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Demographic Characteristics in Gold Mining Areas and Their Effect on Disease Symptoms in The Community of Paya Seumantok Village, Krueng Sabee District, Aceh Jaya Regency

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KEYWORDS

Society, disease, mines, gold, characteristics

ABSTRACT:

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1. Introduction

The compound considered most toxic within the heavy metal group is mercury, which can be released into the atmosphere in the form of mercury vapor as a byproduct of the amalgamation process (Adlim et al., 2019). According to the Nuclear Reaction Data Centres (NRDC, 2000), the largest source of mercury originates from power plants, particularly those using coal, which

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contains significant mercury released into the surrounding environment during combustion. Coal combustion stands as one of the prominent contemporary sources of anthropogenic mercury (Hg). Other sources contributing to mercury pollution include metal and cement factories through smelting processes, as well as chlor-alkali and polyvinyl chloride (PVC) industries releasing mercury as a byproduct of chemical processes. Fuel combustion industries and consumer products, such as thermometers, batteries, electronic devices, and automotive components, also significantly contribute to mercury pollution through waste incineration (NRDC, 2000). Streets et al. (2018) affirm that coal releases geologically hidden mercury into the atmosphere, with fly ash potentially contaminating land and water systems.

Mercury exposure, particularly through methylmercury (MeHg), poses severe health risks to communities. Domanico et al. (2017) highlight methylmercury as the most hazardous, capable of penetrating the nervous system and causing acute or chronic neurological disorders (Lensoni et al., 2023). Exposure to mercury can lead to serious health issues, including acute and chronic symptoms such as headaches, muscle cramps, cough, and aphthous ulcers. Acute toxicity includes mood changes, headaches, hearing impairment, speech disorders (dysarthria), while chronic toxicity manifests as tremors, cerebral ataxia, hearing and vision impairment, tingling from the mouth to the hands, impaired memory, sensory disturbances, and sleep disorders (Sofia et al., 2017). Furthermore, mercury can cause poisoning in fetuses and children if mothers consume food containing mercury, transmitting the toxin through breastfeeding and resulting in motor function decline (Straaten, 2000). In adults, specific anatomical areas, such as the visual cortex and cerebellum, are affected, influencing prenatal brain development processes in fetuses (Clarkson & Thomas, 1998). Mercury pollution in the Aceh Province is closely linked to the controversial artisanal gold mining activities, drawing special attention from the Aceh Provincial Government and the local community (Sofia et al., 2017).

Research conducted by Sofia et al. (2016) reported the highest recorded mercury concentrations in hair in Paya Seumantok Village (48.1 µg/g), followed by Panton Makmur Village (42.1 µg/g), Panggong Village (35.2 µg/g), and Curek Village (11.3 µg/g). The elevated mercury concentration in Paya Seumantok Village is attributed to the presence of numerous artisanal gold processing industries in the area. Krueng Sabee Subdistrict is one of the active gold mining areas located in Aceh Jaya District, Aceh Province, Indonesia. The mining activities began in 2008 and continue to date, conducted without proper authorization. Illegal mining, particularly stone crushing, often occurs within residential areas, while gold burning processes take place both in residential areas and in gold shops. Tailings resulting from the amalgamation process of gold ore allow mercury waste to be released into the air and water, leading to environmental contamination by both organic and inorganic mercury (Lensoni, 2023). Based on the above description, this paper is focused on discussing research on the demographic characteristics in the gold mining area and its relation to disease symptoms experienced by the residents of Paya Seumantok Village, Krueng Sabee Subdistrict, Aceh Jaya District. The symptoms are caused by the spread of mercury by gold miners, with disease indicators based on the criteria set by the World Health Organization (WHO).

2. Methods

This research was conducted on the residents of Paya Seumantok Village, Krueng Sabee Subdistrict, Aceh Jaya District, using indicators or questionnaires previously employed by the World Health Organization (WHO) and other researchers. The research employed the Purposive Sampling method, and sample size was determined using the Slovin formula, resulting in a sample of 90 individuals. Data analysis was performed using SPSS 20. The research protocol obtained ethical approval No. 2559/IV/SP/2021 (dated April 10, 2021) from the Faculty of Nursing, Universitas Sumatera Utara, Medan, Indonesia. The selection of urine samples and human diseases for this study was based on standard methods and approved by the ethics committee.

3. Results

1. Overview of Respondents' Demography

The demographic data of respondents based on gender is illustrated in Figure 1.

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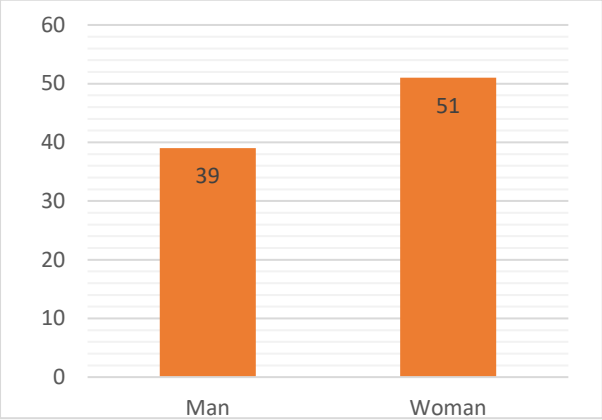

Figure 1 Overview of respondents' demographics based on gender.

According to Figure 1, the respondents in this study were predominantly female, comprising 51 individuals or 56.6%, while males were 39 individuals or 43.3%. The pie chart in Figure 2 depicts the distribution of respondents based on age.

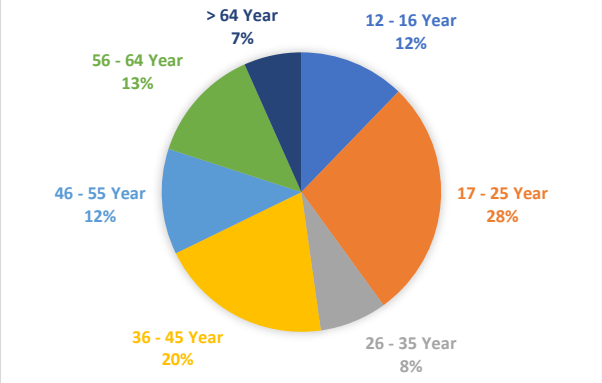

Figure 2. Demographics of respondents based on age.

Data from Figure 2 reveals that the age group of 17-25 years was the most prevalent, constituting 28%, followed by the 36-45 age group at 20%. Subsequently, the 56-64 age group accounted for 13%, the 46-55 age group for 12%, the 26-35 age group for 8%, and the age group above 64 years with the least percentage at 7%. The following figure illustrates the characteristics of respondents based on their occupations.

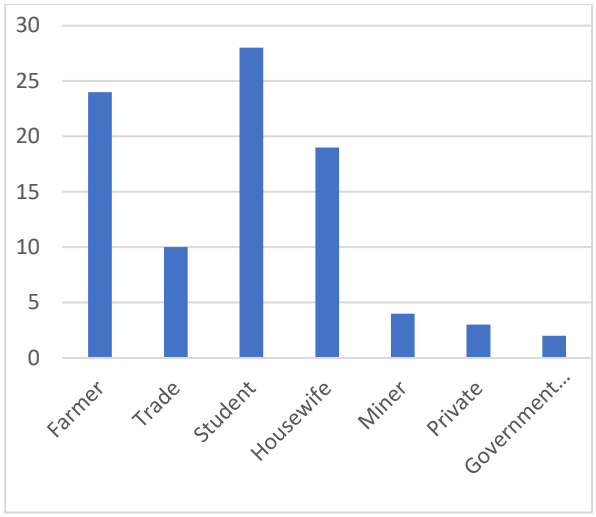

Figure 3. Demographics of respondents based on occupation.

As shown in Figure 3, consistent with the age-based characteristics, the majority of respondents identified as students (28 individuals), followed by farmers (24 individuals), while the occupation with the fewest respondents was civil servants, totaling 2 individuals. Figure 4 presents the demographic characteristics of respondents based on their educational levels.

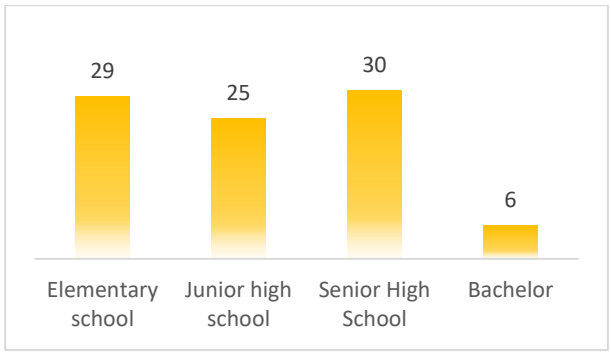

Figure 4. Demographics of respondents based on educational level.

Figure 4 indicates that, on average, respondents had lower educational levels, with 29 and 25 individuals having completed elementary (SD) and junior high school (SMP), respectively. High school-educated respondents numbered 30 individuals, while those with higher education amounted to 6 individuals. The subsequent figure depicts the characteristics of respondents based on the duration of their residence in

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Paya Seumantok Village, Krueng Sabee Subdistrict, Aceh Jaya District.

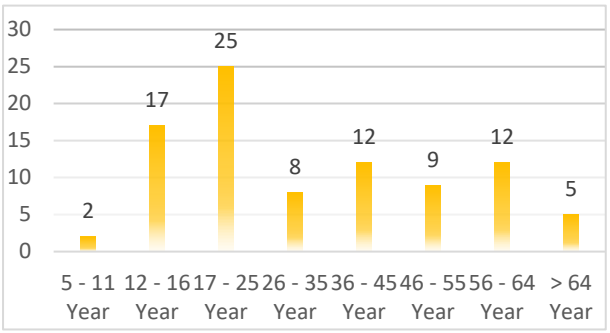


Figure 5. Characteristics of respondents based on the duration of residence.

Figure 5 shows that respondents with a residence duration of 17-25 years were the most prevalent. This aligns with the characteristics of respondents based on age, indicating that nearly all respondents were native inhabitants born and raised in Paya Seumantok Village, Krueng Sabee Subdistrict, Aceh Jaya District. The last figure illustrates the characteristics of respondents based on the distance of their homes from the gold processing facility, where mercury is used in the processing.

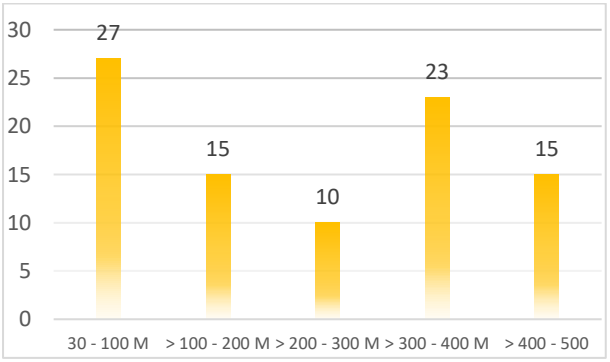


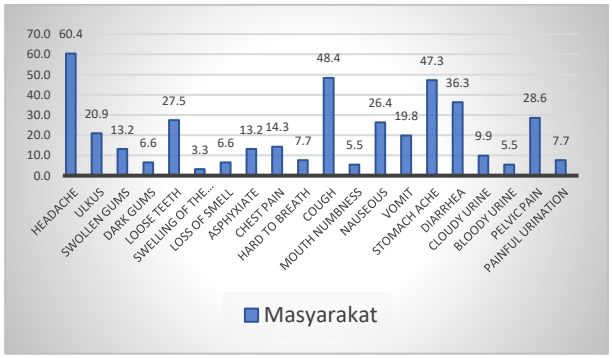
Figure 6 Characteristics of Respondents Based on Distance from Gold Processing Facility

Figure 6 reveals that 27 respondents reside within a distance of 30-100 meters from the gold processing facility, representing the largest group among respondents at various distances. Additionally, 10 respondents live at a distance of 200-300 meters.

a.Analysis of Disease Symptoms

1.Acute Clinical Symptoms

Clinical symptom presentation experienced by the community is illustrated in Figur



e 7.

Figure 7 Overview of Clinical Symptoms of Acute Toxicity

Based on Figure 7, the distribution of the health conditions of the Paya Seumantok Village community indicates several clinical symptoms of acute toxicity commonly experienced by the residents. These include headaches (60.4%), cough (48.4%), abdominal pain (47.3%), diarrhea (36.3%), hip pain (28.6%), and loose teeth (27.5%).

2. Chronic Clinical Symptoms Recorded Include Somatosensory Disturbances

The depiction of chronic toxicity symptoms, including somatosensory disturbances experienced by the community in the research location, is illustrated in the following figure

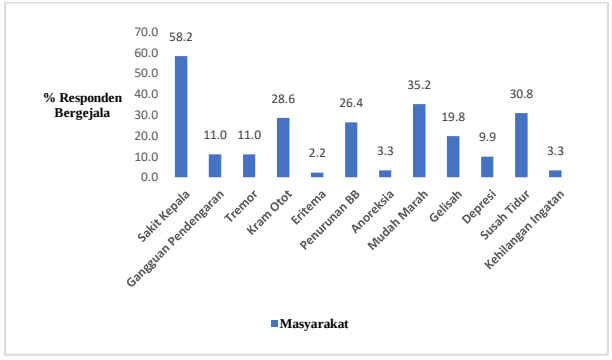


Figure 8 Overview of Chronic Clinical Symptoms

Figure 8 provides an overview of chronic toxicity symptoms, including somatosensory disturbances experienced by the residents of Paya Seumantok Village. Common somatosensory disturbances include headaches (58.2%), irritability (35.2%), difficulty sleeping (30.8%), muscle cramps (28.6%), weight loss (26.4%), and

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restlessness (19.4%). From the analysis results, it is evident that, overall, the community experiences various clinical symptoms, with certain symptoms being more prevalent, as mentioned.

2. Correlation test

Identification of Disease Symptoms in the Community and Demographic Characteristics of the Population around Gold Processing Sites Using Amalgamation Method In this chapter, a correlation analysis will be conducted to determine the influence of demographic characteristics on the disease symptoms experienced by the community, using the Chi-Square method through the SPSS 20 application. Through this analysis, the aim is to unveil the distribution patterns of disease symptoms in the community around traditional gold processing locations in Paya Seumantok Village, Krung Sabee Subdistrict, Aceh Jaya District. The following table presents the results of the correlation test.

Table 1. Correlation of Demographic Characteristics with Chronic Disease Symptoms in the Community.

No.	Respondents Characteristics		Disease Symptoms			Total	P-value
			High	Moderate	Low		
1	Education	High	5	3	0	90	0.51
		Secondary	25	4	0		
		Primary	43	9	1		
2	Gender	Male	30	8	1	90	0.312
		Female	44	7	0		
3	Job	Farmer	21	5	1	90	0.067
		Merchant	9	2	0		
		Student	27	1	0		
		Housewife	14	5	0		
		self-employed	2	1	0		
		PNS	0	2	0		
4	Distance from home to the gold mine	70 - 100 m	21	4	0	90	0.179
		102 - 200 m	12	4	0		
		300	6	2	1		
		387 - 354 m	6	0	0		
		400 - 500 m	28	6	0		
5	Length of residence	5- 11 years	2	1	0	90	0.341
		12- 16 years	15	1	0		
		17- 25 years	22	1	0		
		26- 35 years	6	2	0		
		36- 45 years	10	3	0		
		46- 55 years	7	2	0		
		56- 64 years	9	4	1		
		>64 years	2	2	0		

Based on the Chi-Square Analysis , as shown in Table 2 above, the correlation analysis results indicate that there is no correlation between demographic characteristics and acute disease symptoms experienced by the community. This is evidenced by nearly all types of diseases displaying acute symptoms, with a P-value > α (0.05).

From the correlation analysis results, it can be concluded that there is no correlation between the demographic characteristics of the community and the disease symptoms experienced. For instance, in the case of educational level, the correlation with disease symptoms yields a P-value of 0.510, which is higher than the α value (0.05), indicating no influence of education level on the observed symptoms. The same holds true for other demographic characteristics, such as gender (P-value 0.312), occupation (P-value 0.067), distance from residence to the gold processing facility (P-value 0.067), and length of residence (P-value 0.341).

Based on the analysis , there seems to be no observable influence of demographic characteristics on the disease symptoms in the gold mining area. However, some studies report that diseases resulting from mining activities encompass the digestive system, respiratory system, nervous system, sensory system (skin and eyes), nervous system, and reproductive system. Apart from diseases arising from mercury (Hg) exposure, there are also disruptions to organ systems or a decline in organ systems, such as liver dysfunction, leukosis disorders, and cognitive impairments in the form of reduced memory capacity (Syidiq et al., 2016).

Mercury pollution poses health problems for miners and communities around the Behe River. Findings reveal that the majority of miners (70.8%) have worked for more than five years (49.1%). The most common duration of residence is more than five years (66.7%). River fish

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consumption habits are prevalent (86.7%), with a frequency of more than three times a week (80%). River bathing habits are also common (69.1%), with a bathing duration of more than five years (56.7%). In terms of residence proximity to gold processing facilities, 66.7% of individuals live less than 261 meters from the processing location. The research findings indicate the impacts of gold mining using mercury (Hg) in processing, leading to health issues (skin and nervous system) (Grishela & Tamba, 2017).

In another study, the Chi-square test results indicated that the length of work (in years) significantly influences ($p < 0.05$) the mercury levels in the urine of gold mine workers in Panton Luas Village, Sawang district, South Aceh Regency (Asiah et al., 2015). According to the findings of another study, those working for more than 8 hours comprised 5 workers (12.2%), while those working for 8 hours or less were 36 workers (87.8%). Among the workers, 21 (51.2%) used Personal Protective Equipment (PPE), while 20 (48.8%) did not. Statistical tests between the duration of work and mercury levels in urine resulted in a p-value of $0.497 > 0.05$. However, for PPE and mercury levels in urine, the p-value was $0.021 < 0.05$. The research findings indicated no correlation between the duration of work and mercury levels in urine. However, there was a relationship between the use of PPE and mercury levels in urine (Budiak et al., 2014).

4. Conclusion

Based on the conducted analyses, it can be concluded that there is no correlation between the demographic characteristics of the community around gold processing locations and the acute and chronic disease symptoms experienced by both the community members and workers in the gold processing area of Paya Seumantok Village, Krung Sabee Subdistrict, Aceh Jaya District. This is evident across almost all demographic characteristics, showing p-values > α (0.05).

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