

CROSS-SECTIONAL STUDY ON ADVERSE PREGNANCY OUTCOMES AMONG FEMALE HEALTHCARE WORKERS IN KUCHING, SARAWAK

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ABSTRACT

The weight of occupational risk on women in addition to men, is on their fecundity. NIOSH lists disorders of reproduction as one of the top ten leading work-related diseases and injuries. Nevertheless, women in the workforce is increasing and in healthcare, females make up the majority. This research is to observe the occurrences of adverse pregnancy outcomes among female healthcare workers in relation to their work schedules and its significance in relation to non-healthcare workers. A cross-sectional study was carried out using a questionnaire with 469 respondents; 339 healthcare and 130 non-healthcare workers, reporting 564 pregnancies. In this study, adverse pregnancy outcomes among female healthcare workers is significantly higher than non-healthcare workers. There are no significant findings between healthcare and non-healthcare workers with respect to the types of adverse pregnancy outcomes and the work schedule. However, from the respondents' lifetime pregnancy outcome, we find that complete miscarriage occurred more frequently among healthcare workers who work on shift. Healthcare workers do experience a higher risk of adverse pregnancy outcomes, commonly occurring among those who work on shift/on-call.

Keywords: *Cross-Sectional Study, Adverse Pregnancy Outcomes, Female Healthcare Workers*

INTRODUCTION

Pregnancy is a natural phenomenon and a process that ensures the continuation of the human species. Due to this natural ability, females need more health considerations and care. Tailored and specific programs are available to ensure their good health. In this period of advance development and progress, more and more women are becoming independent and carrying out roles, duties and jobs formerly dominated by men. With this, we see an increasing number of women into the workforce. Now, they too are exposed to hazards from the working environment similar to men (Burdorf *et al.*, 2006). The health risk of these hazards on women is more over man. Their fecundity; their ability to reproduce and remain fertile is at higher risk compared to men. Many studies have showed that stressors from the working environment did affect reproductive system and over time. Hence, many precautionary measures had been developed to protect them.

Healthcare working environment is not free of hazards, which carry risk that can take effect on the

reproductive system of female healthcare workers. The nature of healthcare work by itself, carries a large responsibility. Simply because it deals with human lives hence, we must try ensuring that there is close to no margin of error. Hence, there is no doubt in sentiment that psychosocial stress does exist here (Familoni, 2008). In addition to psychosocial stress, the long working hours with various time schedules also constitutes their working environment, which is also a risk-carrying hazard. The nursing section makes up the bulk of healthcare workers predominated by females. Hence, it is only rightful to explore their health risk. In this study, their pregnancy outcome reflects their fecundity.

The National Institute for Occupational Safety and Health (NIOSH) lists disorders of reproduction as one of the top ten leading work-related diseases and injuries (Burdorf *et al.*, 2006; Figà-Talamanca, 2006; Yamada, 1986). However currently there is no surveillance for such disorders of reproduction at national level. Moreover, hazards due to occupation or otherwise is not listed in Malaysia. Following NIOSH and reviews from

literature, complete miscarriage, threatened miscarriage, prematurity, low birth weight, hypertensive disorders in pregnancy and others categories of adverse pregnancy outcomes (NIOSH 2017) is studied in this paper.

The common stressor attributed to the stressful healthcare working environment is the work schedule and hours. Long and changing work schedules has been reported to contribute to the increase in adverse pregnancy outcomes especially among healthcare staff (Harrington 2001; Hakola, Härmä & Laitinen 1996; Gabbe *et al.*, 2003). In Sarawak, the work schedule depends on the occupation and duties. The nurses commonly practice the rotating shift system similarly practiced in the United Kingdom (Royal College of Physicians, 2013). A normal rotation of a day shift followed by an evening shift and then a night shift makes up an average of 45 working hours per week. The on-call work schedule normally carried out by doctors and some allied health staff workers up to 32 hours in a row and may continue with another round the following day making up more than 70 hours per week of work. The last work schedule is the usual office hours where the staff only works 8 hours per day for 5 days.

This paper studies the occurrences of adverse pregnancy outcomes among female healthcare workers in relation to their work schedules and its significance in relation to non-healthcare workers.

METHODOLOGY

The healthcare workers were from the only tertiary healthcare centre in Sarawak, Malaysia, which best represents the working environment for healthcare workers. To represent a contrasting working environment, we recruited non-healthcare workers from a government tertiary education centre. The number of eligible non-healthcare workers in the tertiary healthcare centre were too few to produce a statistical analysis. We universally sampled the respondents based on a vetted name list according to a set criterion. Calculating the sample size was based on proportionate sampling on the female population in both the studied institutions. The proportion took account the Sarawak state birth rate.

We used a questionnaire to conduct this cross-sectional study. The questionnaire elicits the respondents' demography, pregnancy history and its concurrent work history. We included females who have had an experience of pregnancy in the past three years and the history for each pregnancy was elicited (lifetime analysis deduced). Due to the effect of age increasing risk of adverse pregnancy outcome, those who has experienced pregnancy up to the age of 35 were included. Hence, the

maximum age of a respondent included is 38 years (Kenny *et al.*, 2013).

Statistical analysis includes descriptive statistics involving identification of total number of healthcare and non-healthcare subjects who had any adverse pregnancy outcome and related to work schedule for healthcare workers. Bivariate analysis was used to describe the respondents' sociodemographic factors with the adverse pregnancy outcomes. For the healthcare workers the analysis was carried out with the work schedule, instead.

RESULTS

Table 1 presents the events of adverse pregnancy experienced in the last three years. The most frequently occurring adverse event is deduced as lifetime adverse pregnancy outcome. Out of the 469 respondents who experienced a pregnancy in the last three years, 120 of them had experienced an adverse outcome at least once. 98 of them were among healthcare workers (81.7%). This difference is significant [χ^2 (df)=0.008(1), $p<0.01$].

The average age (standard deviation) of the respondents is 31.9 (3.4) years, minimum age is 23 years. The average age (SD) during pregnancy among all the respondents is 30.2 (3.3) years. There is a statistically significant difference ($p<0.05$) in the mean age between healthcare and non-healthcare workers. Hundred and seven respondents had experienced an adverse pregnancy outcome in their latest pregnancy. Among them, those between the age of 30 to 38 years, there were 88 of them and it was significant at [χ^2 (df)=0.027(1), $p<0.05$]. However, only 85 of them were healthcare workers and the difference were not significant. Nevertheless, the significance of job description is seen in those who experienced adverse pregnancy outcome in their 1st prior pregnancy [χ^2 (df)=0.003(1), $p<0.01$] and not among those between ages 30 to 38.

Adverse pregnancy outcomes occurring among healthcare workers is significant in this study. It is seen that majority of the respondents are nurses. About 78 out of 260 of them had experienced a lifetime adverse pregnancy outcome significant at [χ^2 (df)=0.044(3), $p<0.05$] and 22 out of 59 of them during their 1st prior pregnancy [χ^2 (df)=0.00(3), $p=0.01$]. Very few respondents had experienced three pregnancies in a row hence, the number of adverse pregnancies at their second prior pregnancy were too few for analysis.

Race, income and education factors were not significant. No respondent claimed consuming drugs, alcohol and smoking. None also reported any comorbidities.

The analysis of the effect of work schedule on pregnancy outcomes were carried out only among the healthcare staff. The results were not significant in any

of the pregnancies. Nevertheless, those who work on-call and shift did experienced more frequent adverse pregnancy outcomes.

Table 1: Percentage distribution of adverse pregnancy outcome among respondents following their socio demographic characteristics.

	Lifetime Adverse Pregnancy Outcome, n (%)		Adverse Pregnancy Outcome in Latest Pregnancy, n (%)		Adverse Pregnancy Outcome in 1 st prior pregnancy, n (%)		Adverse Pregnancy Outcome in 2 nd prior pregnancy, n (%)	
	Yes	No	Yes	No	Yes	No	Yes	No
	120 (100)	349 (100)	107 (100)	362 (100)	25 (100)	65 (100)	3 (100)	1 (100)
Job Description								
Healthcare	98 (81.7)	241 (69.1)	85 (79.4)	254 (70.2)	25	47	na**	
Non-healthcare	22 (18.3)	108 (30.9)	22 (20.6)	108 (29.8)	0	18		
<i>p</i> value	0.008*		0.06		0.003*			
Age (years)								
21 – 29	24 (20.0)	98 (28.1)	19 (17.8)	103 (28.5)	7 (28.0)	23 (35.4)	0	1 (100)
30 – 38	96 (80.0)	251 (71.9)	88 (82.2)	259 (71.5)	18 (72.0)	42 (64.6)	3 (100)	0
<i>p</i> value	0.082		0.027*		0.506		0.25	
Race								
Malay	51 (42.5)	154 (44.1)	45 (42.1)	160 (44.2)	33 (50.8)	11 (44.0)	2 (66.7)	0
Bidayuh	27 (22.5)	70 (20.1)	23 (21.5)	74 (20.4)	18 (27.7)	6 (24.0)	0	1(100)
Chinese	13 (10.8)	45 (12.9)	13 (12.1)	45 (12.4)	5 (7.7)	1 (4.0)	0	0
Other Races	29 (24.2)	80 (22.9)	26 (24.3)	83 (22.9)	9 (13.8)	7 (28.0)	1 (33.3)	0
<i>p</i> value	0.878		0.977		0.446		0.50	
Income								
<2000	8 (6.7)	39 (11.2)	8 (7.5)	39 (10.8)	1 (4.0)	3 (4.6)	na	
2000-5000	99 (82.5)	264 (75.6)	86 (80.4)	277 (76.5)	23 (92.0)	54 (83.1)		
>5000	13 (10.8)	46 (13.2)	13 (12.1)	46 (12.7)	1 (4.0)	8 (12.3)		
<i>p</i> value	0.254		0.584		0.489			
	Lifetime Adverse Pregnancy Outcome		Adverse Pregnancy Outcome in Latest Pregnancy		Adverse Pregnancy Outcome in 1 st prior pregnancy		Adverse Pregnancy Outcome in 2 nd prior pregnancy	
	Yes	No	Yes	No	Yes	No	Yes	No
Occupation								
Nursing	78 (65.0)	182 (52.1)	66 (61.7)	194 (53.6)	22 (88.0)	37 (56.9)	na**	
Doctor	7 (5.8)	25 (7.2)	7 (6.5)	25 (6.9)	0	4 (6.2)		
Support staff	13 (10.8)	34 (9.7)	12 (11.2)	35 (9.7)	3 (12.0)	6 (9.2)		
Non-healthcare	22 (18.3)	108 (30.9)	22 (16.9)	108 (29.8)	0	18 (27.7)		
<i>p</i> value	0.044*		0.29		0.01*			
Education								
SPM	13 (10.8)	52 (14.9)	52 (14.4)	13 (12.1)	1 (4.0)	7 (10.8)	1 (33.3)	0
Diploma	87 (72.5)	223 (63.9)	236 (65.2)	74 (69.2)	23 (92.0)	46 (70.8)	2 (66.7)	1 (100)
Degree/ Postgraduate	20 (16.7)	74 (21.2)	74 (20.4)	20 (18.7)	1 (4.0)	12 (18.5)	0	0
<i>p</i> value	0.225		0.735		0.118		1.00	
Work Schedule by Pregnancy***								
Office Hour	27 (27.5)	78 (32.4)	27 (30.6)	82 (32.3)	5 (16.0)	16 (34.0)	1 (33.3)	1 (100)
Shift/On-call	71 (72.4)	163 (67.6)	60 (69.4)	172 (67.7)	21 (84.0)	31 (66.0)	2 (66.7)	0
Total (n)	98 (100)	241 (100)	86 (100)	254 (100)	25 (100)	47 (100)	3 (100)	1 (100)
<i>p</i> value	0.385		0.772		0.166		1.00	
* <i>p</i> <0.05 is significant using Chi-square test								
** n are from Nursing only								
*** n are only healthcare workers								

In Table 2, healthcare workers adverse pregnancy outcomes occur most frequently among those who work in shifts. Following this, complete miscarriage is frequent followed by hypertensive disorders in pregnancy, low birth weight and others. There is however no significant relationship between adverse pregnancy outcomes and work schedule in this study among the healthcare workers.

Table 2: Percentage Distribution of Lifetime Adverse Pregnancy Outcome of Healthcare Workers Over Their Lifetime Work Schedule.

Lifetime Adverse Pregnancy Outcome	Lifetime work schedule, n (%)					
	Office hours		shift		On-call	
Complete miscarriage	7	(25.9)	18	(29.0)	2	(22.2)
Low birth weight	6	(22.2)	11	(17.7)	5	(55.6)
Other complications	9	(33.3)	13	(21.0)	0	(0)
Prematurity	2	(7.4)	4	(6.5)	1	(11.1)
Hypertensive Disorders in Pregnancy	2	(7.4)	14	(22.6)	0	(0)
Threatened Miscarriage	1	(3.7)	2	(3.2)	1	(11.1)
Total	27 (100)		(100) 62		9 (100)	

DISCUSSION

Extreme of ages in pregnancy; less than 20 years and more than 35 years of age, are associated with higher risk of adverse pregnancy outcomes. In addition, increasing age beyond ‘prime age’ to be pregnant do carry increasing risk although not as significant as the extreme ages (Cleary-Goldman *et al.*, 2005; Kenny *et al.*, 2013). However, this study has findings with a significant result at the adverse pregnancy outcome in case of latest pregnancy as seen in table 1 ($p = 0.0027$). The mean age during pregnancy is 30.2 years. Hence, this significant finding shows the presence of external risk in causing adverse pregnancy outcomes.

There are reports 23% of working women suffering adverse pregnancy outcomes compared to 19.1% among non-working women. For healthcare workers, 76.3% of them had suffered at least one adverse pregnancy outcome, compared to 55.9% of females from non-healthcare related work (Park *et al.*, 2017). An observational study review (Mozurkewich *et al.* 2000) and also a study on nurses (Kim *et al.*, 2017) conclude that working hours pose an effect on causing adverse pregnancy outcomes. This study supports that healthcare workers have significantly more chances of experiencing adverse pregnancy outcomes. But it fails to prove that work schedule is a possible cause of adverse outcomes, despite the count of adverse being

higher among those carrying out on-call and shift work. Royal College of Physicians, 2013 stated that this debate is inconclusive but with the balance of evidence, the possible effect is highly suggestive.

Since disorders of reproduction is one of the leading work-related diseases and injuries (Yamada, 1986) it warrants a surveillance system. Other studies (Niedhammer *et al.*, 2009) too have recommended such measures and in Sarawak, it may be done by optimizing the Birth Information Database System and including work history into the antenatal book. A study also recommends that if ever possible to not allow pregnant women to work extended hours or shift (Harrington, 2001).

LIMITATIONS

In comparison to other studies, this study warrants a large sample size, however due to the limitations of a small population be it in Sarawak or in the institutions concerned a matching sample size is unobtainable. Nevertheless, the findings still did show similarities to the common findings from literature though not statistically significant. To achieve a similar sample size would need to process data from the whole country however; there is no record or system in place surveying adverse pregnancy outcomes by occupation or work schedule.

The non-healthcare workers were all from a single different institution and were all under office hour work schedule. This limits the correlation according to work schedule with the healthcare workers. Hence, the different environmental factor arising from the choice of a different institution could only be matched under the office hour work schedule. The number of non-healthcare workers in the tertiary hospital who fits the inclusion criteria is too small for analysis.

It was a challenge in ensuring the integrity of the data obtained. Bias was limited to reporting pregnancies in the last three years. The data obtained was cross-examined with local online birth record system but itself is not comprehensive enough.

RECOMMENDATIONS

The small sample size in this research inhibited the reflection of significant relationships. A wider sampling frame and sample size be obtained if ever this research is to be duplicated.

This study found that other adverse pregnancy outcomes were high in occurrence. This other adverse

pregnancy outcomes mainly include gestational diabetes mellitus and anaemia in pregnancy. There may be a need to investigate further the nutritional intake among pregnant healthcare workers.

CONCLUSION

This study has only partly concurred with literature's general sentiment whereby healthcare workers do carry a

higher risk in developing adverse pregnancy outcome (statistically significant in this study). Those working shift are even more susceptible and complete miscarriage is the most common adverse outcome (despite not being statistically significant). This study however could not prove the statistical significance between the work schedule and adverse pregnancy outcome due to its limitations.

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