# Common motives of admission of pregnant ladies from traditionally gold mining areas in Sudan

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**ABSTRACT**

**Background:** Metallic elements play a vital role in the health of both the fetus and the mother. This study aimed to identify the primary reasons for admitting pregnant women from regions in Sudan where primitive gold mining is prevalent. **Methodology:** Between January 2018 and December 2023, this descriptive retrospective hospital-based study was conducted at El-Obeid Obstetrics and Gynecology Teaching Hospital. All information regarding the participants in the study was extracted from hospital records. **Results:** The leading causes of hospital admission for the majority of patients were prior scarring, labor, MEM&PIHE, and PPROM (representing 26%, 11%, 9%, and 5%, respectively). Patients originating from rural areas exhibited the highest prevalence rates of PIHE, PP, PPROM, PS, and anemia, accounting for 87.5%, 83.3%, 75%, and 61.5%, respectively. **Conclusion:** This study showed that primitive gold mining affects pregnant women in several ways that require community-level intervention. As mining expands rapidly across the nation without safety protocols, more research is needed to determine these individuals' exposure levels.

**Keywords:** Pregnancy, Gold mining, labor, Sudan.

## Introduction

Metallic elements are crucial to fetal and maternal health. Fetuses can absorb metals via the placental barrier, which may disrupt neural tube closure. Abnormal neural tube closure three to four weeks post-conception causes neural tube defects (NTDs), which have a complicated genetic and environmental etiology. New population-level association studies have examined the link between maternal environmental exposure and NTDs, notably metals [1].

Environmental factors during pregnancy can affect fetus and future generations' fitness. It was found that feeding Caenorhabditis elegans mothers ursolic acid (UA), a plant-derived chemical, during reproduction reduced neurodegeneration in their offspring and F2 progeny [2]. A study explored the role of placental total mercury (T-Hg) as a biomarker of prenatal mercury (Hg) exposure and offspring risk for neural tube abnormalities (NTDs). There was a strong correlation between placental T-Hg and T-Hg in umbilical cord, kidney, liver, and brain tissues [3].

Industrialization in the 20th century increased heavy metal exposure. Human poisoning is most often caused by mercury, cadmium, and arsenic. Water, air, and food can induce acute or chronic poisoning, and heavy metal bioaccumulation harms human tissues and organs. Heavy metals disrupt growth, proliferation, differentiation, damage repair, and apoptosis. These metals cause

toxicity by producing ROS, diminishing antioxidant defenses, enzyme inactivation, and oxidative stress. Skin, liver, prostate, lung, urinary bladder, thyroid, kidney, and gastrointestinal cancers are frequently linked to heavy metal exposure. Dysregulated microRNAs (miRNAs) have been linked to several human malignancies. Recent studies have shown that microRNA dysregulation causes numerous tissue cancers [4].

Traditional gold mining in Sudan has been booming in recent years, with little safety measures taken. In the mining districts, the majority of workers put themselves and their families at risk of exposure to high quantities of mercury. Consequently, the purpose of this research was to determine the most prevalent reasons for admitting pregnant women from Sudanese regions that have a primitive gold mining.

## Materials and Methods

This is a descriptive retrospective hospital-based study that took place at El-Obeid Obstetrics and Gynecology Teaching Hospital between January 2018 and December 2023. The sample size includes all pregnant women from domestic gold mining areas such as Sodari, Jabrat Alsheekh, Um andraba, Elmrkh, Abozaiema, Alswanee, Algmah, Um Loaly, Abuhadeed, Abufroa, Um badir, Hamrat Alsheekh, Hamrat Alwiz, and Kagmer. All data pertaining to the study individuals were obtained from hospital records. Aside from demographic information such as age, occupation, and residence, patients' vital identifying variables were also acquired from her records, including:

parity, gestational age at presentation. Recurrent abortion, history of congenital deformity, and fetal fate. History of chronic illness and maternal outcomes.

Pregnant women with singleton pregnancies from domestic mining areas who visited the maternity service at El-Obeid Obstetrics and Gynecology Teaching Hospital during the study period. Pregnant women having repeated pregnancies, as well as those suffering from chronic illnesses such as diabetes, hypertension, and asthma.

### Data analysis

The data were first organized in a conventional spreadsheet and then entered into the SPSS version 24 software application. Descriptive statistics in the form of frequency tables, percentages, and graphs. Statistically significant results were calculated using the 95% confidence level and interval to perform chi square tests. A p-value of <0.05 was judged statistically significant.

## Results

This study investigated 150 pregnant ladies aged 18 to 46 years with a mean age of 27 years. About 97/150(65%) presenting from urban areas and the remaining 53/150(35%) from rural areas. Most patients were aged 25-29 years, followed by 20-24, and ≥35 years, constituting 37/150(25%), 33(22%), and 31(21%), respectively, as indicated in Table 1, Fig 1.

**Table 1.  Distribution of the study subjects by age and resident**

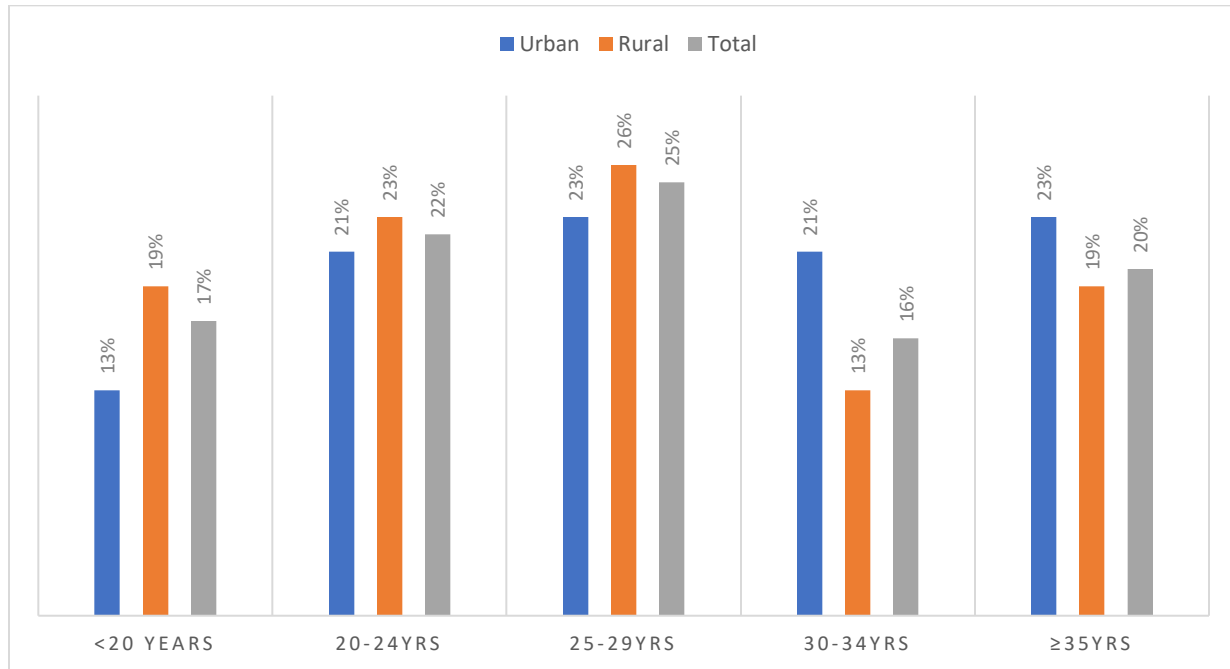| Age group | Urban | Rural | Total |
|---|---|---|---|
| <20 years | 7 | 18 | 25 |
| 20-24 | 11 | 22 | 33 |
| 25-29 | 12 | 25 | 37 |
| 30-34 | 11 | 13 | 24 |
| 35+ | 12 | 19 | 31 |
| Total | 53 | 97 | 150 |

**Figure 1. Description of patients by residence and age**

As indicated in Table 2, Fig2, the reason for hospital admission for most patients was previous scar followed by MEM&PIHE, Labor, and PPROM, representing 39/150(26%), 16(11%), 13(9%), and 8(5%), respectively.

The highest proportions of PIHE, PP, PPROM, PS, and anemia were seen among patients coming from rural areas, representing, 14/16(87.5%), 5/6(83.3%), 6/8(75%), and 24/39(61.5%), correspondingly.

For previous scar, most patients aged 25-29, followed by 20-24, constituting 16/39(41%), and 12(31%), in that order. For MEM, most patients aged 20-24 followed by <20 years, representing 6/16(37.5%), and 4(24%), respectively, whereas, for PIHE most patients were in age range <20 followed by 20-24, constituting, 6/16(37.5%), and 5/16(31.3%), per capta.

**Table 2. Distribution of the study subjects by reason of admission and demographical characteristic**

| Variable | PPROM | Labor | MEM | SM | PIHE | PP | PPH | PS | Anemia | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Residence** | | | | | | | | | | | |
| Urban | 2 | 6 | 6 | 5 | 2 | 1 | 2 | 15 | 2 | 12 | 53 |
| Rural | 6 | 7 | 10 | 2 | 14 | 5 | 3 | 24 | 5 | 21 | 97 |
| Total | 8 | 13 | 16 | 7 | 16 | 6 | 5 | 39 | 7 | 33 | 150 |
| **Age** | | | | | | | | | | | |
| <20 years | 1 | 3 | 4 | 3 | 6 | 0 | 0 | 2 | 1 | 5 | 25 |
| 20-24 | 0 | 2 | 6 | 0 | 5 | 1 | 0 | 12 | 1 | 6 | 33 |
| 25-29 | 1 | 1 | 2 | 1 | 1 | 1 | 4 | 16 | 1 | 9 | 37 |
| 30-34 | 2 | 4 | 2 | 0 | 1 | 1 | 0 | 4 | 3 | 7 | 24 |
| 35+ | 4 | 3 | 2 | 3 | 3 | 3 | 1 | 5 | 1 | 6 | 31 |
| Total | 8 | 13 | 16 | 7 | 16 | 6 | 5 | 39 | 7 | 33 | 150 |
| **PPROM**: Pre-labor rupture of membrane and preterm labor, **MEM**: Miscarriage, ectopic pregnancy, and molar pregnancy, **SM**: Severe malaria, **PIHE**: Pregnancy induced hypertension and eclampsia, **PP**: Placenta previa, **PS**: Previous scar | | | | | | | | | | | |
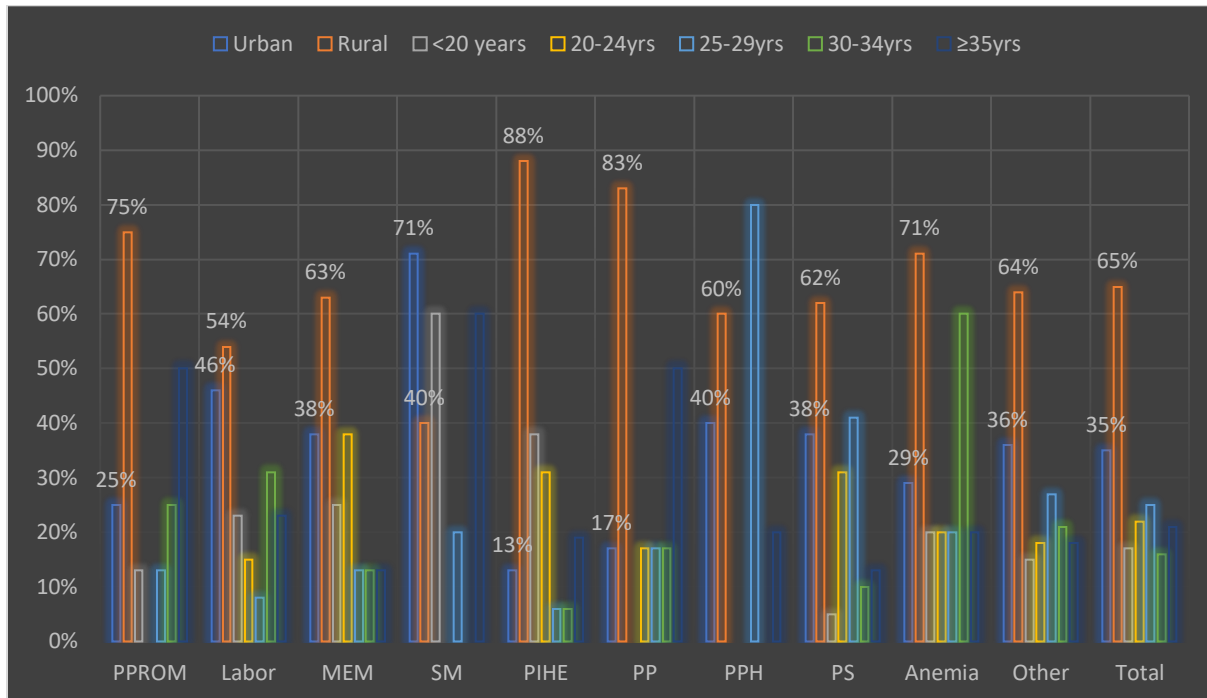
**Figure 2. Description of the patients by reason of admission and demographical characteristic**

Table 3, Fig 3 summarized the distribution of the patient's reason of admission and clinical characteristics. Most patients were Multipara followed by Nulliparous, and Grand-multipara, representing 100/150(66.7%), 33(22%), and 17(11.3%). Most Nulliparous, Multipara, and Grand-multipara, presented PIHE (24.2%), PS (37%), and PIHE (17.6%), in that order.

Regarding association with previous pregnancy outcomes, AW, MS, IUFD, CMF, IUFD+MS were more frequently associated

with PS (34.7%), PS (25%), PS (25%), MEM (100%), and PIHE (100%), in that order.

Concerning gestational age, most problems were associated with 30-39 weeks, followed by <20 weeks, >39, and 20-29 weeks, constituting 98/150(65.3%), 13(86.7%), 11(7%), and 9(6%), correspondingly. AW was predominantly associated with PS (35%), MS with PS (25%), IUFD with PS (25%), CMF with MEM (100%).

**Table 3**. Distribution of the patient's reason of admission and clinical characteristics

| Variable | PPROM | Labor | MEM | SM | PIHE | PP | PPH | PS | Anemia | Other | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parity** | | | | | | | | | | | |
| Nulliparous | 1 | 6 | 4 | 2 | 8 | 0 | 0 | 0 | 1 | 11 | 33 |
| Multipara | 5 | 6 | 12 | 4 | 5 | 5 | 5 | 37 | 5 | 16 | 100 |
| Grand-multipara | 2 | 1 | 0 | 1 | 3 | 1 | 0 | 2 | 1 | 6 | 17 |
| Total | 8 | 13 | 16 | 7 | 16 | 6 | 5 | 39 | 7 | 33 | 150 |
| **Previous Pregnancy outcomes** | | | | | | | | | | | |
| AW | 4 | 7 | 11 | 4 | 5 | 4 | 3 | 33 | 6 | 18 | 95 |
| MS | 2 | 0 | 2 | 0 | 1 | 1 | 0 | 3 | 0 | 3 | 12 |
| IUFD | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 3 | 0 | 2 | 12 |
| CMF | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| IUFD+MS | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

| Total | 7 | 8 | 14 | 5 | 8 | 6 | 5 | 39 | 6 | 23 | 121 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gestational Age (week)** | | | | | | | | | | | |
| <20weeks | 0 | 0 | 8 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 13 |
| 20-29 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 9 |
| 30-39 | 5 | 9 | 2 | 4 | 15 | 6 | 1 | 38 | 4 | 14 | 98 |
| >39 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 4 | 11 |
| Total | 8 | 13 | 10 | 7 | 16 | 6 | 3 | 39 | 7 | 22 | 131 |

**AW**: Alife and Well, **IUFD**: Intrauterine Fetal Death, **CMF**: Congenital Malformation, **MS**: Miscarriage
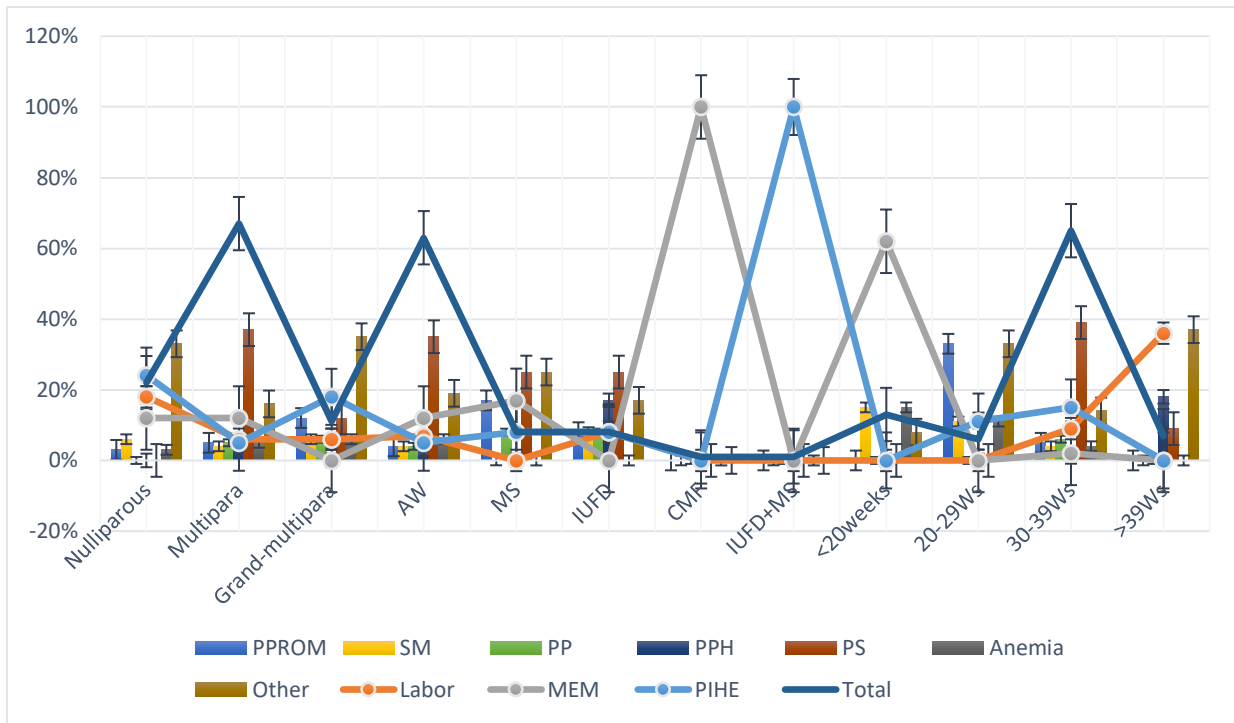


**Figure 3. Description of the patient's reason of admission and clinical characteristics**

## Discussion

The majority of patients in this series were admitted because of the existence of a previous scar (26%). Scar pregnancy is an uncommon and potentially fatal condition in which an embryo implants and proliferates within a uterine scar or scar from a previous cesarean section [5]. hen an embryo implants on the scar from a prior cesarean section, the result is a condition known as a cesarean scar ectopic pregnancy (CSEP). The percentage of live deliveries that require a caesarean section has increased from 20.7% in 1996 to 32.1% in 2021, an increase of 50% in the past decade. Consequently, CSEP has become more common. It is crucial to accurately diagnose and appropriately treat CSEP because it can cause severe morbidity including potentially fatal hemorrhage, uterine rupture, placental accreta spectrum, hysterectomy, and death [6].

In the current study, there were reports of pregnancy-induced hypertension, eclampsia, and miscarriage in several patients. Chronic hypertension, gestational hypertension, and pre-eclampsia are all part of hypertensive disorders of pregnancy (HDP), which is among the most prevalent pregnancy problems. The number of pregnancies afflicted by pre-eclampsia could be significantly reduced with the use of new technologies that screen pregnant women for the condition early on and then prescribe tailored aspirin prophylaxis. Recent developments in pre-eclampsia diagnosis, such as testing based on placental growth factor, have further improved the

identification of pregnancies with the greatest risk of serious problems. Trial results have improved the target blood pressure for chronic hypertension management and the date of delivery for non-severe pre-eclampsia, according to the corresponding literature [7, 8]. There is a potential link between toxic metals like lead (Pb), cadmium (Cd), arsenic (As), and mercury (Hg) and an increased risk of gestational hypertension and preeclampsia [9]. There is a correlation between prenatal exposure to metal mixtures and unfavorable pregnancy and birth outcomes, including miscarriage, low birth weight, preterm birth, and small for gestational age. There are noteworthy correlations between mercury (Hg) and unfavorable outcomes during pregnancy and childbirth, which illustrate a wide range of impacts and possible interactions [10].

Several patients who participated in the present investigation exhibited symptoms of preterm labor and rupture of membranes prior to labor. The rupture of embryonic membranes prior to the initiation of labor is referred to as pre-labor rupture of membranes (PROM). PROM is detected in 30–40% of preterm labor and 3–15% of all pregnancies worldwide [11].

Certain patients who participated in the current investigation exhibited placenta previa. Both placenta previa and placenta accreta are associated with increased maternal and fetal morbidity and mortality. There may be associations between metal exposure and placenta previa and placenta accreta. The present investigation examined the correlations between concentrations of maternal metals (specifically selenium [Mn], cadmium [Cd], lead [Pb], mercury [Hg], and selenium [Cd], lead, and selenium [Pb]) and placenta previa [12].

While the current study shed light on the effects of rudimentary gold mining on pregnant women, it is important to acknowledge its limitations, which include the lack of a control group and the inability to measure metal density.

**In conclusion**: This study reported diverse impacts of primitive gold mining on pregnant women and their fetuses require immediate community-level intervention. It is crucial that additional research investigate the precise level of exposure among these individuals, as mining continues to expand rapidly across the nation in a rudimentary fashion, devoid of any safety protocols.

### Ethical consideration

Official agreements from the Ministry of Health in North Kordofan and the Obstetrics and Gynecology Department at El Obeid Teaching Hospital were secured. All information was kept confidential.

### Ethical Approval

This study's proposal was approved by the Human Research Ethics Committee at MRCC (Approval Number: HREC 0003/MRCC.02/24).

### Conflict of interest

Authors declare no conflict of interest.

### Data Availability:

All raw data of this research are available from corresponding author.

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