



Prevalence and Predictors of Stillbirths Following Vaginal Delivery at the Tumu Municipality of the Upper West Region, Ghana: A Cross-Sectional Study Design

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Abstract

Background: Low- and middle-income countries still have unacceptably high rates that make it imperative to identify local factors that predict stillbirths to effectively develop interventions. The study aimed to identify the prevalence and predictors of stillbirths among singleton pregnant mothers who gave birth in health facilities in the Tumu municipality in the Upper West Region of Ghana.

Methods: Using a retrospective cross-sectional study design, 1168 women who had vaginal deliveries had their medical records reviewed. From January 1 to December 31, 2019, information on vaginal deliveries was gathered from hospital records. The data were summarised using descriptive statistics, and the relationship between maternal and obstetric characteristics and stillbirths was investigated using Pearson's chi-square/Fisher's exact test. To evaluate the predictors of stillbirth, a logistic regression analysis was fitted at a 95% confidence interval (95% CI), and the results were reported using an odds ratio. **Results:** Among the 1168 women, 614 (52.57%) were within the age group of 20 - 29 years; 804 (68.84%) of mothers were multigravida, and 852 (72.95%) attended ANC between 4 to 8 times. The overall prevalence of stillbirths was 12.80 per 1000 total births. Women who attended ANC between 4 - 8 times were 93% less likely to record a stillbirth (AOR 0.07 (0.017 - 0.294) p-value ≤ 0.001). Women whose labour was not monitored using a partograph were more than

15 times likely to record a stillbirth (AOR 15.54, 95% CL: 4.335 - 55.722, p -value ≤ 0.001). **Conclusion:** The overall stillbirth rate was 12.80 per 1000 live births, with better outcomes for pregnant women who attend ANC 4 - 8 times. The likelihood of stillbirths in labor without partograph monitoring is more than 15 times higher compared with those with partograph monitoring. Refresher training on partograph use and regular ANC attendance are recommended.

Subject Areas

Gynecology & Obstetrics

Keywords

Prevalence, Predictors, Stillbirths, Vaginal Delivery, Ghana

1. Background

Globally, stillbirth is a concern for public health, particularly in Sub-Saharan Africa (SSA) [1]. The World Health Organisation defined stillbirth as foetal death in the third trimester (greater than or equal to 28 completed weeks of development) with birth weight greater than or equal to 1000 g or length greater than or equal to 35 cm. It also means that the child dies before the complete expulsion or extraction from its mother [2]. While institutional deliveries are on the rise, stillbirth rates in developing nations have not significantly declined [3].

Every year, there are an estimated 2.6 million stillbirths worldwide, with data available showing that low and lower-middle-income countries account for 84% [4]. Despite this, there is a lot of proof that not all stillbirths that call for reporting are reported. In developing nations like Ghana, where stillbirths are not counted in routine mortality data gathering, the situation is worse [5] [6].

Various studies have suggested diverse factors, including maternal age, occupation, and parity, to be associated with stillbirths in different settings [6] [7]. According to the 2017 Ghana Maternal Health Survey, 20 stillbirths per 1000 live births, or 2% of pregnancies, resulted in stillbirth nationwide [8]. Earlier research has identified several significant predictors of stillbirth, which may be maternal or foetal [1] [9].

The rate of stillbirth is a sensitive indicator of the healthcare system and a significant predictor of the standard of care received during pregnancy and childbirth. Initiatives launched after 2015 demonstrate that stillbirths remain a sustainable development goal and are part of a hidden global agenda. At the 2014 World Health Assembly, Ghana was one of 194 countries that supported the Every Newborn Action Plan's goal of ending avoidable stillbirths. The plan's objective was to lower the country's rate of stillbirth to 12 or less per 1000 live births by 2030 [10].

Although there are various strategies and plans to improve the well-being of mothers and children, the level of stillbirth is a major public health problem in areas

such as Tumu [8]. Consequently, the stillbirth rate has been 20 stillbirths per 1000 live births [8]. Despite global efforts to reduce stillbirths, progress remains uneven, particularly in Sub-Saharan Africa, where the burden is disproportionately high. In Ghana, the stillbirth rate remains elevated at 20 per 1000 live births [8], with concerns of underreporting in rural areas like the Tumu Municipality. Although various studies have identified factors such as maternal age, parity, and antenatal care as predictors of stillbirth, there is a lack of research focusing on these determinants within the rural northern Ghanaian context. Additionally, limited district-level data obscures local variations and hampers the development of targeted interventions. Understanding the specific maternal, fetal, and health system factors influencing stillbirths in Tumu is therefore crucial for informed policy-making and improved maternal and newborn outcomes.

2. Methods

2.1. Study Design and Setting

A retrospective cross-sectional study design was used, in which the records of pregnant women who delivered at the Tumu Municipal Hospital were reviewed. There was a total of 1202 delivery records collected and kept in the records department of the hospital.

The Tumu Municipal Hospital is located in the capital of the Sissala East Municipality in the Upper West Region of Ghana. The municipality covers an area of approximately 4600 km². About 58% of the population are illiterate, and the rates are higher among females [11]. The hospital serves a population of about 67,029 inhabitants, and it is the only government hospital and the highest referral point within the district. All emergency cases from all sub-district facilities are directed to it as their initial point of contact. Because there are not enough qualified midwives in the area, community health nurses support the work of the midwives.

2.2. Definition and Measurement of Variables

2.2.1. Dependent Variable

The main outcome of interest was stillbirth. The dependent variable was categorised binarily into Live and Stillbirths. Live births was defined as the delivery of a newborn alive, and Stillbirth was defined as the delivery of a dead foetus (fresh still or macerated birth).

2.2.2. Independent Variables

The explanatory variables selected for the study were: parity, defined as the number of times a person has given birth before the present delivery; while gravidity was the number of pregnancies a participant has had prior to the current pregnancy. The gestational age was the number of weeks a person was pregnant before giving birth. Baby weight refers to the initial weight recorded at birth. Additionally, Antenatal Care (ANC) visits were defined as the frequency with which a mother visited the ANC clinic before giving birth.

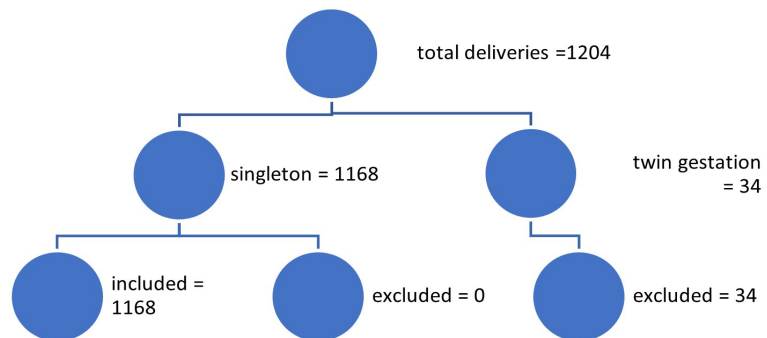
2.3. Data Collection/Management

From 1st January 2019 to 31st December 2019, the medical records of every delivery case recorded in the hospital's registers were reviewed. The participant's records were reviewed for adverse pregnancy outcomes, that is stillbirth. Maternal age, gravida, parity, education, and employment status were extracted for each patient participating in the study. The record also yielded information on partograph readings. Four midwives, two from maternity and two from the labour units of the hospital were selected and trained to collect data. All the four data collectors extracted data from the same source which was then later compared to ensure quality of data and to avoid errors. Missing data were traced from the antenatal and postnatal registers for completion. However, for data that was not found in these registers, the mean was used to impute missing values for continuous variables while the mode was used for imputation of categorical variables.

2.4. Inclusion and Exclusion Criteria

All vaginal deliveries from 1st January 2019 to 31st December 2019 were considered eligible for the study. However, twin deliveries and deliveries with incomplete records were excluded from the study.

2.5. Data Flow



2.6. Statistical Analysis

Data was analysed using STATA statistical software, version 16.0. Categorical variables were summarised using frequencies and percentages, and continuous variables were summarised considering the means (with standard deviations) or medians (with limits) where appropriate. The dependent variable and key explanatory variables were subjected to a chi-square test for associations and Fisher exact test where appropriate at a cut-off value of 0.05. Two logistic regression models were fitted between the outcome variable and the explanatory variables at a 95% confidence interval (95% CI). The first model (Model I) investigated a bivariate association, whereas Model II adopted a multivariable strategy that sought to address issues of confounders and identify the root causes of stillbirths at the Tumu Municipality. A multicollinearity test was done to rule out correlation between predictor variables (see **Appendix I**). All variables were included in the multivar-

iable regression except Mothers' temperature on admission due to the record of a zero in one of the matrixes leading to poor convergence. For Model I and Model II, the results were presented as crude odds ratios (COR) and adjusted odds ratios (AOR), respectively. Odds below 1 were evaluated as having a lower chance of perinatal mortality, while odd numbers above 1 were regarded as having a higher likelihood of perinatal mortality.

3. Results

3.1. Socio-Demographics, Maternal and Foetal Characteristics

A total of 1168 participants met the eligibility criteria and hence were included in the study. Nearly all mothers, 1153 (98.72%) gave birth to live babies and most mothers, 614 (52.57%) were within the age group of 20 - 29 years with the mean age of 27.51 and a standard deviation 6.86 years, with only a little over a tenth, 134 (11.13%) being teenagers. More than a quarter, 374 (32.02%), had no form of formal education, while 200 (17.12%) had tertiary level education. A little over one-fourth (32.36%) were farmers, with nearly three-fourths, 804 (68.84%) being multigravida women. Over a quarter, 416 (35.62%) were multiparous while nearly three-fourths, 852 (72.95%) had ANC attendance between 4 to 8 times during the current pregnancy. Preterm deliveries constituted 20%, and over three quarters (81.51%) of labour were monitored using a partograph. The majority, 1126 (96.40%) of mothers presented with an initial temperature of 37.4 degrees Celsius and below. The majority (81.25%) of babies born weighed between 2.5 - 3.5 kg, and females constituted the majority (52.57%) of children born.

The chi-square or Fisher exact test indicated an association between Antenatal care visits, Gestational Age, and partograph use during labour to stillbirths among study participants (**Table 1**).

Table 1. Socio-demographics, maternal and foetal characteristics.

Variable	Birth outcome (n = 1168)		Total	X ² /F	p-value
	Live birth (%)	Stillbirth (%)			
Mothers Age				***	0.697
14 - 19	132 (11.30)	1 (0.09)	135 (11.39)		
20 - 29	614 (52.57)	7 (0.60)	621 (53.17)		
30 - 55	407 (34.85)	7 (0.60)	414 (35.45)		
Mean (SD)		27.51 (6.86)			
Educational level				***	0.977
No formal education	374 (32.02)	6 (0.51)	380 (32.53)		
Primary school	116 (9.93)	1 (0.09)	117 (10.02)		
Junior high school	246 (21.06)	3 (0.26)	249 (21.32)		
Senior high school	217 (18.58)	2 (0.17)	219 (18.75)		
Tertiary	200 (17.12)	3 (0.26)	203 (17.38)		

Continued

Occupation				***	0.581
Farmer	378 (32.36)	8 (0.68)	386 (33.05)		
Hairdresser/seamstress	154 (13.18)	1 (0.09)	155 (13.27)		
Trader	108 (9.25)	1 (0.09)	109 (9.33)		
Public Servant	155 (13.27)	3 (0.26)	158 (13.53)		
House Wife	215 (18.41)	1 (0.09)	216 (18.49)		
Student	143 (12.24)	1 (0.09)	144 (12.33)		
Gravidity				***	0.573
Primigravida	349 (29.88)	3 (0.26)	352 (30.14)		
Multigravida	804 (68.84)	12 (1.03)	816 (69.86)		
Parity				***	0.671
Nulliparous	359 (30.74)	3 (0.26)	362 (30.99)		
Primiparous	282 (24.14)	4 (0.34)	286 (24.49)		
Multiparous	416 (35.62)	6 (0.51)	422 (36.13)		
Grand Multiparous	96 (8.22)	2 (0.17)	98 (8.39)		
ANC visits				***	0.001
0 - 3	151 (12.93)	7 (0.60)	158 (13.53)		
4 - 8	852 (72.95)	5 (0.43)	857 (73.37)		
9 above	150 (12.84)	3 (0.26)	153 (13.10)		
Gestational Age				4.06	0.044
Less than 37 weeks	222 (19.01)	6 (0.51)	228 (19.52)		
37 weeks and above	931 (79.71)	9 (0.77)	940 (80.48)		
Partograph use				***	<0.001
Yes	952 (81.51)	4 (0.34)	956 (81.85)		
No	201 (17.21)	11 (0.94)	212 (18.15)		
Mother's temperature on admission				***	1.000
Less than 37.4	1126 (96.40)	15 (1.28)	1141 (97.69)		
37.4 and above	27 (2.31)	0 (0.00)	27 (2.31)		
Baby weight (kg)				***	0.073
Less than 2.5	66 (5.65)	3 (0.26)	69 (5.91)		
2.5 - 3.5	949 (81.25)	10 (0.86)	959 (82.11)		
3.6 and above	138 (11.82)	2 (0.17)	140 (11.99)		
Gender				0.26	0.612
Male	539 (46.15)	8 (0.68)	547 (46.83)		
Female	614 (52.57)	7 (0.60)	621 (53.17)		

*** = Fisher's exact test.

3.2. Prevalence of Stillbirth and Its Predictors

The overall prevalence of stillbirth was 12.84 per 1000 total births recorded for the period. Variations in the rate were observed among subgroupings. Teenage mothers recorded the lowest stillbirth rate of 7.50 per 1000 total births. The prevalence of stillbirths among mothers with no formal education and tertiary level education was high, 15.80 and 14.80 per 1000 total births, respectively, compared with mothers who had a senior high school qualification of 9.10 per 1000 total births. Public servants and farmers recorded the highest mortalities, 19.00 and 20.70 per 1000 total births, respectively, when compared with the other occupational groups. Mothers who attended ANC less than 4 times recorded the highest stillbirth rate of 44.30 per 1000 total births compared with mothers who attended ANC between 4 - 8 times during the current pregnancy. Partograph use recorded the lowest stillbirth rate of 4.09 per 1000 total births compared with women whose labour was not monitored with a partograph (Table 2).

In the univariate logistic regression, partograph use and ANC attendance were significantly associated with birth outcome. Women who attended ANC between 4 - 8 times were 87% less likely to record a stillbirth (COR 0.13 95% CL: 0.040 - 0.404, p-value \leq 0.001) compared with those who attended ANC less than 4 times during the current pregnancy. Women whose labour was not monitored using a partograph were about 13 times more likely to record a stillbirth (COR 13.02, 95% CL: 4.106 - 41.318, p-value \leq 0.001) compared with those whose labour was monitored using a partograph. After adjusting for confounding, women who attended ANC between 4-8 times were 93% less likely to record a stillbirth (AOR 0.07 (0.017 - 0.294) p-value \leq 0.001) compared with those who attended ANC less than 4 times and Women whose labour was not monitored using a partograph were more than 15 times likely to record a stillbirth (AOR 15.54, 95% CL: 4.335 - 55.722, p-value \leq 0.001) compared with those whose labour was monitored using a partograph. See details in Table 2 below.

Table 2. Prevalence of stillbirth and its predictors.

Variable	Stillbirth per 1000 total births	COR (CI)	p-value	AOR (CI)	p-value
Overall	12.84				
Mothers Age					
14 - 19	7.50	Reference			
20 - 29	11.30	1.50 (0.184 - 12.335)	0.703	7.61 (0.453 - 127.888)	0.159
30 - 55	16.90	2.27 (0.277 - 18.622)	0.445	9.89 (0.402 - 243.451)	0.161
Educational level					
No formal education	15.80	Reference			
Primary school	8.50	0.54 (0.064 - 4.509)	0.567	0.53 (0.045 - 6.410)	0.621
Junior high school	12.00	0.76 (0.188 - 3.068)	0.700	2.15 (0.326 - 14.246)	0.426

Continued

Senior high school	9.10	0.57 (0.115 - 2.871)	0.500	1.76 (0.183 - 16.925)	0.625
Tertiary	14.80	0.94 (0.231 - 3.778)	0.925	1.74 (0.049 - 62.099)	0.762
Occupation					
Farmer	20.70	Reference			
Hairdresser/seamstress	6.50	0.31 (0.381 - 2.473)	0.267	0.36 (0.031 - 4.263)	0.420
Trader	9.20	0.44 (0.054 - 3.537)	0.438	0.16 (0.015 - 1.756)	0.135
Public Servant	19.00	0.91 (0.239 - 3.492)	0.896	0.84 (0.027 - 26.783)	0.923
House Wife	4.60	0.22 (0.027 - 1.550)	0.154	0.18 (0.019 - 1.672)	0.131
Student	6.90	0.33 (0.041 - 2.664)	0.299	0.21 (0.011 - 3.824)	0.290
Gravidity					
Primigravida	8.50	Reference			
Multigravida	14.70	1.74 (0.487 - 6.191)	0.395	0.72 (0.000 - 55594.330)	0.953
Parity					
Nulliparous	8.30	Reference			
Primiparous	14.00	1.70 (0.377 - 7.646)	0.491	0.74 (0.000 - 59555.300)	0.959
Multiparous	14.20	1.73 (0.429 - 6.951)	0.443	0.89 (0.000 - 75090.680)	0.983
Grand Multiparous	20.40	2.49 (0.411 - 15.132)	0.321	0.91 (0.000 - 88023.770)	0.988
ANC visits					
0 - 3	44.30	Reference			
4 - 8	5.80	0.13 (0.040 - 0.404)	<0.001	0.07 (0.017 - 0.294)	<0.001
9 above	19.60	0.43 (0.109 - 1.700)	0.230	0.34 (0.050 - 2.367)	0.279
Gestational Age					
Less than 37 weeks	26.30	Reference		Reference	
37 weeks and above	9.60	0.36 (0.126 - 1.015)	0.053	0.40 (0.112 - 1.407)	0.152
Partograph use					
Yes	4.20	Reference		Reference	
No	51.90	13.02(4.106 - 41.318)	<0.001	15.54 (4.335 - 55.722)	<0.001
Baby weight (kg)					
Less than 2.5	43.50	Reference		Reference	
2.5 - 3.5	10.40	0.23 (0.062 - 0.863)	0.029	0.30 (0.059 - 1.467)	0.136
3.6 and above	14.30	0.31 (0.052 - 1.954)	0.217	0.253 (0.025 - 2.554)	0.244
Gender					
Male	14.60	Reference		Reference	
Female	11.30	0.76 (0.277 - 2.132)	0.613	0.86 (0.262 - 2.802)	0.799

4. Discussion

In underdeveloped nations, where the majority of neonatal deaths are believed to occur [12], this phenomenon is still a serious issue [13] and in both developed and

developing nations alike, neonatal deaths are reported more in rural than urban areas [14]. Therefore, solid strategic interventions that are based on a thorough understanding of the causes and variables associated with the incidence of stillbirths are necessary to achieve reductions in the worldwide burden of stillbirths [15]. There is however little evidence of this context in most rural poor communities in Ghana, hence the quest of this study to assess the prevalence and predictors of stillbirths following vaginal delivery at Tumu municipality of the Upper West Region of Ghana.

This study found the overall stillbirth rate to be 12.84 per 1000 total births. This is lower compared to the national rate of 17 stillbirths per 1000 live births [16] though there has been a decline in the stillbirth rates from 21 per 1000 live births to 17 per 1000 live births from 2013 to 2022, respectively. This finding and change witnessed over this period, though encouraging, is still high and a little over recommendations by the WHO. This finding is nonetheless lower than that in other developing countries outside Africa. For instance, a study in India found 62.0 per 1000 live births [17], another in Afghanistan found 37 per 1000 live births [18], and an increase from 24.8 to 38.1 per 1000 live births from 2017 to 2020 in Cambodia [19]. In other African countries, there was a comparatively higher stillbirth rate of 20.1 per 1000 live births in Burkina Faso [20], 61.8 per 1000 livebirths in Nigeria, a country that ranks second after India in neonatal deaths [21], and 22.0 per 1000 live births in Tanzania [22]. The low stillbirth rate seen in this study may be due to the gradual but sustained improvement in the health service delivery like the Community-based Health Planning Services (CHPS) system along with partnerships formed such as the Tumu Healthcare Initiative to improve the maternal healthcare and women's healthcare services in Tumu [23]. Even so, health authorities in the region will need to sustain efforts and improve in the areas of ANC attendance and the use of partograph to monitor labour to further reduce the rate as observed in a study with 9.2 per 1000 livebirths found in Ethiopia [24].

Similar to the findings in this study which indicated that labours not monitored with the partograph had over 15-fold higher odds of resulting in neonatal deaths, the use of partographs for labour monitoring has been found in earlier studies conducted in Ghana, Angola, and Burkina Faso to be a useful tool for improving pregnancy outcomes through early referrals for interventions like augmentation and emergency surgery when necessary [25]. This gives credence to the fact that partograph use is the best tool for monitoring labour and an indicator for the timely use of the next intervention to avert a negative outcome. About 81% of labour in this study was monitored with the partograph. This might be as a result of the Upper West Regional Health Directorate's continuous training of midwives as part of its audit of obstetric and newborn referrals in the area.

With recourse to the results, pregnant women who attended ANC 4 to 8 times had better prospects with stillbirths than their colleagues who attended fewer times or not at all. This aligns with the available literature [26]. The ANC visit is an embodiment of the aphorism 'Be good to your baby before it's born'. Because

the foetal organs are actively growing throughout the first 12 weeks of pregnancy and subsequently developing through the rest of the pregnancy, this care is crucial [27].

5. Conclusion

The overall rate of neonatal mortality was 12.84 per 1000 live births among singleton pregnancies. The foetal outcomes of pregnant women who attended ANC 4 to 8 times were better than those of their colleagues who attended ANC less frequently or not at all. The likelihood of stillbirths in labours without partograph monitoring was equally high. It is recommended that all midwives and other auxiliary staff who support the labour force undergo refresher training on the importance of monitoring labour progress using a partograph. We also recommend that mothers be better educated about the importance of routinely attending ANC and arriving at the hospital early in the event of labour for proper monitoring. The address of frequent ANC attendance must involve a multi-sectoral collaboration.

Ethics Approval and Consent to Participate

The Committee on Human Research, Publications and Ethics, School of Medicine and Dentistry, Kwame Nkrumah University of Science and Technology, waived the need for informed consent and granted ethical permission for this work. The retrospective nature of the data without identifying patient information makes consent for participation irrelevant. Informed consent was not required. Because of the following, the research complied with the informed consent waiver requirements: it posed no more than a minimal risk to the patients; it did not negatively impact the patients' rights or welfare; and it was practically impossible to conduct the research without the waiver. The reference number for this approval is CHRPE/AP/172/24. The Tumu Municipal Hospital's management was consulted for approval.

Availability of Data and Materials

All data are fully available without restriction.

Author Contributions

Conception and design: MMB, PDAA, ES, RNA, AAS, ASDA & MHK; Acquisition of data: MMB, PDAA, ES & RNA; Analysis: MMB, PDAA, ES & RNA; Interpretation of data: MMB, PDAA, ES & RNA; Drafting the article: MMB, PDAA, ES, RNA, AAS, ASDA, MHK & BSM; Revising it critically for important intellectual content: MMB, PDAA, ES, RNA & BSM; Final approval of the version to be published: MMB, PDAA, ES, RNA & BSM.

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Collinearity Test Results

The VIF indicated that all the variable used in the multivariable regression had very low correlation and hence did not affect the outcome of the model.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix I. Collinearity Test Results

Variable	VIF	Tolerance	R-Squared
Mother Age	1.85	0.5406	0.4594
Educational level	1.22	0.8186	0.1814
Occupation	1.14	0.8748	0.1252
Gravity	3.05	0.3279	0.6721
Parity	4.01	0.2491	0.7509
ANC visits	1.11	0.9038	0.0962
Gestational age	1.10	0.9127	0.0873
Partograph use	1.03	0.9706	0.0294
Baby weight	1.16	0.8621	0.1379
Baby gender	1.03	0.9755	0.0245
Mean VIF 1.62			

Appendix II. Abbreviations

AOR, Adjusted Odds Ratio; ANC, Antenatal care; CI, Confidence Interval; X^2/F , Chi-Square or Fisher's exact test; CHPS, Community-based Health Planning Services; HB, Haemoglobin; IPT, Intermittent Preventive Treatment; OR, Odds Ratio; SSA, SD, Standard deviation; Sub-Saharan Africa; VIS, Variance Inflation Factor.