labor in emergency, pre-labor, delivery and post-delivery rooms and explore the level of maternal outcome required. This checklist was adopted from a study conducted elsewhere; it was translated from

English to Arabic language and then backward to English [12].

The content of the checklist was divided into four parts: 1) Assessing the admission in emergency room included the women condition at the time of admission, socio-demographic background such as age, address, level of education and family income. 2) Assessment during the pre-labor stage like monitoring the general condition of the women in labor and her fetus in addition to the assessment of the progress of labor, and whether the intervention was done. 3) Assessment during the delivery room for elements related to the second stage of labor with focus on the conditions leading to the occurrence of adverse events, the assessment for the fetal monitoring during the second stage whether it is appropriate or not, whether intervention was done for her, and finally, 4) The assessment of the post- delivery condition which includes the conditions during the postpartum period.

## 2.4 Data Collection Methods

All pregnant women admitted to the hospital for childbirth and met the inclusion criteria were become eligible to be included in this study during the time period of 6 months. A daily assessment of the admitted pregnant women over the three working shifts (morning, afternoon, and evening). Training was conducted for all the 12 qualified health care providers who contribute in the collection of data. The training include sessions for how to use the observation as a method and the use of the checklist as well as to be familiar with the hospital setting and other medical logistical process of the data collection. The team was divided into four groups of three members to work in three day and night shifts on 24 hour. The assessment starts from the time women's admission. One observer starts following up staff performance for woman in labor from the time of admission throughout labor and delivery, when an observer's shift ended, the next observer carries on from the point where the previous observer had stopped and continued observing the staff performance for the next shift, and so on till the delivered woman was discharged from the hospital. The completed checklists were collected daily and checked by the researcher, so that any misunderstanding or mistakes could be checked and resolved immediately with the observer; by this way the researcher could make sure about the inter-observer reliability.

Antenatal care score was constituted according to WHO guideline as: accepted for those who have more than 3 antenatal visits during pregnancy, bad for those with 1-3 antenatal visits during pregnancy, no antenatal care for those who did not had any visit during pregnancy [13].

The questionnaire was assessed by experts in public health, gynecologists and obstetricians in relation to the objectives of the study. Some modification was conducted accordingly.

A pilot study was carried out on a group of 20 women in labor one week before the beginning of the study and were not included in the main study. Analysis of the questions was undertaken to assess the reliability, consistency, and understanding of the questionnaire resulting in Cronbach's  $\alpha$  of 0.74.

For assessing the findings and the outcome of the study, an operational definition for the adverse event was considered as that event associated with 'unintended harm to the patient by an act of commission or omission rather than by the underlying disease or condition of the patient' [14].

## 2.5 Data Analysis

Analyses were conducted using SPSS v. 20 and proceeded through the following steps: 1) Cronbach's alphas were used to test for reliability of the questionnaire (Alpha=0.73); 2) The occurrence of adverse events was calculated by recording the responses into dichotomous categories, with 0 = no and 1= yes; 3) Bivariate chi-square tests of independence were used to determine the relationship between the different types of adverse events among both mother and newborn. The *P*-values of  $< 0.05$  was considered as statistically significant.

## 3. RESULTS

### 3.1 Sociodemographic Characteristics of the Participants

Table 1 shows the sociodemographic characteristics among 322 participants with adverse events. The majority of the participants were from different areas of Aden city (85.4%), at age group 20-30 years old (73.3%), holding primary school degree or illiterate (69.0%), and with family income ranged from low to intermediate (79.6%).

### 3.2 Overall Prevalence of Adverse Events among Mothers and Newborns during Childbirth

In this study, a total number of women admitted to the emergency department during the study period (180 days) was 4281. Out of the total, 3793 were attended for labor, but only 2526 (66.7%) were enrolled and consented as they met the inclusion criteria. Thus, the Overall prevalence of adverse events among mothers and newborns during childbirth was 12.7% (322/2526) in Al-Sadaka Hospital, Aden City. However, the total reported events were 340 episode among the study cohort with around 83.2% of the outcomes occurred among 268 mothers alone, 10.6% among newborns, and 6.2% AEs reported in both mothers and their newborns.

### 3.3 Adverse Events among Mothers and Newborns

Although the rate of AEs seen higher among the multiparty women (ranged  $> 70\%$ ) or among those has a good standard of antenatal visit, no statistical significant association was found between the AEs occurred among mother, newborn, or both of them when correlated to type of parity or antenatal care (*p* value  $>0.05$ ), as seen in Table 2.

Table 3, showed the different types of adverse events reported among either women (288 events) or newborns (54 events). Over one third (36.5%) of mothers recorded the adverse events in form of uterine atone, followed by placenta remnant (30.9%), and then genital tear (26.7%). While among newborns, meconium aspiration was the highest recorded AEs (51.9%), followed with asphyxia (31.5%) and five cases reported with immediate death (9.3%).

### 3.4 Types of Adverse Events among Mothers by Socio- demographic Characteristics

Three main outcomes of adverse events were measured among women: the influence on uterine atone, Placenta Remnant, genital tract laceration, were analyzed by sociodemographic characteristics of the participants (Table 4). All these four adverse events were reported with higher among women from Aden city, at age between 20-30 years, of primary or secondary education level, and of those with low monthly

income, however, no statistical significant differences reported between all these factors and the sociodemographic characteristics ( $P > 0.05$ ).

### 3.5 Types of Adverse Events among Newborn by Socio- demographic Characteristics

Sociodemographic characteristics of the mother were reflected to the main outcomes of adverse events seen among newborns, as seen in Table 5. Although only 28 newborns were reported with some types of adverse events such as meconium aspiration, asphyxia, neonatal death,

and stillbirth, the majority of them were from Aden city, of mother at the age-group between 20-30 years old, illiterate mothers, and those mothers with low monthly income. However, no significant differences were found in all these variables ( $P > 0.05$ ).

### 3.6 Adverse Events According to Parity

Multiparous mothers exhibited the highest percentage of adverse events among women with uterine atone, placenta remnant, genital laceration, and both placenta remnant and genital laceration with a range from 71.1% to 76.5%. However, statistically it was not significant (Table 6).

**Table 1. Socio-demographic Characteristics of the study population**

Characteristics	Cases N=(322)	
	No	%
Residency	Aden	275 85.4
	Outside Aden	47 14.6
Age group (years)	< 20	33 10.2
	20 – 30	236 73.3
	>30	53 16.5
	Mean 25.8 years (SD± 5.5)	
Educational level	Illiterate	100 31.1
	Primary	122 37.9
	Secondary	69 21.4
	University	31 9.6
Family income/capita	Low	147 45.7
	Intermediate	109 33.9
	High	66 20.5

**Table 2. Adverse events among mother and newborn according to the obstetric history and antenatal care visits**

Characteristics	Mother		Newborn		Both		P value
	NO.	%	NO.	%	NO.	%	
<b>Parity</b>							
Nulliparous	70	26.1	10	29.4	9	45.0	0.185
Multiparous	198	73.9	24	70.6	11	55.0	
<b>Antenatal visits</b>							
Accepted >3	133	49.6	17	50.0	10	50.0	0.408
Bad 1-3	89	33.2	7	20.6	6	30.0	
No visit	46	17.2	10	29.4	4	20.0	

**Table 3. Type and distribution of adverse events among mothers and newborns**

Adverse events in mothers	No.	%	Adverse events in newborn	No.	%
Uterine atone	105	36.5	Meconium aspiration	28	51.9
Placenta remnant	89	30.9	Asphyxia	17	31.5
Genital tear	77	26.7	Dead immediately after delivery	5	9.3
Genital trauma/placenta remnant	17	5.9	Stillbirth	4	7.4
Total	288	100.0	Total	54	100.0

**Table 4. Types of adverse events (uterine atone, placenta remnant, genital tract laceration) by mother socio-demographic characteristics**

Characteristics	Uterine atone			Placenta remnant			Genital tract laceration			*Mixed event		
	No.	%	P value	No.	%	P value	No.	%	P value	No.	%	P value
<b>Residence</b>												
Aden	90	86.5	0.415	75	84.3	0.422	68	89.5	0.168	14	82.4	0.464
Outside Aden	14	13.5		14	15.7		8	10.5		3	17.6	
<b>Age group (years)</b>												
< 20	16	15.4	0.050	7	7.9	0.276	5	6.6	0.171	1	5.9	
20 – 30	68	65.4		63	70.8		62	81.6		14	82.4	0.679
>30	20	19.2		19	21.3		9	11.8		2	11.8	
<b>Educational level</b>												
Illiterate	34	32.7	0.718	28	31.5	0.074	19	25.0	0.380	5	29.4	0.947
Primary	35	33.7		41	46.1		28	36.8		7	41.2	
Secondary	25	24.0		11	12.4		21	27.6		4	23.5	
University	10	9.6		9	10.1		8	10.5		1	5.9	
<b>Family income\capita</b>												
Low	47	45.2	0.701	41	46.1	0.103	34	44.7	0.306	7	41.2	0.918
Intermediate	33	31.7		36	40.4		22	28.9		6	35.3	
High	24	23.1		12	13.5		20	26.3		4	23.5	

\* Mixed event = Genital Trauma and Placenta Remnant

**Table 5. Distribution of newborn's adverse events (meconium aspiration, asphyxia, early neonatal death, stillbirth) by the mother's socio-demographic characteristics**

Characteristics	Meconium aspiration			Asphyxia			Early neonatal death			Stillbirth		
	No.	%	P value	No.	%	P value	No.	%	P value	No.	%	P value
<b>Residence</b>												
Aden	23	82.1	0.609	15	88.2	0.734	3	60.0	0.105	3	75.0	0.553
Outside Aden	5	17.9		2	11.8		2	40.0		1	25.0	
<b>Age group (years)</b>												
< 20	4	14.3	0.142	2	11.8	0.682	1	20.0	0.729	1	25.0	0.512
20 – 30	23	82.1		11	64.7		3	60.0		2	50.0	
>30	1	3.6		4	23.5		1	20.0		1	25.0	
<b>Educational level</b>												
Illiterate	9	32.1	0.934	6	35.3	0.509	1	20.0	0.570	1	25.0	0.743
Primary	10	35.7		4	23.5		1	20.0		1	25.0	
Secondary	7	25.0		4	23.5		2	40.0		1	25.0	
University	2	7.1		3	17.6		1	20.0		1	25.0	
<b>Family income\capita</b>												
Low	15	53.6	0.390	7	41.2	0.278	2	40.0	0.955	2	50.0	0.927
Intermediate	10	35.7		4	23.5		2	40.0		1	25.0	
High	3	10.7		6	35.3		1	20.0		1	25.0	

**Table 6. Distribution of adverse events according to parity**

Adverse events	Nulliparous		Multiparous		P-value	
	No.	%	No.	%		
<b>Maternal</b>	Uterine atone	28	26.9	76	73.1	0.843
	Placenta remnant	24	27.0	65	73.0	0.867
	Genital laceration	22	28.9	54	71.1	0.771
	Both P remnant and G laceration	4	23.5	13	76.5	0.697
<b>Newborn</b>	Meconium aspiration	12	42.9	16	57.1	0.060
	Asphyxia	6	35.3	11	64.7	0.468
	Early neonatal death	1	20.0	4	80.0	0.700
	Still birth	1	25.0	3	75.0	0.905

**Table 7. Association between the prolonged (labor) second stage childbirth and maternal and newborn adverse events**

Adverse events	Characteristics		Not prolong labor		Yes prolong labor		P value
			No.	%	No.	%	
<b>Parity</b>	Nulliparous	-	50	18.9	39	67.2	<b>0.000</b>
	Multiparous	-	214	81.1	19	32.8	
<b>Maternal</b>	Uterine atone	No	183	69.3	35	60.3	0.186
		Yes	81	30.7	23	39.7	
	Placenta remnant	No	189	71.6	44	75.9	0.510
		Yes	75	28.4	14	24.1	
	Genital laceration	No	201	76.1	45	77.6	0.814
		Yes	63	23.9	13	22.4	
	Genital trauma/Placenta remnant	No	249	94.3	56	96.6	0.491
		Yes	15	5.7	2	3.4	
<b>Newborn</b>	Meconium aspiration	No	243	92.0	51	87.9	0.314
		Yes	21	8.0	7	12.1	
	Asphyxia	No	251	95.1	54	93.1	0.543
		Yes	13	4.9	4	6.9	
	Died immediately after delivery	No	260	98.5	57	98.3	0.907
		Yes	4	1.5	1	1.7	
	Stillbirth	No	263	99.6	55	94.8	<b>0.003</b>
		Yes	1	0.4	3	5.2	

**Table 8. Association of adverse events and the effect of intervention during childbirth on maternal and neonates**

Characteristics	Fundal pressure (85/322)26.4%			Oxytocin use (73/322)22.7%			Episiotomy (76/322)23.6%		
	No.	%	P value	No.	%	P value	No.	%	P value
<b>Maternal</b>									
Uterine atone	29	25.9	0.138	25	29.1	0.598	27	28.7	0.378
Placenta remnant	25	23.1	0.200	27	31.4	0.363	24	25.5	0.587
Genital laceration	31	28.7	0.125	21	24.4	0.835	25	26.6	0.417
<b>Newborn</b>									
Meconium aspiration	15	13.9	<b>0.019</b>	10	11.6	0.535	12	12.8	0.096
Asphyxia	7	6.5	0.493	5	5.8	0.796	9	9.6	<b>0.027</b>
Early neonatal death	3	2.8	0.207	1	1.2	0.091	1	1.1	0.649
Stillbirth	1	0.9	0.716	2	2.3	0.417	1	1.1	0.853

Similar expression was found regarding adverse events among newborns, where most of these AEs: Meconium aspiration, asphyxia, early

neonatal death, and stillbirth were reported among multiparous mother than in nulliparous in a range from 57.1% to 80.0%. However, this



findings shows no statistically significant differences.

### 3.7 Association of Adverse Events with Prolonged Second Stage Childbirth on Mother and Newborn

The association of the nature of the labor during the second stage of childbirth and the occurrence of AEs was illustrated in Table 7. Nulliparous was typically associated with prolonged time of childbirth with statistically significance ( $P < 0.001$ ). On the other side, all adverse events related to mother like uterine atone, placenta remnant, genital laceration, and genital trauma/placenta remnant were not significantly associated with prolonged labor ( $P > 0.05$ ). Similarly, the newborn AEs (meconium aspiration, asphyxia, early neonatal death) were not significantly associated with prolonged labor, except for the three cases of stillbirth were found significantly associated with prolonged labor ( $P = 0.003$ ).

### 3.8 Association of Adverse Events and the Effect of Intervention during Childbirth on Maternal and Neonates

Fundal pressure, use of oxytocin, and use of episiotomy are the three main interventions usually implemented during labor, as seen in Table 8. For maternal related AEs, no associations was found between the use of all these three types of interventions and development of AEs such as uterine atone, genital laceration and placenta remnant, respectively ( $P > 0.05$ ). However asphyxia as one of the AEs among the newborn was found likely associated with the use of episiotomy as a method of intervention during childbirth ( $P = 0.027$ ), while the rest of AEs showed no associations with the other types of interventions.

## 4. DISCUSSION

Childbirth is a significant event in a woman's life, with important implications for her physical and psychosocial wellbeing. Despite considerable debate and research, facility practices for normal, non-complicated labor are not standardized, however, still large gaps between actual practices and scientific evidence both in developed and developing countries [15].

The corner stone of the present research is to answer the question how frequent and why adverse events occur during labour and affect the health of mothers and their newborns, during the

normal, life-enhancing process of procreation in Al Sadaka teaching hospital, Aden city, Yemen? Thus, the findings of this study illustrated clearly the prevalence of adverse events among women attended this hospital for childbirth. The overall prevalence of 12.7% of women have been affected by adverse events or their newborns was not far from rates reported in high income countries such as Portuguese (11.7%), [16] and in Sweden (12%), [17] or in other developing countries like Palestine (14.2%), [18] and Morocco (15%). Unlikely, lower rates of prevalence was found in countries like Canada (7.5%), [19] and USA (9%), [20] Denmark (9.0%), [21] South Africa (8.2%) and Egypt (6%), [22]. However, the percentage of adverse events of this work was clearly lower than that reported prevalence by previous study in Yemen (18.4%), [1].

The findings of this study revealed that uterine atone and placenta remnant (32.2%) as adverse events among mothers during labor were similar in rate as found in a study conducted in France (37.0%), [23] but very lower than other studies such as from India (86.0%), [24] Zimbabwe (82.4%), [25] Colombia (82.0%), [26] and in Saudi Arabia (70.0%) [27]. The lower percentage in our study could be explained by the difference in the timeframe because it restricted to 6 months, study population which included only healthy women attended for delivery and setting which involve only one hospital.

In regard to the adverse events leading to placenta remnant was the highest percentage (70.8%) among women at age between 20-30 years, where it was higher than the findings from the study conducted in Pakistan (37.7%) [28].

In the other hand, mothers suffered of genital laceration accounts for 23.6%, which was lower than the result of studies conducted in Sri Lanka (59.0%), [29] Pakistan (36.4%), [30] and Egypt (32.2%), [31] and higher than those reported in India (9.9%), [24] Saudia Arabia (10.0%), [27] and Ethiopia (14.0%) [32]. Usually some of the obstetric interventions used during childbirth could be considered among the violence practices during labor. Namely, some of these practices are the irrational practice of fundal pressure, inductive labor and practices of episiotomy that may contribute in the occurrence of cervical laceration. Meanwhile, all these practices were reported in our study, but not found associated with vaginal laceration rate in our study, which was also consistent with many

other studies elsewhere with the aim of assessing the cervical laceration with obstetric practices during childbirths [33,34].

Meconium aspiration (51.9%) was the highest type of adverse events reported among newborns in this study and followed by asphyxia (31.5%). Furthermore, relation between meconium aspiration and multiparous was found high too, however no clear explanation can be given. Higher prevalence of meconium aspiration among newborns (82.0%) were reported in a study from India belonged to multipara pregnant women [35].

Dead immediately after delivery or cases of stillbirth (9.5%, and 7.4%, respectively) were considered as an important indicator of maternal care and of maternal health as well as it reflects the quality of obstetric and perinatal care available [36,37]. This findings was similar to what has been reported in British Columbia (8.1%), [38] but much higher than the USA reported deaths (0.6%) [39].

The results of the current study showed that, the percentage of birth asphyxia related to mothers experience to prolonged of labor was (6.9%), this findings was very much lower than what has been found in study conducted in Ethiopia (26.1%) [40]. Prolonged (labor) second stage was found in this study as risk factor during child birth was found strongly associated with nulliparous mothers ( $P=0.001$ ). Although findings from some studies revealed that women experiencing prolonged labor who gave birth vaginally were more likely to have a stillbirth among other types of adverse events, [34] which is similar to our findings where a strong association was found between prolonged labor and the stillbirth as an important adverse event among newborn ( $P=0.003$ ).

No association was found between the effect of intervention such as fundal pressure (26.4%), oxytocin use (22.7%), or episiotomy (23.6%) during childbirth on mother as an adverse events. However, among neonates adverse events like meconium aspiration and asphyxia were found significantly associated with fundal pressure and episiotomy as two main interventions during childbirth ( $p=0.019$ ,  $p=0.027$ , respectively). The prevalence of fundal pressure in our study (26.4%) was closer to what has been reported by Moiety (2014) in Alexandria (24.38%) [41]. Women who have been subjected to episiotomies take longer to

heal from delivery, even compared to women who have equivalent tears [42]. Some studies reported a high incidence of anal sphincter tears or uterine rupture among mothers in the use of uterine fundal pressure maneuver in spontaneous deliveries [43,44]. However, signs of sphincter tear could not be easily reported among mothers immediately after labor and need a time of follow-up to identify the condition, which was not used in this study too as a long term labor adverse events.

The findings of this study related to the oxytocin intervention was (22.7%) this findings was higher than the results of the study conducted in Ethiopia (17.3%), [45] but lower than the results conducted in Brazilian (38.2%) [46].

No association was found between measured elements of adverse events (uterine atone, placenta remnant, genital tract laceration) in mothers and the mother's socio- demographic characteristics such as age, residency, education level, and family income. Similarly, no association was found between newborn adverse events (meconium aspiration, asphyxia, early neonatal death, stillbirth) and the mother's socio-demographic characteristics such as age, residency, education level and family income. World Health Organization's evidence-based practice for normal birth does not recommend routine episiotomy, and episiotomy is classified as "can be harmful".[47] The findings of the current study showed that, the episiotomy intervention was used for (29.2%), which was much lower than findings from Tibet (49.3%), [48] or from China (85.0%) [49].

The study was conducted in one of the biggest hospitals in Yemen with around 6000 delivery per year. The health care professionals working in this hospital were having good experience. However, limitation of resources and continuous training, low level of antenatal care for the mothers among other factors could be enough to generalize the finding at the level of the country as the condition in most of the hospitals during the time of the internal conflict is almost similar or more closer to each other. Similar model could be extrapolated for some international conditions in other countries.

## 5. LIMITATIONS OF THE STUDY

Although, this study is considered as the first one in assessing the AEs among mothers and newborns during childbirth in Al-Sadaka teaching

hospital at Aden City, some limitation were also illustrated. The study was not able to assess the postpartum adverse events due to lack of follow-up of the mother or her newborn after discharged from the hospital. Therefore, the prevalence of AEs were limited only to the time the women or her newborn were attended in the hospital for short time not more than 6 hours maximum as the absence of rules of specific time the mother have to stay in the hospital after the childbirth. As this study was cross-sectional and limited to one hospital in the country within a certain period of the year, as well as the time when the study was conducted was probably different from the current situation, so the findings of the study should be carefully used in case of generalizing the findings to the country.

## 6. CONCLUSION

More than one in ten mothers were affected by AEs during childbirth. The prevalence of AEs was very much higher among mothers than the newborns. Uterine atone and meconium aspiration constituted the dominant types of adverse events among mothers and newborns respectively. However, the stressed outcome was among newborn as stillbirth or early death. Prolonged second stage of childbirths and some performed interventions were critical factors lead to some adverse events among mothers and newborns. Increasing awareness among health care providers on how to avoid adverse events during childbirths and to adhere to the guidelines in managing the childbirth is of paramount importance to make a significant change in the rate of adverse events among mothers and newborns; this consequently lead to reduce the rate of maternal mortality and infant mortality rate in the country. Further studies in different settings are indicated to address the magnitude of AEs in the country, and might include both public and private hospitals those running childbirth services.

## CONSENT AND ETHICAL APPROVAL

An official approval from the authority of Aden health office permission were obtained, as well as from the local authority of the Al Sadaka Teaching Hospital. A verbal consent was obtained from all participants after a brief explanation about the objectives of the study and it is importance. They were also informed that all the data collected will be handled confidentially. Any participant refused to participate was

informed that she has the right to withdraw from the study at any time.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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