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# Sex Differences and Co-occurrence of Self-Reported Smoking and Alcohol Consumption Among Adults in a Rural Coastal Village in Indonesia: A Cross-Sectional Study

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## Abstract

**Background:** Smoking and alcohol use contribute substantially to preventable morbidity and mortality. In Indonesia, tobacco use is strongly patterned by sex, but community-level evidence describing the co-occurrence of smoking and alcohol consumption in rural coastal settings is limited.
**Objective:** To describe self-reported smoking and alcohol consumption among participating adults in Pulisan Village, compare the proportions reporting each behaviour by sex, and examine the crude association between smoking and alcohol consumption.
**Methods:** A cross-sectional study was conducted among 216 adults recruited by convenience sampling. Two investigator-developed yes/no questions, administered in private interviews, asked whether participants smoked and consumed alcohol; neither question specified a reference period, frequency, quantity, or product type. Frequencies and percentages were reported overall and by sex. Pearson chi-square tests and crude odds ratios (ORs) with 95% confidence intervals (CIs) were used for 2 × 2 comparisons.
**Results:** Among participating men, 82/115 (71.3%) reported smoking and 67/115 (58.3%) reported alcohol consumption; among women, the corresponding proportions were 5/101 (5.0%) and 7/101 (6.9%). Sex differences were statistically significant for smoking (crude OR = 47.71, 95% CI 17.80–127.84; $p < 0.001$) and alcohol consumption (crude OR = 18.74, 95% CI 7.99–43.97; $p < 0.001$). Alcohol consumption was reported by 64/87 (73.6%) smokers and 10/129 (7.8%) non-smokers (crude OR = 33.11, 95% CI 14.85–73.85; $p < 0.001$).
**Conclusion:** In this convenience sample, self-reported smoking and alcohol consumption were concentrated among men and frequently co-occurred. Because the measures lacked a defined reference period and the smoking–alcohol estimate was unadjusted for sex and age, the findings should be interpreted as descriptive and hypothesis-generating rather than as population prevalence or evidence of a causal relationship.

**Keywords**: Alcohol consumption; cross-sectional study; rural health; sex differences; smoking; Indonesia

## INTRODUCTION

Smoking and alcohol consumption are major preventable contributors to disease and premature mortality. The World Health Organization (WHO) reports that tobacco causes more than 7 million deaths each year, including more than 1.6 million deaths among non-smokers exposed to second-hand smoke (1). Alcohol consumption was responsible for an

estimated 2.6 million deaths worldwide in 2019, including approximately 2.0 million deaths among men and 0.6 million among women (2). Recent Global Burden of Disease analyses likewise show a substantial and strongly sex-patterned smoking burden across Southeast Asia, with Indonesia among the countries with the highest male smoking prevalence in the region (18).

Indonesia has a particularly marked sex pattern in tobacco use. The 2021 Global Adult Tobacco Survey (GATS) estimated that 34.5% of Indonesian adults used tobacco, with tobacco use reported by 65.5% of men and 3.3% of women; current tobacco smoking was reported by 64.7% of men and 2.3% of women (3). Repeated analysis of Indonesian GATS data confirms that male smoking prevalence remains above 60% and that the sex gap persists (11). Indonesian studies further show that smoking patterns vary substantially across rural populations, age groups, and selected subpopulations, emphasizing that national averages should not be treated as interchangeable with local community estimates (12,16,17). National alcohol data also show a marked male predominance, including among young adults (4,5).

Smoking and drinking often co-occur because they share social, behavioural, environmental, and reinforcing determinants. Joint-estimation and observational studies have documented tobacco-alcohol co-use in Asian and other adult populations (6,7,19,20), while systematic reviews show that alcohol use can impede smoking cessation and that smoking and binge drinking are positively associated (8,22). Recent evidence also indicates that co-use patterns differ by age and population and that combined exposure can carry health risks beyond those associated with either behaviour alone (23,25). Accordingly, the magnitude of a crude smoking-alcohol association should be interpreted cautiously when both behaviours are strongly patterned by a third variable such as sex.

Evidence from Indonesia includes national surveillance, policy evaluations, and studies in specific populations (5,9,11-17). Indonesian smoke-free policy studies demonstrate that tobacco behaviour is shaped by broader policy and contextual factors, while rural studies document substantial heterogeneity in smoking exposure and determinants (12,14-16). These data support the value of context-specific assessment, but a single-village convenience sample cannot establish village-wide prevalence or national generalizability. The contribution of the present study is therefore a local description of self-reported smoking and alcohol consumption, sex differences in these reports, and their crude co-occurrence among participating adults in Pulisan Village.

This study aimed to (1) describe the proportions of participating adults who reported smoking and alcohol consumption; (2) compare each behaviour between male and female participants; and (3) examine the crude association between smoking and alcohol consumption. Based on national and regional evidence showing strong sex differences in tobacco and alcohol use (3,5,11,18), we expected both behaviours to be reported more frequently by men than women. Based on prior co-use literature (6-8,19-25), we also expected smoking and alcohol consumption to be positively associated.

## METHODS

### Study design and setting

This quantitative study used a cross-sectional design. Data were collected in Pulisan Village, Indonesia, in November 2025. The design permits description of the sampled participants and estimation of contemporaneous associations, but it does not establish temporal sequence or causality.

### Participants and recruitment

Participants were residents of Pulisan Village aged 18 years or older. A total of 216 adults were recruited by convenience sampling. Residents were approached door-to-door at their residences and at communal gathering points at the village office between 08:00 and 17:00 on weekdays and weekends. Recruitment depended on accessibility and willingness to participate; no sampling frame or random selection procedure was used. The number of residents who were unavailable, ineligible, or declined participation was not systematically recorded, so a response rate cannot be calculated. All 216 participants had complete responses for the two study items and were included in the analysis.

### Measures

The study used two investigator-developed single-item questions rather than standardized

surveillance items. This choice reduced respondent burden but limited construct validity, comparability with national surveillance, and the ability to distinguish current, occasional, or past behaviour.

Smoking was assessed with the question "Apakah Anda merokok?" ("Do you smoke?"), with response options Yes (coded 1) and No (coded 0). No reference period was specified, and the item did not distinguish regular from occasional smoking or identify the tobacco or nicotine product used.

Alcohol consumption was assessed with the question "Apakah Anda mengonsumsi alkohol?" ("Do you consume alcohol?"), with response options Yes (coded 1) and No (coded 0). No reference period was specified, and quantity, frequency, heavy episodic drinking, and alcohol-related problems were not measured.

Both questions were read aloud in private one-to-one interviews using a structured interview guide. Because each exposure was measured by a single dichotomous item, internal-consistency statistics such as Cronbach's alpha are not applicable. The principal measurement limitation is not internal consistency but the absence of a defined time frame and established criterion validity. Social-desirability bias may be especially important for alcohol reporting and may differ by sex.

**Data collection and management**

After study information was provided and verbal consent obtained, the two study questions were administered. Responses were entered into Microsoft Excel and coded as 1 (Yes) and 0 (No), then imported into IBM SPSS Statistics version 27. Records were checked for completeness during data entry. No missing responses were reported for smoking or alcohol consumption. The analytical dataset contained no full names or other direct personal identifiers and was stored on a password-protected computer accessible to the research team.

**Statistical analysis**

Frequencies and percentages were calculated overall and by sex. Pearson's chi-square test of independence was used for the sex × smoking, sex × alcohol, and smoking × alcohol 2 × 2 tables. Independent recalculation from the reported cell counts confirmed that all expected frequencies exceeded 5 (minimum expected count = 29.81), so the large-sample chi-square assumption was satisfied. Crude odds ratios (ORs) with 95% confidence intervals (CIs) were calculated from the 2 × 2 cell counts. Statistical significance was defined as $p < 0.05$.

Because smoking and alcohol consumption were common in this sample, ORs are interpreted strictly as odds ratios rather than prevalence ratios or risk ratios. The smoking–alcohol analysis is crude and may be confounded by sex because both behaviours were strongly concentrated among men. The study therefore treats the association as descriptive and hypothesis-generating rather than as an adjusted or causal effect.

Multivariable regression is not reported because the available analytical record for this manuscript contains marginal 2 × 2 tables rather than the individual-level cross-classification required to adjust the smoking–alcohol association for sex and age without reconstructing or inventing participant-level observations. This limitation is stated explicitly in the interpretation.

**Ethical considerations**

Ethical approval is recorded in the study documentation as Ethics Committee of Universitas Advent Indonesia (UNAI), No. 629/KEPK-FIK/UNAI/EC/X/26. The approval identifier is reported exactly as supplied in the study record; no public copy of the approval letter was retrievable for independent date verification.

The study reports approval from the Ethics Committee of Universitas Advent Indonesia (UNAI). Participants received information about the study purpose, procedures, voluntary participation, withdrawal, and confidentiality, and verbal informed consent was obtained before data collection. Unique study codes were used in the analytical dataset.

## RESULTS

**Table 1. Characteristics and self-reported smoking and alcohol consumption among participants (N = 216). Percentages describe the convenience sample and are not population-weighted estimates.**

| Characteristic | Category | n | % |
|---|---|---|---|
| Age (years) | 18–29 | 62 | 28.7 |
| | 30–39 | 58 | 26.9 |
| | 40–49 | 56 | 25.9 |
| | 50–59 | 40 | 18.5 |
| Sex | Male | 115 | 53.2 |
| | Female | 101 | 46.8 |
| Smoking | Yes | 87 | 40.3 |
| | No | 129 | 59.7 |
| Alcohol consumption | Yes | 74 | 34.3 |
| | No | 142 | 65.7 |

**Table 2. Self-reported smoking and alcohol consumption by sex**

| Behaviour | Total n (%) | Men n (%) | Women n (%) | $\chi^2$ (df) | p | Crude OR (95% CI) |
|---|---|---|---|---|---|---|
| Smoking: Yes | 87 (40.3) | 82 (71.3) | 5 (5.0) | 98.423 (1) | <0.001 | 47.71 (17.80–127.84) |
| Smoking: No (ref) | 129 (59.7) | 33 (28.7) | 96 (95.0) | | | 1.00 |
| Alcohol: Yes | 74 (34.3) | 67 (58.3) | 7 (6.9) | 62.907 (1) | <0.001 | 18.74 (7.99–43.97) |
| Alcohol: No (ref) | 142 (65.7) | 48 (41.7) | 94 (93.1) | | | 1.00 |

Note: OR = odds ratio; CI = confidence interval; ref = reference category. ORs are crude and compare men with women. p values are from Pearson's chi-square tests.

**Table 3. Crude association between self-reported smoking and alcohol consumption**

| Smoking | Alcohol: Yes n (%) | Alcohol: No n (%) | Total | $\chi^2$ (df) | p | Crude OR (95% CI) |
|---|---|---|---|---|---|---|
| Yes | 64 (73.6) | 23 (26.4) | 87 | 99.918 (1) | <0.001 | 33.11 (14.85–73.85) |
| No (ref) | 10 (7.8) | 119 (92.2) | 129 | | | 1.00 |

### Participant characteristics

All 216 recruited participants had complete data for smoking and alcohol consumption. Ages ranged from 18 to 59 years. The largest age category was 18–29 years (62/216, 28.7%). Of the participants, 115 (53.2%) were men and 101 (46.8%) were women. Because the recruitment denominator was not recorded, participant flow beyond the final analytical sample cannot be quantified.

### Sex differences in smoking and alcohol consumption

Smoking was reported by 82 of 115 men (71.3%) and 5 of 101 women (5.0%). The difference was statistically significant ($\chi^2(1) = 98.423$, $p < 0.001$), with a crude OR of 47.71 (95% CI 17.80–127.84) for men compared with women. Alcohol consumption was reported by 67 men (58.3%) and 7 women (6.9%); this difference was also statistically significant ($\chi^2(1) = 62.907$, $p < 0.001$; crude OR = 18.74, 95% CI 7.99–43.97). The wide confidence intervals indicate substantial uncertainty in the magnitude of the sex contrasts, particularly because few women reported either behaviour.

### Crude association between smoking and alcohol consumption

Among participants who reported smoking, 64 of 87 (73.6%) also reported alcohol consumption, compared with 10 of 129 (7.8%) participants who did not report smoking. Independent recalculation from these four cells counts confirmed $\chi^2(1) = 99.918$ ($p < 0.001$) and a crude OR of 33.11. The corresponding log-Wald 95% CI is 14.85–73.85. This estimate is unadjusted and should not be interpreted as a causal effect, prevalence ratio, or risk ratio.

## DISCUSSION

Three findings characterize this convenience sample. First, both smoking and alcohol consumption were reported far more often by men than women. Second, the two behaviours frequently co-occurred: nearly three quarters of participants who reported smoking also reported alcohol consumption, compared with fewer than one in ten non-smokers. Third, the crude smoking–alcohol association was very large but imprecisely estimated and is likely to be partly explained by the strong concentration of both behaviours among men. These findings therefore support a description of clustering within the sample, not a causal interpretation.

The sex pattern in smoking is directionally consistent with Indonesian and regional evidence. GATS 2021 and subsequent analyses show persistently high male smoking prevalence and very low female smoking prevalence in Indonesia (3,11). The Global Burden of Disease 2021 ASEAN analysis similarly identified Indonesia as having the highest age-standardised male smoking prevalence among ASEAN countries (18). Rural Indonesian studies also show that tobacco use and exposure can remain substantial outside urban settings (12,16). Direct numerical comparison with the present study remains inappropriate, however, because national surveys use probability sampling and standardized definitions whereas this study used convenience sampling and a single question without a specified reference period.

A similarly large male–female contrast was observed for alcohol consumption. Indonesian survey analyses report higher alcohol consumption among men, supporting the direction of the present finding (4,5). Nevertheless, the present alcohol item did not specify current use, frequency, quantity, or heavy episodic drinking. Alcohol use may also be socially sensitive, and differential underreporting by sex cannot be excluded. The data therefore support sex-stratified description but do not establish sociocultural mechanisms because gender norms, occupation, peer context, and drinking motives were not measured.

The crude association between smoking and alcohol consumption is consistent with a substantial literature on co-use. Studies from Thailand and Hong Kong, population surveys, and longitudinal work show that tobacco and alcohol commonly cluster (6,7,19,20,25). Systematic reviews further indicate that alcohol use can adversely affect smoking cessation and that smoking is associated with binge drinking (8,22). Joint exposure may also amplify some health risks (23). The present crude OR of 33.11 is much larger than many published adjusted associations and should not be interpreted as an independent effect. The outcome was common, which makes the OR numerically more extreme than a prevalence ratio, and sex is a strong plausible confounder in these data. The wide CI (14.85–73.85) additionally shows considerable uncertainty in the magnitude.

From a public-health perspective, the observed clustering supports considering coordinated screening and risk communication rather than assuming that tobacco and alcohol use are independent behaviours. Evidence on co-use communication and smoking cessation suggests that addressing alcohol alongside tobacco can be clinically and behaviourally relevant (21,22,24). However, the present study did not test an integrated intervention, and Indonesian tobacco-control evidence shows that individual behaviour is also shaped by policy and environmental conditions (14,15). Program decisions should therefore combine standardized screening, local needs assessment, evidence-based cessation support, alcohol-risk assessment, and broader tobacco-control measures.

The study has several strengths. It provides directly collected community data from an understudied rural coastal setting, reports sex-specific distributions, and makes the limitations of convenience sampling and non-standardized measures explicit. The complete responses for the two study items also avoid item-level missingness in the reported analyses.

Several limitations materially constrain interpretation. Convenience sampling creates selection bias because residents who were available and willing to participate may differ from those who were absent or declined; because non-participation was not recorded, the direction and magnitude of this bias cannot be estimated. The single-village sample limits external validity. The two investigator-developed questions lacked a reference period and did not measure intensity, frequency, or product type, creating potential exposure misclassification and limiting comparison with standardized surveillance definitions. Interview-based self-report may introduce social-desirability bias, particularly for alcohol, and differential underreporting by sex could distort sex contrasts. The cross-sectional design prevents temporal ordering and causal inference. Finally, the smoking–alcohol analysis is unadjusted for sex, age, and other shared determinants; residual and uncontrolled confounding may therefore account for part of the observed association. These limitations mean that the study is best interpreted as a local descriptive and hypothesis-generating analysis.

Future studies should use probability-based or clearly enumerated sampling where feasible, standardized tobacco and alcohol measures with defined reference periods, and sufficient sample size for adjusted models. Collecting frequency and quantity of use, socioeconomic characteristics, occupation, and potentially relevant social-context variables would allow more informative analysis of co-use and its determinants.

## CONCLUSION

Among 216 conveniently sampled adults in Pulisan Village, self-reported smoking and alcohol consumption were substantially more common among men than women and frequently co-occurred. The crude smoking–alcohol association was large, but its magnitude should not be interpreted as an independent or causal effect because both behaviours were strongly patterned by sex and the analysis was unadjusted. The findings provide local descriptive evidence that can inform more rigorous surveillance and needs assessment; they do not establish population prevalence or the effectiveness of an integrated intervention.

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**Conflict of Interest**

The authors declare no conflicts of interest related to this study.

**Author Contributions**

MWM: Conceptualization, methodology, investigation, data collection, formal analysis, writing – original draft, and writing – review and editing.

FFP: Methodology, investigation, data collection, data interpretation, writing – review and editing, and manuscript revision.

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