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Factors associated with terminated pregnancies in Sri Lanka: A case study of the Sri Lankan Demographic and health survey (DHS) 2016

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Abstract

Pregnancy termination is considered to have adverse effects on women's health and to have created financial, economic, and social problems in their lives. This study aimed to identify factors associated with pregnancy termination in Sri Lanka. The study used 2016 Sri Lanka Demographic and Health Survey (DHS) data of 16,323 ever-married women aged 15–49, who were clustered in selected enumerated areas. A binary logistic random intercept multilevel model was fitted to find the association between pregnancy termination and the predictor variables in this study. The overall pregnancy termination rate among Sri Lankan women was 16.14%. Increasing age of women was found to be associated with increasing odds of pregnancy termination. Women who were overweight or obese had higher odds of pregnancy termination, with 14% and 36%, respectively, compared to women with a normal weight. With increasing parity, the likelihood of pregnancy termination decreased. Women who used contraceptives had a 24% higher likelihood of pregnancy termination than those who refrained from using them. Cohabiting women had a 57% higher chance of pregnancy termination. Working women had 15% higher odds than unemployed women. Women who experienced domestic violence had a 14% higher odds of pregnancy termination than those who did not. Women from the Northern, Eastern, and North Central provinces had a lower likelihood of pregnancy termination compared to those from the Western province. Women in the urban sector were more likely to terminate their pregnancy than those in the estate sector. Further, women residing in households where indoor smoking was permitted had a 13% greater chance of ending their pregnancy compared to non-smoking households. The study highlights the importance of restructuring education related to health and well-being, family planning, and work-life balancing for both women and their partners, and developing and implementing or strengthening policies and laws related to mitigating pregnancy termination including domestic violence for women.

Department of Census and Statistics, Sri Lanka can be found here: http://www.statistics.gov.lk/Datadessimination/DataDissaPolicy_2007Oct26 The data dissemination application can be found here: http://www.statistics.gov.lk/Datadessimination/datadissemination_DRAform.

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Abbreviations: AOR, Adjusted Odds Ratio; BMI, Body Mass Index; CI, Confidence Interval; DCS, Department of Census and Statistics; DHS, Demographic and Health Survey; ICC, Intra-Cluster Correlation; ICF, Inner City Fund; LR, Likelihood Ratio; SE, Standard Error; SSA, Sub-Saharan Africa; VIF, Variance Inflation Factor; WHO, World Health Organization.

Introduction

A pregnancy can end with live birth or termination. Whenever a pregnancy is terminated due to a miscarriage, induced abortion, or stillbirth, it is referred as a terminated pregnancy [1]. The term "miscarriage", also known as "spontaneous abortion", refers to the loss of pregnancy before 20 weeks [2]. A stillbirth is the loss of pregnancy after 20 weeks from the time of commencement of pregnancy [3]. An induced abortion is a termination of pregnancy that is brought about through external interventions. In this study, when a woman experienced a pregnancy that ends in a miscarriage, induced abortion, or a stillbirth, it was considered a termination of pregnancy. Different countries have varying laws and perspectives regarding induced abortions. In some countries where there are legal restrictions as safe methods are not accessible, and individuals may turn to unsafe methods, which can harm maternal health and even result in death [4].

Ending a pregnancy, regardless of the method used, can have adverse effects on a woman's mental and physical well-being, causing conditions like depression, anxiety, and concerns about fertility [5]. Additionally, it can give rise to challenges in the family, financial constraints, and generate a sense of shame, stigma, and societal disapproval [1, 6].

It is estimated that the annual number of miscarriages and induced abortions that occur globally is 23 million and 73 million, respectively [7, 8]. In 2019, a total of 1.9 million stillbirths occurred worldwide [7, 9, 10]. Additionally, most miscarriages and stillbirths are the highest in South Asian countries [11, 12] and 97% of all unsafe abortions occur in developing countries [13]. Due to these alarming statistics, terminated pregnancy is considered a major issue in maternal and child health globally [14].

In Sri Lanka, a South Asian country, the rate of stillbirths was 6.9 per 1000 births in 2021, and a national survey conducted in 1999 reported an abortion rate of 45 per 1000 women aged between 15 and 49 years [15, 16]. These numbers highlight the urgent need for immediate action as they represent the potential loss of future citizens, which is a national disaster.

Like many other nations, Sri Lanka also grapples with a substantial number of women in their reproductive years experiencing unwanted pregnancies, with a growing percentage resorting to abortion as a mean to avoid childbirth [17]. Furthermore, induced abortion is a crime in Sri Lanka, unless the mother's life is at risk due to the pregnancy [18].

Several studies have been conducted to identify risk factors for abortions, miscarriages, and stillbirths in Sri Lanka [19–23]. Due to small sample sizes and the samples not representing the general population, the results obtained from these studies may have had low power and compromise the inferences that can be drawn from them.

Inadequate levels of education and employment in lower-skilled positions were notable contributors to the heightened risk of unsafe abortion. Further, a woman's marital status, her decision-making regarding family size, and the gender composition of her existing children contribute to her vulnerability to unsafe abortions [21, 24, 25]. Furthermore, attitudes of abortion were found to be influenced by additional factors, including ethnicity, religion, age, the number of children a family has, individual exposure, and personal experiences related to the issue [26–31].

The occurrence of induced abortions was observed to be infrequent among individuals who were unmarried, students, and among adolescent women [32]. Further the knowledge of the illegal status of abortion was more prevalent through media channels. Seeking assistance, particularly from non-medical sources like spouses, friends, neighbors, and family increased the risk of undergoing an unsafe abortion [24].

Women aged over 35 years, face a heightened risk of miscarriage in their first three months of pregnancy, with obesity and unmanaged diabetes recognized as direct contributors to this

risk [33]. Further, various maternal factors, including thrombophilia, antiphospholipid antibody syndrome, extreme weight, and hypertension are known to heighten the risk of miscarriage [34]. Other identified risk factors include cigarette smoking, excessive caffeine consumption, trauma, and malnutrition [34]. Furthermore, maternal age, elevated BMI, and a prior history of miscarriages have also been recognized as risk factors for experiencing miscarriages [35].

The most frequent maternal factors identified in the stillbirth of population encompass maternal age, educational attainment, employment status, chronic hypertension or pregnancy-induced hypertension, chronic diabetes mellitus or gestational diabetes, weight status (underweight, overweight, or obesity), null parity, and the presence of anemia [36]. Additionally, the factors linked to stillbirth include smoking during late pregnancy, having no previous pregnancies, using assisted reproductive technologies, alcohol and drug use, a history of prior stillbirth, experiencing social disadvantage, and belonging to various ethnic backgrounds [20, 37].

The Demographic and Health Survey (DHS) is a survey implemented by Inner City Fund (ICF) International that collects, analyzes, and disseminates accurate and nationally representative data. These surveys are conducted in many developing countries around the world, including Sri Lanka [38]. Although the DHS is a reliable source of nationally representative data, little to no research has been done on terminated pregnancies in Sri Lanka using the DHS data set.

The aim of this study is to contribute to the existing literature on terminated pregnancies in the Sri Lankan context by identifying factors associated with terminated pregnancies at the individual and community levels using data from the Sri Lanka DHS in 2016. Furthermore, this study will help identifying necessary interventions for reducing terminated pregnancy rates in Sri Lanka, which will benefit decision-makers, health authorities, and policymakers identifying solutions related to maternal and child health.

Materials and methods

Data source, sampling, and data collection

The study used secondary data obtained from the most recent DHS conducted in Sri Lanka in 2016 by the Department of Census and Statistics (DCS). The sample design of the 2016 DHS followed a two-stage stratified sampling design. In the initial phase of the design, 2,500 census blocks/ clusters were chosen as the primary sampling units (PSUs). Within these designated PSUs, 10–12 housing units were selected as the secondary sampling units (SSUs). A total of 18,302 ever-married women between the ages of 15–49 in the selected census blocks were interviewed using a questionnaire [38]. Thus, individuals were nested within selected census blocks, which, by the sample design, were also nested within sectors and districts, adding a clustering effect to the collected data. After removing irrelevant and unrealistic responses, the study sample was finalized with 16,323 respondents in 2476 clusters.

Ethics approval

This study involves a secondary analysis of the data from the 2016 DHS Sri Lanka survey, which was obtained from the DCS Sri Lanka. Permission and the ethical approval for the study was obtained from the DCS Sri Lanka. Given that the research relied on pre-existing data, securing consent from the participants was deemed unnecessary. All protocols adhered to the relevant guidelines and regulations [39].

Study variables

Response variable. Data on past miscarriages, stillbirths, and abortions were collected by interviewing the women who qualified to respond to the question "Have you ever had a

pregnancy that ended in a miscarriage, abortion, or stillbirth?" in the questionnaire. The response options were "Yes" or "No". Therefore, the variable "Pregnancy Termination Status" was used as the response variable in the study and was coded as 0 for "Yes" and 1 for "No".

Explanatory variables. The explanatory variables used in the study, including individual-level and community-level factors are shown in Table 1. These variables were selected based on their theoretical relevance, practical significance, and availability in the data set.

Statistical analysis

The prevalence of pregnancy terminations was analyzed using univariate and bivariate analysis for the descriptive part of the variables. Then, the multicollinearity among the explanatory variables was checked using the Variance Inflation Factor (VIF) before fitting the model [40]. Afterward, a binary logistic random intercept multilevel model was employed due to the hierarchical nature of the data set, which consisted of fixed and random effects. The fixed effects show the association of the explanatory variables with the response variable, while the random effect, a measure of random variation, was assessed using the Intra-Cluster Correlation (ICC) [41]. Goodness of fit of the models was assessed using likelihood ratio test.

The statistical analysis for this study was conducted using SAS on Demand for Academics. SAS is a powerful and widely used software suite for data analysis, management, and reporting. It has been used in various industries, including healthcare, finance, and academia, for over four decades. All statistical tests were performed at a 5% level of significance.

Results

Baseline characteristics

The distribution of independent categorical variables across pregnancy termination statuses is presented in Table 2. The overall percentage of women who have ever had a pregnancy that ended in a miscarriage, abortion, or stillbirth accounted for 16.14% in the study sample. The majority of the 16,323 eve-married women in the sample lived in rural areas (78.75%). Of the women, 66.55% had education up to secondary level and more than half (57.72%) was between 35 and 49 years old. The majority of women (66.53%) was between 15 and 24 years old when they first unionized with a male. More than one-third of the women had a parity of two (36.78%) and 45.9% reported a normal Body Mass Index (BMI). Regarding marital status, 90.67% of women was married and most reported not experiencing any domestic violence from their husband or partner. Of the women, 67.85% was unemployed. The majority of women was from the Western Province (19.46%) and lived in households with a low wealth index quintile (23.41%). Moreover, according to the recorded data, 84.41% of women lived in households where smoking indoors was not allowed.

Results of binary logistic random intercept multilevel model

The mean VIF was 1.25, indicating the absence of high multicollinearity between the explanatory variables. Table 3 presents the results of the fitted binary logistic random intercept multilevel models. The goodness of fit of the models was evaluated using the Likelihood Ratio (LR) test. The interpretation of the fixed effects was based on the model with the lowest -2 Log Likelihood, which was Model 3.

Results of measures of associations

The complete model including both individual and community-level factors was found in Model 3 in Table 3. Individual factors such as woman's age, BMI, parity, contraceptive use,

Table 1. Details of explanatory variables.

Variable	Code
Individual Level	
Woman's Age (Years)	1–15 to 24
	2–25 to 34
	3–35 to 49
Woman's BMI[a/]	1-Underweight
	2-Normal Weight
	3-Overweight
	4-Obese
Highest educational level	1-Never attended school
	2-Pre-school or Primary
	3-Secondary
	4-Higher
Parity	0
	1
	2
	3 or more
Use of any contraceptive method	0-No
	1-Yes
Married/ Living with a man	1-Married
	2-Living with a man
	3-Separated/ Divorced/ Widowed
Woman's Age at first union (Years)	1- Less than 15
	2–15 to 24
	3–25 to 34
	4–35 to 49
Woman's working status	1-Yes
	2-No
Encountered any domestic violence	0-No
	1-Yes
Smoking allowed inside the home	1-Yes
	2-No
Wealth index quintile	1-Lowest
	2-Second
	3-Middle
	4-Fourth
	5-Highest
Community Level	
Region	1-Western Province
	2-Central Province
	3-Southern Province
	4-Northern Province
	5-Eastern Province
	6-Northwestern Province
	7-North Central Province
	8-Uva Province
	9-Sabaragamuwa Province
Locality	1-Urban
	2-Rural
	3-Estate

[a/] BMI—Body Mass Index

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Table 2. Distribution of independent categorical variables across pregnancy termination status.

Variables	Overall (%)	Pregnancy Not Terminated	Pregnancy Terminated
	(n=16323)	(n= 13676)	(n= 2634)
	N (%)	N (%)	N (%)
Individual Level			
Highest educational level			
Never attended school	264 (1.62)	222 (84.09)	42 (15.91)
Pre-school or Primary	1 262 (7.73)	1 100 (87.16)	162 (12.84)
Secondary	10 863 (66.55)	9 071 (83.50)	1 792 (16.50)
Higher	3 934 (24.10)	3 296 (83.78)	638 (16.22)
Woman's Age (Years)			
15–24	1 295 (7.93)	1 176 (90.81)	119 (9.19)
25–34	5 606 (34.34)	4 840 (86.34)	766 (13.66)
35–49	9 422 (57.72)	7 673 (81.44)	1 749 (18.56)
Woman's BMI			
Underweight	1 503 (9.21)	1 298 (86.36)	205 (13.64)
Normal Weight	7 492 (45.90)	6 381 (85.17)	1 111 (14.83)
Overweight	5 192 (31.81)	4 297 (82.76)	895 (17.24)
Obese	2 136 (13.09)	1 713 (80.20)	423 (19.80)
Woman's age at first union (Years)			
<15	254 (1.56)	216 (85.04)	38 (14.96)
15–24	10 859 (66.53)	9 183 (84.57)	1 676 (15.43)
25–34	4 925 (30.17)	4 057 (82.38)	868 (17.62)
35–49	285 (1.75)	233 (81.75)	52 (18.25)
Parity			
0	1 494 (9.15)	1 254 (83.94)	240 (16.06)
1	3 852 (23.60)	3 268 (84.84)	584 (15.16)
2	6 003 (36.78)	4 992 (83.16)	1 011 (16.84)
3 or more	4 974 (30.47)	4 175 (83.94)	799 (16.06)
Use of contraceptive method			
No	2 482 (15.21)	2 146 (86.46)	336 (13.54)
Yes	13 841 (84.79)	11 543 (83.40)	2 298 (16.60)
Married/ Living with a man			
Married	14 800 (90.67)	12 383 (83.67)	2 417 (16.33)
Living with a man	578 (3.54)	476 (82.35)	102 (17.65)
Separated/ Divorced/ Widowed	945 (5.79)	830 (87.83)	115 (12.17)
Woman's working status			
Yes	5 248 (32.15)	4 310 (82.13)	938 (17.87)
No	11 075 (67.85)	9 379 (84.69)	1 696 (15.31)
Encountered any domestic violence			
No	13 137 (80.48)	11 038 (84.02)	2 099 (15.98)
Yes	3 186 (19.52)	2 651 (83.21)	535 (16.79)
Smoking allowed inside the home			
Yes	2 544 (15.59)	2 099 (82.51)	445 (17.49)
No	13 779 (84.41)	11 590 (84.11)	2 189 (15.89)
Wealth index quintile			
Lowest	3 822 (23.41)	3 296 (86.24)	526 (13.76)
Second	3 309 (20.27)	2 811 (84.95)	498 (15.05)
Middle	3 205 (19.63)	2 663 (83.09)	542 (16.91)

(*Continued*)

Table 2. (Continued)

Variables	Overall (%)	Pregnancy Not Terminated	Pregnancy Terminated
	(n=16323)	(n= 13676)	(n= 2634)
	N (%)	N (%)	N (%)
Fourth	3 126 (19.15)	2 592 (82.92)	534 (17.08)
Highest	2 861 (17.53)	2 327 (81.34)	534 (18.66)
Community Level			
Region			
Western Province	3 177 (19.46)	2 580 (81.21)	597 (18.79)
Central Province	1 965 (12.04)	1 600 (81.42)	365 (18.58)
Southern Province	1 818 (11.14)	1 485 (81.68)	333 (18.32)
Northern Province	2 003 (12.27)	1 779 (88.82)	224 (11.18)
Eastern Province	1 696 (10.39)	1 461 (86.14)	235 (13.86)
Northwestern Province	1 892 (11.59)	1 587 (83.88)	305 (16.12)
North Central Province	1 169 (7.16)	1 001 (85.63)	168 (14.37)
Uva Province	1 134 (6.95)	949 (83.69)	185 (16.31)
Sabaragamuwa Province	1 469 (9.00)	1 247 (84.89)	222 (15.11)
Locality			
Urban	2 571 (15.75)	2 131 (82.89)	440 (17.11)
Rural	12 854 (78.75)	10 771 (83.79)	2 083 (16.21)
Estate	898 (5.50)	787 (87.64)	111 (12.36)

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marital status, employment status, exposure to domestic violence, and smoking status inside the house were found significant. Some levels of region and locality were also significant among the community-level factors.

The odds of pregnancy termination increased significantly with the increasing age of women. Women aged 35–49 years old [AOR = 2.64, 95% CI = (2.10, 3.31)] had approximately three times higher odds of pregnancy termination compared to those women aged 15–24 years old. Overweight [AOR = 1.14, 95% CI = (1.04, 1.26)] and obese [AOR = 1.36, 95% CI = (1.20, 1.55)] women had 14% and 36% higher odds of pregnancy termination, respectively, compared to women with normal weight. The odds of pregnancy termination decreased with the increasing number of children a woman had. Women with three or more children [AOR = 0.62, 95% CI = (0.50, 0.76)] had 38% lower odds of pregnancy termination compared to women with zero parity. Women who used contraceptives [AOR = 1.24, 95% CI = (1.07, 1.45)] had 24% higher odds of pregnancy termination compared to otherwise. Cohabiting women [AOR = 1.57, 95% CI = (1.16, 2.13)] had 57% higher odds of pregnancy termination compared to separated, divorced, or widowed women. Working women [AOR = 1.15, 95% CI = (1.05, 1.27)] had 15% higher odds of pregnancy termination compared to unemployed women. Women who faced domestic violence [AOR = 1.14, 95% CI = (1.02, 1.28)] had 14% higher odds of pregnancy termination compared to otherwise. Women from the Northern [AOR = 0.60, 95% CI = (0.50, 0.73)], Eastern [AOR = 0.80, 95% CI = (0.67, 0.97)], and North Central [AOR = 0.78, 95% CI = (0.64, 0.95)] provinces had a lesser likelihood of pregnancy termination compared to women from the Western province. Women in the estate sector [AOR = 0.70, 95% CI = (0.53, 0.92)] had 30% lower odds of pregnancy termination compared to women in the urban sector. Women who resided in houses where smoking was permitted indoors [AOR = 1.13, 95% CI = (1.01, 1.28)] had 13% higher odds of pregnancy termination compared to those who did not.

Table 3. Individual and community level factors associated with pregnancy termination (n=16323).

Variable	Model 1		Model 2		Model 3	
	AdjOR[a/]	CI_{95}	AdjOR	CI_{95}	AdjOR	CI_{95}
Fixed Effects						
Individual level						
Woman's Age (Years)						
15–24			1.00		1.00	
25–34			1.73***	(1.39, 2.15)	1.73***	(1.39, 2.15)
35–49			2.68***	(2.13, 3.37)	2.64***	(2.10, 3.31)
Woman's BMI						
Underweight			1.00	(0.85, 1.19)	1.00**	(0.85, 1.18)
Normal weight			1.00		1.00	
Overweight range			1.14*	(1.03, 1.26)	1.14***	(1.04, 1.26)
Obese			1.36***	(1.19, 1.54)	1.36***	(1.20, 1.55)
Woman's Age at first union (Years)						
<15			1.00		1.00	
15–24			0.95	(0.66, 1.35)	0.95	(0.66, 1.36)
25–34			0.94	(0.65, 1.36)	0.94	(0.65, 1.37)
35–49			0.85	(0.52, 1.38)	0.84	(0.52, 1.37)
Highest education level						
Never attended school			1.00		1.00	
Pre-school or Primary			0.77	(0.53, 1.12)	0.79	(0.54, 1.15)
Secondary			1.08	(0.76, 1.53)	1.10	(0.77, 1.56)
Higher			0.92	(0.64, 1.32)	0.94	(0.65, 1.36)
Parity						
0			1.00		1.00	
1			0.75**	(0.62, 0.90)	0.78**	(0.64, 0.94)
2			0.66***	(0.54, 0.80)	0.69**	(0.57, 0.84)
3 or more			0.58***	(0.47, 0.71)	0.62***	(0.50, 0.76)
Use of contraceptive method						
Yes			1.36***	(1.18, 1.58)	1.24**	(1.07, 1.45)
No			1.00		1.00	
Married/ Living with a man						
Married			1.52***	(1.24, 1.88)	1.51**	(1.22, 1.86)
Living with a man			1.64**	(1.21, 2.21)	1.57**	(1.16, 2.13)
Separated/ Divorced/ Widowed			1.00		1.00	
Woman's working status						
Yes			1.16**	(1.06, 1.28)	1.15**	(1.05, 1.27)
No			1.00		1.00	
Encountered any domestic violence						
Yes			1.13*	(1.01, 1.26)	1.14*	(1.02, 1.28)
No			1.00		1.00	
Smoking allowed inside the home						
Yes			1.15*	(1.02, 1.29)	1.13*	(1.01, 1.28)
No			1.00		1.00	
Wealth index quintile						
Lowest			1.00		1.00	
Second			1.02	(0.89, 1.17)	0.92	(0.80, 1.07)
Middle			1.15*	(1.00, 1.33)	1.01	(0.87, 1.17)

(*Continued*)

Table 3. (Continued)

Variable	Model 1		Model 2		Model 3	
	AdjOR[a/]	CI_{95}	AdjOR	CI_{95}	AdjOR	CI_{95}
Fourth			1.14	(0.98, 1.31)	0.97	(0.83, 1.14)
Highest			1.22*	(1.05, 1.43)	1.01	(0.85, 1.20)
Community Level						
Region						
Western Province					1.00	
Central Province					1.13	(0.96, 1.33)
Southern Province					1.02	(0.86, 1.19)
Northern Province					0.60***	(0.50, 0.73)
Eastern Province					0.80*	(0.67, 0.97)
Northwestern Province					0.86	(0.73, 1.01)
North Central Province					0.78*	(0.64, 0.95)
Uva Province					0.95	(0.78, 1.15)
Sabaragamuwa Province					0.84	(0.70, 1.01)
Locality						
Urban					1.00	
Rural					1.01	(0.89, 1.15)
Estate					0.70**	(0.53, 0.92)
Random Effects						
Cluster Variance (SE[b])	0.13*** (0.04)		0.10** (0.04)		0.08* (0.04)	
ICC	0.04		0.03		0.02	
Model Fit						
-2 Log Likelihood	14413.54		14160.87		14110.70	
BIC[c]	14429.17		14364.04		14392.02	
AIC[d]	14417.54		14212.87		14182.70	

[a/] AdjOR: Adjusted Odds Ratio, CI_{95}—95 percent Confidence Interval;

[b/] SE: Standard Error;

[c/] BIC: Bayesian Information Criterion;

[d/] AIC: Akaike Information Criterion;

[e/] Level of significance:

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

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Results of measures of variance

Model 1, the empty model, indicated a statistically significant variability in the odds of pregnancy terminations with a cluster variance of 13%. Further, the ICC of the empty model shows that 4% of the total variability in the pregnancy terminations in Sri Lanka was attributed to differences between clusters, leaving 96% of the variability to be accounted for by other unknown factors. Model 3, the full model, adjusted for individual and community-level factors, reduced the cluster variance to 0.08 (Standard Error (SE) = 0.04) which remained significant. This shows that 2% of the total variance of pregnancy terminations was attributed to clusters. In a multilevel study, an ICC equal to or greater than 2% indicates significant group-level variance and is considered a minimum precondition [42].

Discussion

This study analyzed the association of women's and community characteristics with pregnancy termination in Sri Lanka using data collected under the Sri Lanka DHS 2016. A binary logistic random intercept multilevel model was fitted to identify the factors related to pregnancy termination. The results showed that the woman's age, BMI, parity, contraceptive use, marital status, working status, domestic violence encounter status, smoking status inside the house, region, and locality significantly explained the variations in pregnancy termination in Sri Lanka.

Factors associated with pregnancy termination in Sri Lanka

The fitted binary logistic random-intercept multilevel model showed that the likelihood of pregnancy termination increased with increasing age of women, which is in agreement with previous studies [43, 44]. This increase in pregnancy termination is attributed to the aging reproductive system of women, leading to negative pregnancy outcomes that may necessitate or cause a pregnancy termination [45]. In the Sri Lankan context, induced abortions are illegal unless they are performed to save the life of the mother. However a study done in Sri Lanka found the older age as a determinant of induced abortion [22]. Moreover, local studies show that advanced maternal age was associated with adverse obstetric and perinatal outcomes including stillbirths and miscarriages [33, 35, 46].

The fitted binary logistic random intercept multilevel model showed that woman's BMI was a significant factor associated with pregnancy termination. Women who did not have a normal weight on the BMI scale (18.5 kg/m^2 to 24.9 kg/m^2) [47] experienced significantly higher rates of pregnancy termination. Similar results on the association of pregnancy termination, mostly attributed to miscarriages and stillbirths, and BMI was observed in previous local and global studies [33, 35, 48–51]. The reasons behind the higher rates of pregnancy termination due to a higher BMI compared to normal weight are still unclear, but studies have found that factors such as high blood pressure, pre-gestational and gestational diabetes, and placental diseases or disorders are more likely to occur in overweight or obese women which can cause adverse pregnancy outcomes [52, 53]. In addition, underweight women experience infertility due to hormonal disturbances caused by eating disorders and lack of nutrients, and they may also experience miscarriages and sexual dysfunction [54]. Therefore, apart from miscarriages and stillbirths, induced abortion could be performed to save the mother's life in cases where life threatening pregnancy complications occur. However, the association between induced abortion and not having a normal BMI needs further investigation.

The odds of a terminated pregnancy were high among women who had no children compared to those women who had children. Furthermore, the study observed lower odds of pregnancy termination with increasing parity, which is consistent with previous studies conducted in Sub-Saharan Africa (SSA) [55] and Ghana [56]. A study done in Sri Lanka found that nulliparous women have higher likelihood of giving stillbirths [36]. However, this aspect in terms of miscarriage and induced abortion has not been explored much in local literature and hence needs further investigation.

The likelihood of pregnancy termination was high among women who have used contraceptives, which aligns with the findings of prior studies [57, 58]. The use of contraceptive methods, especially oral contraceptive pills, can cause hormonal disruptions, and these disruptions have been found to increase the risk of pregnancy complications that can lead to terminations, such as stillbirths, miscarriages, or abortions [59]. Furthermore, a previous Sri Lankan study revealed that the practice of traditional contraception could lead to repeated abortions,

and in that scenario women may consider induced abortion as a contraceptive method or back-up procedure for contraceptive failure [60].

This study found that, unlike the results of other studies [61, 62], married and cohabiting women had a higher risk of pregnancy termination compared to women who were not married or not living with their partner. Furthermore, a previous study conducted in Sri Lanka found that the susceptibility of unmarried women to induced abortion was not influenced by their social standing and highlights the societal stigma attached to 'unwed mothers' in Sri Lanka, where cohabitation outside of marriage is not culturally accepted [21]. Also, evidence shows that it is married women, over the age of 30 years, with at least one or two (living) children (of a very young age), who often seek abortion services [63].

The binary logistic random intercept multilevel model showed that working women had a higher likelihood of pregnancy termination compared to non-working women. These findings are supported by research conducted in SSA [55]. Stress at work, long working hours, and a heavy physical workload significantly contribute to pregnancy terminations [64–66]. Previous studies in Sri Lanka show that, in recent decades, women have increasingly sought independence to actively contribute to both family finances and social responsibilities, much like their partners. This endeavor may be a probable factor contributing to the elevated risk of unsafe abortions [21]. Furthermore, the availability of job opportunities for women in the Middle-East, especially within the lower economic strata of the local labor market is cited as a factor leading to the choice of abortion as a method of ending pregnancies and preventing births [67].

The results of this study showed that the likelihood of pregnancy termination was high among women who lived in houses where smoking was allowed indoors. Women typically spend a lot of time at home during pregnancy and inhaling cigarette smoke, even if they do not smoke themselves, for an extended period can expose them to passive smoking. According to the World Health Organization (WHO), exposure to passive smoking can lead to adverse effects on pregnancy outcomes [68]. Previous studies have also shown that miscarriage, stillbirth, and abortion is significantly associated with passive smoking [69–73]. However, it would be worth conducting further studies on the association between pregnancy termination, including miscarriage, stillbirth, and induced abortion, and living in houses where indoor smoking allowed, as there has been a few or no detailed studies conducted in Sri Lanka on this matter.

The results of the fitted model show that women who experienced domestic violence have a significantly higher likelihood of terminating their pregnancies than those who have not experienced any domestic violence. These results are consistent with the findings of previous studies [74, 75]. A plausible reason for this could be that physical violence and accidental blows on a woman, both during and outside of pregnancy, can cause physical damage, especially to the lower abdomen region, and also result in mental distress which can lead to pregnancy complications and result in termination [75–77]. In a previous local study, it was shown that instances of domestic violence can result in induced abortions, as the woman may feel compelled to end the pregnancy due to it being unwanted or a consequence of non-consensual sexual engagement [78].

The results of the fitted model show that the odds of pregnancy terminations are significantly lower in regions with low population density, such as the Northern, Eastern, and North Central provinces, compared to that in the Western province, which has the highest population density [79]. Furthermore, the estate sector, which has the lowest density at the locality/sector level [79], has a lower likelihood of pregnancy terminations compared to the urban sector. These results may have been influenced by population density, as lower numbers of cases were reported in regions and localities with lower population density when compared to

denser regions and localities. However, past research has indicated that districts with fewer urban areas and marginalized populations tend to have higher rates of unsafe abortions [80]. This warrants further investigations.

Limitations of the study

The present study used only the 2016 DHS data set. Therefore, causal inference between the predictor variables and pregnancy termination was not considered. Although the study dataset has many variables that could be considered for this study, not all of them were included because the fitted model faced converging issues and hence, those variables were removed from the study. Furthermore, the survey used in data collection relied up on self-reported data, so there may be inaccurate or misleading information and as a result a recalled bias. Additionally, since induced abortion is illegal in Sri Lanka, unless women were granted permission to discuss it confidentially, many respondents who have undergone an induced abortion might not have admitted to it. This could have resulted in a probable underreporting of this issue, affecting the obtained results.

Conclusions

This study identified factors associated with pregnancy termination in Sri Lanka. The results indicated that increasing age of women, being classified as either overweight or obese based on the BMI scale, exposure to passive smoking at home, use of contraceptive methods, being married or cohabiting, being employed, and experiencing domestic violence increase the odds of pregnancy termination. Moreover, having more children (increasing parity) is linked to a lower likelihood of pregnancy termination. Additionally, community-level variables like region and locality were identified as significant factors associated with pregnancy termination. These findings highlight the time to call for the improvement of education related to health and wellbeing, family planning, work-life balance for both women and their partners, and the implementation or strengthening of policies and laws related to domestic violence for women. Implementing these measures can ensure safe and positive pregnancy outcomes and ensuring the human capital in the future of Sri Lanka.

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