ORIGINAL ARTICLE

The Influence of Work Factors on Reproductive Health of Female Workers in Sidoarjo Industrial Area, Indonesia

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ABSTRACT

Introduction: Female workers have different abilities and physiology to male workers. Thus, female workers are very sensitive to some hazards in workplace environment. The existing hazards in work environment can cause various effects towards pregnancy among female workers. The objective of this study was to analyze the influence of work factors including shift work, work attitude, and work duration on reproductive health. **Methods:** The study was a cross-sectional study. The number of research sample was 109 female workers selected by simple random sampling. The respondents were female workers in plastic and soft drink industry in Sidoarjo. Primary data was collected by using questionnaires. The dependent variable was the reproductive health of female workers. Reproductive health status of female workers includes menstrual disorders and pregnancy disorders. The independent variables included work pattern, work duration, and shift work. **Results:** The percentage of respondents who were married was 81.7%. The percentage of respondents experiencing reproductive disorders was 63.3% in which 60.6% cases were menstrual disorders and 20.2% cases were pregnancy disorders. The results of logistic regression test showed that reproductive health during pregnancy was affected by shift work (p=0.007). **Conclusion:** Female workers who worked in the evening and at night shift had high risks of pregnancy disorders and miscarriage than female workers who worked at normal working hours. Working in shifts and the irregular working hours also associated with the miscarriage occurence. Companies need to provide protection for pregnant workers in order to avoid irregular shift work and evening or night shift.

Keywords: Female workers, Shift work, Reproductive health, Work factors

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INTRODUCTION

The number of workers in East Java Province in 2017 was 20,099,220. The number of male workers was 11,947,824 while that of female workers was 8,151,396 (1). This number was 40.56% of the total workforce in Indonesia. In recent years, the number of female workers in Indonesia had increased. In 2017, the number of female workers in Indonesia reached 38.2% compared to that of male worker (2).

Each country has its own protection for female workers against hazard in working environment. In Indonesia, the law provides some special protection for female workers such as permission to take a leave during their first and second day of menstruation, permission to rest before and after giving birth, restriction from working at night and working over 40 hours a week (24). However, in reality many female workers still have to work over 40 hours per week and it is difficult to get their rights to take a maternity leave during the pregnancy.

Female workers possess different abilities and physiology from male workers. In fact, they are very sensitive to some hazards such as noise, heat, dust, vibration that exist in the workplace environment (3). Workers with longer work duration will likely have higher possibility of hazard exposure in the workplace (4). In addition, the excessive workload may affect workers' health and mentality (5). Female workers need to be protected from workplace hazards especially when they are in menstrual period, pregnancy period, and breastfeeding period. The hazards in work environment may cause various disorders such as menstrual disorders and pregnancy

disorders among the female workers (6). It is important to protect female workers during their pregnancy states, so that they avoid the consequences health risks for both the workers and their babies. The objective of this study was to analyze the influence of shift work, work attitude and work duration on the reproductive health.

MATERIALS AND METHODS

Primary data was obtained by using questionnaires. Field observation was conducted to cross-check the validity of information obtained. The questionnnaires collect data about reproductive health, sociodemographic, shift work, work attitude, work duration. The reliability analysis of each section of additional questionnaires showed Cronbach's Alpha Value = 0.750. Data analysis was performed by using SPSS 17.0. This research obtained ethical approval from Faculty of Public Health Universitas Airlangga Research Ethics Committee.

Reproductive Health

Reproductive health problem in this study was defined as having menstrual disorder or pregnancy disorder. Menstrual disorder included heavy menstrual bleeding, premenstrual syndrome, irregular menstrual bleeding, dysmenorrheal disorder, and menstrual cycle disorder (23). Pregnancy disorder was defined as having disorder during and after pregnancy like abortion or low birth weight infant.

Shift Work is a system of working hours in which different groups of workers take turn to work on determined shifts in a day. Shift work can be in the form of a shift work system with a rotation system and division of work hours in the morning, afternoon and night while the other is not having a shift work or always working with vulnerability at 08.00-16.00 (12). Division of labor with shift work system can possibly turn into irregular work when shift exchanges occur among workers.

Work Attitude is classified into monotonous and non-monotonous type of work. Work attitude is the body position of a worker while working. It is considered as "monotone" if a worker sits or stands for ≥ 4 hours.

Study Location, Sampling, Study Design, Data Collection

A cross-sectional study was conducted in Sidoarjo industrial area started from 1st January 2017 until 1st May 2017. The population being studied was female workers in Sidoarjo industrial area located in East Java Indonesia. The number of respondents was 109 female workers selected by using simple random sampling. Respondents were workers working in soft drink and plastic industry in Sidoarjo Regency.

The dependent variable was reproductive health of female workers. Reproductive health of female workers in this study covered menstrual disorders and pregnancy disorders. The independent variables included work pattern, work duration, and working shift.

Data Analysis

The collected data were entered, coded, and analyzed using SPSS version 17.0. The reliability analysis of each section of additional questionnaires showed Cronbach Alpha Value = 0.750. The analysis of validity showed validity value of 60%. Level of significance was set at 0.05 ($p<0.05$). Descriptive statistic was performed using frequencies, percentage and cross tabulation for shift work, work attitude, and period of work on reproductive health. Simple logistic regression analysis was then undertaken to identify the predictors of reproductive health.

RESULTS

Socio-demographic of female worker

Table I shows the socio-demographic characteristics of the respondents. The percentage of respondents in general age interval of 20-35 years old was 68.8% of 109. The percentage of respondents showing normal nutritional status was 62.4%. Of the total respondents, 81.7% were married, 78.9% had normal menarche age, and 43.1% had one birth.

Nutritional status was assessed based on Asian Modified Body Mass of Index of WHO with Slim, Normal, and Fat (for overweight and obese) classification.

Table I: Socio-demographic characteristic of the respondents (N=109)

Variable	Total	Percentage (%)
Age		
<20years old	15	13.8
20-35 years old	75	68.8
>35years old	19	17.4
Nutritional Status		
Slim	6	5.5
Normal	68	62.4
Fat	35	32.1
Marital Status		
Single	20	18.3
Married	89	81.7
Menarche Age		
Predocs puberty	4	3.7
Normal	86	78.9
Menarche Tarda	19	17.4
Number of Parturition		
Never had parturition	43	39.4
Single	20	18.3
No children	23	21.1
1-time parturition	47	43.1
>1-time parturition	19	17.4
Parturition distance		
No parturition distances		
Single	20	18.3
Married (no children)	23	21.1
1-time parturition	47	43.1
≤ 2 years of parturition distance	12	11.0
> 2 years of parturition distance	7	6.4

Reproductive health of female worker

Table II describes the reproductive health of women workers. The percentage of respondents experiencing reproductive disorders was 63.3% in which 60.6% cases were menstrual disorders and 20.2% cases were pregnancy disorders.

Table II: Reproductive health of female workers among respondents (N=109)

Variable	Total	Percentage (%)
Reproduction health		
No disorders	40	36.7
With disorders	69	63.3
Menstrual disorders		
No disorders	43	39.4
With disorders	66	60.6
Pregnancy disorders		
No disorders	87	79.8
With disorders	22	20.2

The effect of shift work factor on reproductive health of female workers

Table III describes the effect of shift work factor on reproductive health of female workers. The percentage of female workers with shift work who experienced reproductive health disorders was 71.4%. Shift work, especially evening and night shift work, affected the reproductive health of female workers. The result of logistic regression test indicated that shift work affected reproductive health (p=0.007). On the other hand, the percentage of female workers without shift work who did not experience reproductive health problem during pregnancy was 56.3%. Mann-Whitney test, as the replacement of T-test, was conducted to know if there was a difference between workers with shift work and those without shift work. The statistical test showed p=0.007. Thus, it can be concluded that there was a difference between female workers with shift work and those without shift work related to their reproductive health. Control of confounding factors in analysis was conducted by selecting candidates before multivariable analysis. Simple regression test was applied to all candidates. Those who got p > 0.25 were not included to multivariable analysis so that adjusted OR/PR was achieved.

The effect of work attitudes factor on reproductive health of female workers

Table IV describes the effect of work attitudes factor on reproductive health of female workers. Work attitude is body position of a worker while working. It is classified into monotonous and non-monotonous type of work. It is considered as "monotone" if a worker sits or stands for ≥ 4 hours. Of the female workers with monotonous work attitude, 64.7% experienced reproductive health disorders and 35.3% did not experience ones. On the other hand, only 58.3% of female workers who worked with non-monotonous work attitude experienced reproductive health disorders during pregnancy.

The effect of work duration factors on reproductive health of female workers

Table V describes the effect of work duration factors on reproductive health of female workers. The results

Table III: The effect of shift work factors on reproductive health of female workers

Shift Work	Reproductive health						p-Value	Adjusted Prevalence Ratio (PR)	95% CI
	With disorders		No disorders		Total				
	N	%	N	%	N	%			
Shift work	55	71.4	22	28.6	77	100.0	0.007	3.214	1.366 - 7.0
No shift work	14	43.8	18	56.3	32	100.0			
Total	69	63.3	40	36.7	109	100.0			

Table IV: The effect of work attitudes factor on reproductive health of female workers

Work Attitude	Reproductive health						p-Value	Adjusted Prevalence Ratio (PR)	95% CI
	With disorders		No disorders		Total				
	N	%	N	%	N	%			
Monotonous	55	64.7	30	35.3	85	100.0	0.568	0.764	0.303 - 1.927
Non-monotonous	14	58.3	10	41.7	24	100.0			
Total	69	63.3	40	36.7	109	100.0			

Table V: The effect of work duration factors on reproductive health of female workers

Work duration	Reproductive health						p-Value	Adjusted Prevalence Ratio (PR)	95% CI
	With disorders		No disorders		Total				
	N	%	N	%	N	%			
< 5 Years	30	57.7	22	42.3	52	100.0	0.233	0.727	0.431 - 1.228
6 – 10 Years	24	66.7	12	33.3	36	100.0			
>10 Years	15	71.4	6	28.6	21	100.0			
Total	69	63.3	40	36.7	109	100.0			

showed that the longer work duration they had, the bigger number of workers experienced reproductive health disorders. According to the table above, 71.4% of female workers with more than 10 years work duration experienced reproductive health disorders. The results of logistic regression analysis showed that reproductive health disorder during pregnancy was affected by shift work (p = 0.007). Attitude and period of work had no statistical relationship to reproductive health during pregnancy.

DISCUSSION

Pregnant women are very vulnerable to various hazards (toxic chemical, infectious agent, physical agent) and work processes that exist in the workplace (7-8). One of the facts affecting the health of pregnant women and infants is the shift work that exists in the work environment. Recent epidemiologic evidence indicates that female workers with night shift have an increased risk of developing cancer, metabolic syndrome, cardiovascular disease, diabetes, and reproductive disorders compared with female workers with traditional working hours (9). Gamble et.al (10) stated that reproductive health issues are associated with working nights or rotating shifts. For example, shift work has been associated with an increased risk of irregular menstrual cycles, endometriosis, infertility, miscarriage, low birth weight or pre-term delivery, and reduced incidence of breastfeeding. In addition, shift work can affect circadian rhythms that can affect the quality of sleep and health of female workers. Irregular shift works will lead to pregnancy disorders and developmental disorders of infants after birth (11).

The results showed that reproductive health disorder was affected by shift work. While the period of work and work attitude did not affect the reproductive health disorders of female workers. The results were in line with the study by Zhu, Hjollund, Olsen (12) who stated that there was a correlation between shift work and the incidence of pregnancy disorders on female workers. The Women who work in the evening and night shifts will tend to experience prematurity-like disorders such as prematurely born and impaired fetal growth. According to Zhu, Hjollund, Olsen (12), fixed night work had a high risk of post term birth (odds ratio, 1.35; 95% CI, 1.01-1.79); fixed evening work had a high risk of full-term low birth weight (odds ratio, 1.80; 95% CI, 1.10-2.94); and shift work as a group showed a slight excess of small-for-gestational-age babies (odds ratio, 1.09; 95% CI, 1.00-1.18). Those results were in accordance with the results of this study (p=0.001).

Female workers with shift works were those who worked in packing unit. In this unit, shift works were divided into morning, afternoon, and night shift and were distributed among workers with regular rotation. This routine rotation adhered to the1-3-2 pattern. Female workers who had morning shift this week worked night shift in the following week. Female workers who had night shift this week worked afternoon shift in the following week. Actually, this was one of the control efforts. However, female workers who are pregnant or on pregnant programs should be given exemption so that they do not need to work at night shift. Female workers who worked in non-production units such as in the office did not have shift works. They only worked from 08.00 to 16.00.

Shift work and irregular work affect the system work in the body. Shift work changes the circadian rhythm that affects the ovulatory cycle and impacts on irregular menstruation (13). It also affects the process of pregnancy that occurs. Working women need to be given suitable or non-shifts working hours and avoid shift works that aggravate their work (14). This needs to be implemented for female workers to avoid any pregnancy disruption that can occur. A good working time for pregnant women is between 07.00 and 18.00 and not morethan 40 hours a week (15).

Based on the reproductive health manual in the workplace published by Ministry of Health Republic of Indonesia (16), work rotation and shift works can cause stress to female workers. It can lead to menstrual disorders and libido disorders. The more irregular shift work they have, the greater influence on the circulatory system they experience. Thus, job rotation or division of shift works should be done with careful consideration of health effects on female workers.

Shifts in work can also cause shift work disorder. This shift work disorder can cause circadian rhythm disturbance, the increase of cost due to workers' inadequacy, high incidence of work accidents, and human errors in the workplace (17). Shift work after 07.00 to 18.00 and work duration exceeding 40 hours a week will result in inadequate sleep duration and decrease sleep quality. People have the tolerance limit of shift work. Boivin and Boudreau (18) stated that circadian rhythm is very complex and influenced by work time, shift work continuity, rest period and unpredictable working time of a predetermined work schedule. Very prone work time shifts for female worker are at night and late at night. Different exposure to light with different shifts will affect the quality of sleep of female workers (19). Quality and bedtime are related to circadian rhythms (20). If the rhythm experiences disturbance, health problems will occur and affect the occurrence of pregnancy disorders (21).

Female workers who work in the evening and at night shifts will be at risk of pregnancy disorders and miscarriage compared to those who work at normal working hours. Shift work rules and irregular working hours result in fetal miscarriage. Female workers working at night shifts during the first 20 weeks of pregnancy are particularly

vulnerable and at risk of HDP (Hypersensitive Disorders of Pregnancy). This risk will double if they return to work at the night shift the next day. If a female worker gets a night shift, the company needs to provide sufficient rest time for the female workers to avoid the occurrence of HDP. The risk of female workers working on night shifts will increase if they have BMI ≥ 30 kg/m^2 (22).

CONCLUSION

Female workers are highly susceptible to various reproductive disorders. Shift work factor affected the incidence of reproductive health disorder among female workers in Sidoarjo industrial area. Female workers with irregular shift work and night shift had higher risk of reproductive disorders. Work rotation and shift work can cause stress, menstrual disorder, and circadian rhythm disturbance. Therefore, female workers, especially those who are pregnant and in menstruation period, need to be protected and be given exemption from having night shift. Female workers who worked in the evening and at night shift had high risks of pregnancy disorders and miscarriage than female workers who worked at normal working hours. Working rules of shifts and the irregular working hours also affected the miscarriage. Companies need to provide protection for pregnant workers in order to avoid irregular shift work and evening or night shift.
On the contrary, work duration and work attitude factors had no influence. Shift work was statistically related to the incidence of menstrual disorder and pregnancy disorder.

Companies should pay attention to the reproductive health of female workers through good shift work management. Female workers who are pregnant or on pregnant program should be able to report to companies immediately so that they will be given exemption from working night shifts. This is important to prevent reproductive health problem during pregnancy or after giving birth.

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