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Original Research Article

Cumulative Exposure: Assessing Demographic and Occupational Risk Factors of Occupational Disease in Sasirangan Artisans, Banjarmasin

ABSTRACT

Traditional textile industries, such as the Sasirangan home-based industry in Banjarmasin, expose artisans to complex physical and chemical hazards. Previous epidemiological models often relied on subjective self-reports and lacked comprehensive risk factor analysis. This study aims to analyze the relationship between demographic and occupational risk factors with the incidence of Occupational Diseases (OD) among Sasirangan artisans, supported by direct clinical validation. An observational analytic design with a cross-sectional approach was conducted on 50 artisans selected via simple random sampling. OD incidence was rigorously determined through direct medical examinations and structured anamnesis by a certified physician. Bivariate analysis using the Chi-Square test revealed that age (p=0.028) and working period/tenure (p=0.025) were significantly associated with the incidence of OD. Notably, artisans with a tenure exceeding 5 years had a 5.07 times higher prevalence ratio of experiencing OD. Conversely, gender (p=0.121), daily work duration (p=0.579), and multitasking workloads (p=0.566) showed no significant associations. The findings conclude that clinically diagnosed OD in this sector is predominantly driven by cumulative exposure factors advanced age and prolonged tenure, rather than daily operational metrics. Therefore, mitigating OD risks requires specific workstation engineering, such as ergonomic chairs with spinal backrests and adjustable tables, rather than merely relying on administrative controls like limiting working hours.

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INTRODUCTION

According to the World Health Organization (WHO) and the International Labour Organization (ILO), Occupational Diseases (OD) are defined as health disorders contracted primarily as a result of exposure to risk factors arising from work activities[1]. A recent report by the ILO (2025) highlighted that every day, nearly 8,000 people die due to unsafe working conditions, of which 7,000 cases (around 87%)

are caused by occupational diseases, while occupational accidents account for only about 1,000 cases [2]. This data confirms that OD is a "silent killer" and the largest contributor to morbidity and mortality rates in the working world. The informal sector, particularly Micro, Small, and Medium Enterprises (MSMEs), is the most vulnerable group to this risk due to the minimal implementation of Occupational Health and Safety (OHS) standards [3].

Theoretically, the onset of OD is deeply rooted in the accumulation of occupational risk factors. Work duration, defined as the total hours spent working per day, plays a crucial role; prolonged static work without adequate recovery time leads to continuous muscle contraction and lactic acid accumulation, triggering severe musculoskeletal fatigue. Working period (tenure) represents the cumulative chronological exposure to hazardous environments (such as chemical dyes and dust) and non-ergonomic postures over the years, progressively increasing the severity of tissue damage. Furthermore, a multitasking workload managing multiple unstandardized tasks simultaneously, forces workers into rapid physical and cognitive transitions. This not only exacerbates biomechanical strain but also elevates physiological stress, depleting the body's adaptive capacity and making it more susceptible to chronic diseases.

In Indonesia, traditional textile industries such as weaving and batik heavily rely on high-risk manual handling processes. Research by Azizah (2025) highlighted that industrial workers with static work postures and repetitive movements have a high risk of bodily injuries [4]. The Sasirangan fabric industry in Banjarmasin City is a prime example of a home-based industrial center with complex production workflows. The creation of Sasirangan cloth involves intense manual labor, primarily the repetitive basting (sewing patterns tightly with needle and thread) and the continuous manual dyeing and washing processes in chemical vats. Fauziah (2023) stated that physical complaints among Sasirangan artisans, such as lower back and shoulder pain triggered by prolonged hunched postures during these workflows, are often ignored until they become chronic [5]. More specifically, Heriyani (2024) identified that the pattern-making and ironing sections are highly vulnerable to lower back pain, while the dyeing sections are at risk of experiencing dermatitis [6].

Despite the complex health risks among traditional textile artisans, existing literature reveals significant scientific gaps. Previous studies have predominantly focused on localized ergonomic complaints or OHS behavioral compliance, such as the study by Skripsiana (2024), which merely highlighted the relationship between artisan behavior and health outcomes [7]. Furthermore, findings regarding occupational risk factors remain inconsistent. For instance, while Mandaha (2022) found a strong association between prolonged working hours (>8 hours) and physical health disorders among Sumba weavers [5], other studies in the informal sector suggest that hazard intensity and prolonged tenure play a more critical role than mere daily duration. Additionally, most previous epidemiological models in this sector rely on self-reported symptoms, which are prone to subjectivity. There is a lack of studies that combine occupational risk factor analysis with direct clinical validation. To address these methodological and contextual limitations, this study aims to comprehensively analyze how demographic and occupational risk factors, specifically working period, daily work duration, and multitasking workloads correlate with the incidence of Occupational Diseases (OD) among artisans in the Sasirangan Industrial Center, Banjarmasin, supported by direct medical examinations.

METHODS

This study utilized an observational analytic design with a cross-sectional approach to investigate the relationship between demographic and occupational risk factors with the incidence of Occupational Disease (OD). The research was conducted at the Sasirangan Industrial Center in Banjarmasin City from June to October 2025. The study population comprised all active traditional artisans working at the study site. A sample of 50 respondents was selected using the Simple Random Sampling technique based on the inclusion criteria: physically active artisans who were willing to participate in the study. Prior to data collection, this study ensured research ethics compliance by obtaining informed consent from all respondents, guaranteeing the confidentiality and anonymity of their data.

The independent variables included demographic factors (age and gender) and occupational factors (daily work duration, working period/tenure, and workload, which was categorized into single-task and multitasking). The dependent variable was the incidence of OD. Data were collected using a researcher-developed instrument that had been approved by the Ethics Committee. Furthermore, the OD incidence was strictly determined through a direct medical examination conducted by a certified examining physician. This examination included structured anamnesis (occupational health history) and a

comprehensive physical examination (evaluating vital signs, musculoskeletal conditions, respiratory, and dermatological status) to formulate a reliable clinical diagnosis. Data analysis was conducted using univariate and bivariate analyses with the Chi-Square statistical test (or Fisher's Exact test as an alternative) at a 95% confidence level (α=0.05).

RESULT AND DISCUSSION

Univariate analysis was conducted to describe the frequency distribution of respondent characteristics, including individual factors (age and gender) and occupational factors (working period, work duration, and workload/multitasking). The detailed distribution of the characteristics of the 50 artisans in the Sungai Jingah Sasirangan Industrial Center is presented in Table 1.

Table 1. Respondent Characteristic Distribution

Variable	Category	n	%
Gender			
	Male	28	56.0
	Female	22	44.0
Age			
	15-24 years	5	10.0
	25-44 years	29	58.0
	45-59 years	13	26.0
	≥ 60 years	3	6.0
Working Period			
	≤ 5 years	11	22.0
	> 5 years	39	78.0
Work Duration			
	≤ 8 hours/day	43	86.0
	> 8 hours/day	7	14.0
Workload			
	1 task (*single task*)	34	68.0
	>1 task (*Multitasks*)	16	32.0

source: Primary data, 2025

Based on Table 1, the demographic profile shows that the workforce is predominantly male (56.0%) and concentrated in the prime productive age of 25-44 years (58.0%), indicating a reliance on physical endurance. Regarding occupational factors, the majority are highly experienced artisans with a working period exceeding 5 years (78.0%). Interestingly, most respondents (86.0%) work overtime (> 8 hours per day). In terms of task organization, the workflow is largely compartmentalized, with 68.0% of artisans focusing on a single task rather than multitasking.

In terms of occupational risk factors, most artisans were experienced workers with a working period of more than 5 years, totaling 39 individuals (78%). Despite having a long tenure, compliance with working hours was quite good, where the majority of respondents (86%) worked normal durations of ≤ 8 hours per day. Regarding task organization, 34 individuals (68%) focused on a single task, while the remaining 32% had a multitasking workload, such as combining dyeing and finishing tasks.

Table 2. The Relationship between Respondents' Characteristics and the Incidence of Occupational Diseases (OD)

Variables	Category	History of OD				Total	*p-value*
		Yes (n)	%	No (n)	%		
Gender	Male	8	28,6	20	71,4	28	0,121
	Female	11	50	11	50	22	
Age	15-24 years	0	0	5	100	5	0,028
	25-44 years	9	31,1	20	68,9	29	
	45-59 years	9	69,2	4	30,8	13	
	≥ 60 years	1	33,3	2	66,7	3	

Variables	Category	History of OD				Total	*p-value*
		Yes (n)	%	No (n)	%		
Working Period	≤ 5 years	1	9,1	10	90,9	11	0,025
	> 5 years	18	46,2	21	53,8	39	
Work Duration	≤ 8 hours/day	2	28,6	5	71,4	7	0,579
	> 8 hours/day	17	39,5	26	60,5	43	
Workload	1 task (*single task*)	12	34,3	23	65,7	34	0,566
	>1 task (*Multitasks*)	7	43,75	9	56,25	16	

source: Primary data, 2025

Bivariate analysis using the Chi-Square test (Table 2) reveals the associations between independent variables and the incidence of Occupational Diseases (OD). The analysis of the working period variable showed a statistically significant relationship with the history of OD (p=0.025; p<0.05). Workers with a long tenure (> 5 years) had a significantly higher prevalence of OD (46.2%) compared to newer workers (9.1%). Prevalence Ratio (PR) estimation indicates that workers with over 5 years of tenure are 5.07 times more likely to experience OD than those with shorter tenures. This indicates a strong association between prolonged cumulative exposure and a higher tendency for occupational health complaints.

Similarly, the age variable demonstrated a significant relationship with OD incidence (p=0.028; p<0.05). The data distribution showed a linear trend where cases increased alongside advancing age. The 45–59 age group recorded the highest proportion of OD (69.2%), drastically higher than the youngest worker group (15–24 years), which recorded zero cases (0.0%). Conversely, the work duration variable yielded a p-value of 0.579 (p>0.05). Although workers operating for > 8 hours descriptively showed a higher OD prevalence (39.5%) compared to those working ≤ 8 hours (28.6%), this difference was not statistically significant. Similar non-significant results were found for workload (p=0.566) and gender (p=0.121), suggesting that these specific variables, within this sample structure, did not predominantly differentiate the incidence of OD.

Relationship Between Demographic Factors (Age and Gender) and the Incidence of Occupational Disease

The findings indicated a significant association between age and the incidence of OD among Sasirangan artisans (p=0.028). Descriptively, a linear trend was observed where older workers exhibited a higher tendency for OD, peaking in the 45–59 age group (69.2%). This aligns with the natural physiological degeneration process. According to the EU-OSHA report, aging involves a multidimensional decline in physical capacity and immune defenses [8]. From an ergonomic mechanism, Ksatria et al. and Rochmania et al. emphasized that physiological changes in older age decrease blood flow to muscles and reduce tissue elasticity, accelerating lactic acid accumulation [9,10]. Furthermore, regarding chemical hazards in the dyeing process, aging weakens the epidermal skin barrier and respiratory tolerance, making senior workers exceptionally vulnerable to contact dermatitis and respiratory complaints compared to young workers (15–24 years) who recorded zero OD cases.

Conversely, gender showed no significant relationship with OD (p=0.121). Descriptively, female workers reported a higher proportion of complaints (50.0%) than males (28.6%), which is often attributed to lower muscle strength capacity when facing the same biomechanical load [11]. However, the lack of statistical significance provides a critical insight: OD risks in the Sasirangan Industrial Center are purely occupational hazard-based, not gender-based. This finding supports Conti's [12]. View that when hazard exposure is highly intensive and the work environment is unergonomic, the primary determinant of disease is the occupational hazard itself, overriding biological characteristics. Thus, anyone exposed to these extreme working conditions has an equivalent probability of experiencing health disorders.

Relationship Between Occupational Risk Factors and the Incidence of Occupational Disease

The working period (tenure) was significantly associated with a history of OD (p=0.025). Workers with long tenures (>5 years) had a notably higher proportion of OD (46.2%) compared to newer workers (9.1%). In occupational epidemiology, this strong association is governed by the principle of cumulative exposure [13]. Biomechanically, artisans subjected to repetitive non-ergonomic postures over years will experience accumulated skeletal muscle fatigue, triggering chronic Musculoskeletal Disorders (MSDs) [14]. Furthermore, prolonged tenure is directly proportional to the accumulated volume of chemical pollutants and fabric dust inhaled, significantly elevating the vulnerability of the respiratory system and skin [15,16].

Interestingly, statistical tests revealed that work duration had no significant relationship with the incidence of OD (p=0.579). Data indicated that workers operating for >8 hours indeed had a higher OD prevalence (39.5%) than those working ≤8 hours (28.6%); however, this difference lacked statistical power. While previous studies by Sani and Widajati and Härmä consistently state that long work durations correlate with increased OD risks due to disrupted recovery time, the non-significance in this study can be critically explained by two factors [17,18]. First, a methodological limitation: there was a massive sample imbalance (43 overtime workers vs. only 7 standard-hour workers), which drastically reduced the statistical power to detect a true difference (Type II error). Second, alternative biomechanical explanations suggest a "hazard saturation" effect. In heavy jobs with highly intensive hazard exposures, such as the extreme static bending in Sasirangan basting, muscle fatigue saturation manifests maximally even within the first 8 hours [19]. Therefore, the addition of overtime hours no longer produces a statistically prominent difference in morbidity.

Similarly, the workload variable (single-task vs. multitasking) showed no significant association with OD (p=0.566). Multitasking workloads are generally associated with destructive physiological stress responses due to constant work interruptions [20,21]. However, the lack of a significant difference between the two groups in this setting can be justified through the concept of task variation. Single-task artisans (e.g., exclusively basting) are exposed to highly monotonous static loads all day, stressing a specific muscle group to the point of damage [22]. Conversely, multitasking artisans inevitably switch activities, which acts as a natural task rotation that temporarily rests certain muscles [21]. Consequently, the high joint damage risk from monotonous static posture in single-tasking is equivalent to the high total physical fatigue in multitasking. Both rhythms possess severe hazard profiles, culminating in nearly identical OD manifestations.

Overall, the incidence of clinically diagnosed Occupational Diseases among Sasirangan artisans is predominantly associated with cumulative factors (advanced age and prolonged tenure) rather than daily operational metrics (working hours or task organization). These findings indicate that administrative controls, such as limiting working hours, will be highly ineffective if the core hazards remain unaddressed. To effectively mitigate these risks, concrete workstation engineering must be implemented. For instance, providing specialized chairs with adequate spinal backrests for the pattern-making/basting section and utilizing adjustable-height tables for the dyeing process are urgently needed to prevent artisans from continuously maintaining prolonged hunched postures.

CONCLUSION

Based on the results of the study in the Sasirangan Industrial Center, Banjarmasin, it can be concluded that the factors significantly associated to the incidence of Occupational Disease (OD) are age and working period. The empirical data demonstrates that older workers and those with a prolonged tenure (>5 years) have a significantly higher tendency to experience OD. Conversely, the variables of gender, work duration, and workload showed no significant statistical relationship with the incidence of OD. This finding highlights that the OD risks in the Sasirangan industrial center are driven by extreme, fundamental occupational hazards that affect workers regardless of their daily task organization or working hours.

Therefore, Occupational Health and Safety (OHS) interventions cannot simply rely on administrative controls such as limiting working hours or rotating tasks. Interventions must comprehensively target specific workstation engineering and work posture modifications. Crucial recommendations include redesigning ergonomic work chairs with adequate spinal support, adjusting the heights of worktables or dyeing vats to prevent prolonged hunched postures, implementing mandatory scheduled micro-breaks, and ensuring the strict use of Personal Protective Equipment (PPE) for chemical handling. Finally, this study acknowledges the limitation of a relatively small sample size (n=50 respondents). Future research is strongly encouraged to expand the study scope to a broader population

across multiple home-based industrial centers to validate and generalize these findings.

AUTHOR'S CONTRIBUTION STATEMENT

The contributions of the authors are as follows: SHZ conceptualized the study and wrote the entire original draft; NSS and FH contributed to the methodology design and data analysis; WN and FDP provided data for discussion and contributed to data analysis; and WS contributed to manuscript editing and supervision.

CONFLICTS OF INTEREST

No author of this paper has a conflict of interest, including specific financial interests, relationships, and/or affiliations relevant to the subject matter or materials included in this manuscript.

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