

# Metabolic syndrome and health-related behaviors associated with pre-oral cancerous lesions among rural adults in Taiwan

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**\*Objectives:** To explore the associations of health-related behaviors, metabolic syndrome, and risk factors in adults with pre-oral cancerous (POC) lesions in rural, disadvantaged communities with a high prevalence of oral cancer.

**\*Setting:** Community-based health survey in the western coastal area of Yunlin County, Taiwan.

**\*Participants:** 5,161 adult residents participated in this study.

**\*Outcome measures:** Assessed parameters included oral leukoplakia, oral submucous fibrosis, fasting blood glucose, triglycerides, high-density lipoprotein cholesterol, blood pressure, and waist circumference. Statistical analyses included descriptive statistics, chi-squared tests, and multivariate binary logistic regression.

**\*Results:** A high percentage of participants were found to have metabolic syndrome (40%) and POC lesions (7.3%). Participants with POC lesions tended to be male ( $p < .001$ ), betel nut chewers ( $p < .001$ ), and smokers ( $p < .001$ ); have a low level of education ( $p < .001$ ), seldom undergo dental check-ups ( $p < .01$ ) irregularly participate in physical activity ( $p < .01$ ), and have metabolic syndrome ( $p < .01$ ).

**\*Conclusions:** Although male sex and disadvantaged socioeconomic status are nonmodifiable factors associated with POC and metabolic syndrome in adults, several factors, notably health behaviors, are modifiable. Clinicians can reduce the incidence and consequences of POC by developing programs for early detection, encouraging regular dental check-ups, and initiating individualized, health-promoting behavior modification programs for reducing risky behaviors associated with oral cancer.

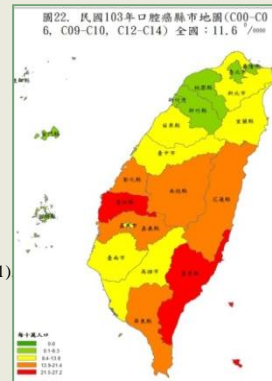


Table 1 Demographic characteristics and health-related behaviors among rural residents with pre-oral cancerous lesions (n = 5161)<sup>a</sup>

Variable <sup>b</sup>	Non-POC <sup>c</sup> (n = 4784) <sup>d</sup>	POC <sup>c</sup> (n = 377) <sup>d</sup>	P value <sup>e</sup>
Age <sup>f</sup>			.837 <sup>g</sup>
< 65 yr <sup>h</sup>	3822 (93%) <sup>d</sup>	305 (76%) <sup>d</sup>	
≥ 65 yr <sup>h</sup>	962 (93%) <sup>d</sup>	72 (76%) <sup>d</sup>	
Gender <sup>f</sup>			<.001 <sup>g</sup>
Female <sup>h</sup>	2842 (99%) <sup>d</sup>	38 (1%) <sup>d</sup>	
Male <sup>h</sup>	1942 (85%) <sup>d</sup>	339 (15%) <sup>d</sup>	
Education level <sup>f</sup>			<.001 <sup>g</sup>
High school and above <sup>h</sup>	2122 (95%) <sup>d</sup>	108 (5%) <sup>d</sup>	
Elementary school and below <sup>h</sup>	2662 (91%) <sup>d</sup>	269 (9%) <sup>d</sup>	
Self-perceived economic status <sup>f</sup>			<.001 <sup>g</sup>
Feel good or fair <sup>h</sup>	3848 (93%) <sup>d</sup>	275 (76%) <sup>d</sup>	
Feel poor or bad <sup>h</sup>	936 (90%) <sup>d</sup>	102 (10%) <sup>d</sup>	
Alcohol use <sup>f</sup>			<.001 <sup>g</sup>
Never <sup>h</sup>	3669 (95%) <sup>d</sup>	180 (5%) <sup>d</sup>	
Current and cessation <sup>h</sup>	1115 (85%) <sup>d</sup>	197 (15%) <sup>d</sup>	
Betel chewing <sup>f</sup>			<.001 <sup>g</sup>
Never <sup>h</sup>	4411 (95%) <sup>d</sup>	209 (5%) <sup>d</sup>	
Current and cessation <sup>h</sup>	373 (69%) <sup>d</sup>	168 (31%) <sup>d</sup>	
Cigarette smoking <sup>f</sup>			<.001 <sup>g</sup>
Never <sup>h</sup>	4069 (96%) <sup>d</sup>	169 (4%) <sup>d</sup>	
Current and cessation <sup>h</sup>	715 (77%) <sup>d</sup>	208 (23%) <sup>d</sup>	
Dental check-ups <sup>f</sup>			<.001 <sup>g</sup>
Regular (>1 per year) <sup>h</sup>	2182 (95%) <sup>d</sup>	110 (5%) <sup>d</sup>	
Seldom/never <sup>h</sup>	2602 (91%) <sup>d</sup>	267 (9%) <sup>d</sup>	
Physical activity <sup>f</sup>			<.001 <sup>g</sup>
Regular <sup>h</sup>	2411 (94%) <sup>d</sup>	145 (8%) <sup>d</sup>	
Irregular <sup>h</sup>	2373 (91%) <sup>d</sup>	232 (9%) <sup>d</sup>	

Abbreviations: POC, pre-oral cancer.  
<sup>a</sup>Regular: at least 3 times a week and 30 minutes per time.  
<sup>b</sup>Variable: BMI, body mass index; POC, pre-oral cancer.

Table 2 Association of metabolic syndrome and its components with pre-oral cancer lesions<sup>a</sup>

Variable <sup>b</sup>	Non-POC <sup>c</sup> (n = 4784) <sup>d</sup>	POC <sup>c</sup> (n = 377) <sup>d</sup>	P value <sup>e</sup>
BMI (body mass index) kg/m <sup>2</sup> <sup>f</sup>			<.001 <sup>g</sup>
Normal/underweight <sup>h</sup>	2273 (95%) <sup>d</sup>	119 (5%) <sup>d</sup>	
Overweight/obesity <sup>h</sup>	2511 (91%) <sup>d</sup>	258 (9%) <sup>d</sup>	
Systolic blood pressure (mmHg) <sup>f</sup>			<.001 <sup>g</sup>
≤ 129 <sup>h</sup>	2155 (94%) <sup>d</sup>	127 (6%) <sup>d</sup>	
≥ 130 <sup>h</sup>	2629 (91%) <sup>d</sup>	250 (9%) <sup>d</sup>	
Diastolic blood pressure (mmHg) <sup>f</sup>			<.001 <sup>g</sup>
≤ 84 <sup>h</sup>	2830 (94%) <sup>d</sup>	170 (6%) <sup>d</sup>	
≥ 85 <sup>h</sup>	1954 (90%) <sup>d</sup>	207 (10%) <sup>d</sup>	
Fasting blood glucose (mg/dL) <sup>f</sup>			<.001 <sup>g</sup>
≤ 100 <sup>h</sup>	3679 (94%) <sup>d</sup>	250 (6%) <sup>d</sup>	
≥ 101 <sup>h</sup>	1105 (90%) <sup>d</sup>	127 (10%) <sup>d</sup>	
Triglyceride (mg/dL) <sup>f</sup>			<.001 <sup>g</sup>
≤ 149 <sup>h</sup>	3989 (94%) <sup>d</sup>	240 (6%) <sup>d</sup>	
≥ 150 <sup>h</sup>	795 (85%) <sup>d</sup>	137 (15%) <sup>d</sup>	
High-density lipoprotein (mg/dL) <sup>f</sup>			<.001 <sup>g</sup>
Male ≥ 40 / Female ≥ 50 <sup>h</sup>	3814 (94%) <sup>d</sup>	263 (6%) <sup>d</sup>	
Male < 40 / Female < 50 <sup>h</sup>	970 (89%) <sup>d</sup>	114 (11%) <sup>d</sup>	
Waist circumference (cm) <sup>f</sup>			<.001 <sup>g</sup>
Male ≤ 89 / Female ≤ 79 <sup>h</sup>	2608 (94%) <sup>d</sup>	172 (6%) <sup>d</sup>	
Male ≥ 90 / Female ≥ 80 <sup>h</sup>	2176 (91%) <sup>d</sup>	205 (9%) <sup>d</sup>	
Metabolic syndrome <sup>f</sup>			<.001 <sup>g</sup>
No <sup>h</sup>	2933 (95%) <sup>d</sup>	166 (5%) <sup>d</sup>	
Yes <sup>h</sup>	1851 (90%) <sup>d</sup>	211 (10%) <sup>d</sup>	

<sup>a</sup>Metabolic syndrome ≥ three risk factors (e.g. abnormal blood pressure, fasting blood glucose, triglyceride, HDL, waist circumference).  
<sup>b</sup>Abbreviations: BMI, body mass index; POC, pre-oral cancer.



Table 3 Logistic regression of factors associated with pre-oral cancer lesions<sup>a</sup>

Predictor <sup>b</sup>	aOR (95% CI of OR) <sup>c</sup>	P <sup>d</sup>
Male gender <sup>e</sup>	7.24 (5.01–10.47) <sup>d</sup>	<.001 <sup>g</sup>
Low education level <sup>e</sup>	2.05 (1.53–2.67) <sup>d</sup>	<.001 <sup>g</sup>
Betel chewing <sup>e</sup>	2.98 (2.25–3.94) <sup>d</sup>	<.001 <sup>g</sup>
Cigarette smoking <sup>e</sup>	1.95 (1.47–2.59) <sup>d</sup>	<.001 <sup>g</sup>
Seldom dental check-ups <sup>e</sup>	1.42 (1.10–1.84) <sup>d</sup>	.007 <sup>g</sup>
Irregular physical activity <sup>e</sup>	1.41 (1.11–1.79) <sup>d</sup>	.005 <sup>g</sup>
Presence of metabolic syndrome <sup>e</sup>	1.39 (1.10–1.77) <sup>d</sup>	.006 <sup>g</sup>

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.

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