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ASSESSMENT OF NON-COMMUNICABLE DISEASE RISK FACTORS IN A RURAL PARISH OF ECUADOR

**EVALUACIÓN DE LOS FACTORES DE RIESGO DE ENFERMEDADES
NO TRANSMISIBLES EN UNA PARROQUIA RURAL DE ECUADOR**

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Assessment of Non-Communicable Disease Risk Factors in a Rural Parish of Ecuador

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ABSTRACT

Background: Chronic noncommunicable diseases, including cardiovascular diseases, are a public health problem in the world and are one of the leading causes of mortality worldwide, approximately 17.9 million deaths per year [1]. The growth of these diseases is even more evident in low- and middle-income countries (LMICS), countries in which health systems face problems of prevention and health promotion [2]. In Ecuador, rural populations are not free from the presence of these diseases but data and information on risk factors for the development of noncommunicable diseases is scarce [3]. **Methods:** This cross-sectional study assessed behavioral, anthropometric, and biochemical risk factors among 1,568 adults in La “Independencia”, Ecuador, using the WHO STEPSwise approach [4]. Data were collected on socioeconomics, smoking, alcohol consumption, diet, physical activity, body mass index (BMI), blood pressure, fasting glucose and total cholesterol. Statistical analysis included descriptive and inferential tests to evaluate associations between demographic and clinical variables [5]. **Results:** The prevalence of risk factors for the development of chronic noncommunicable diseases such as cardiovascular disease found in this study were: behavioral risk factors included daily smoking (40.69%), alcohol consumption (45.07%), and low consumption of fruits and vegetables (76.59%). Physical measures identified high rates of abdominal obesity (50.51%), general obesity (34.25%), and elevated blood pressure (20.34%). Laboratory measurements highlighted a prevalence of elevated glucose (41.26%) and elevated cholesterol (73.47%). [9]. **Conclusions:** Our findings highlight the need for targeted public health interventions that address modifiable risk factors in rural Ecuador. Strategies should focus on health promotion programs, improve access to health care to mitigate cardiovascular risks [10].

Keywords: cardiovascular risk factors, non-communicable diseases, WHO STEPS, Ecuador, rural health



Evaluación de los Factores de Riesgo de Enfermedades no Transmisibles en una Parroquia Rural de Ecuador

RESUMEN

Antecedentes: Las enfermedades crónicas no transmisibles, incluidas las enfermedades cardiovasculares, constituyen un problema de salud pública a nivel mundial y representan una de las principales causas de mortalidad, con aproximadamente 17.9 millones de muertes por año [1]. El crecimiento de estas enfermedades es aún más evidente en los países de ingresos bajos y medianos (PIBM), donde los sistemas de salud enfrentan dificultades en la prevención y la promoción de la salud [2]. En Ecuador, las poblaciones rurales no están exentas de estas enfermedades; sin embargo, la información disponible sobre los factores de riesgo asociados a su desarrollo es limitada [3]. **Métodos:** Este estudio transversal evaluó factores de riesgo conductuales, antropométricos y bioquímicos en 1,568 adultos residentes de la parroquia La “Independencia”, Ecuador, utilizando la metodología STEPS de la Organización Mundial de la Salud (OMS) [4]. Se recopilaron datos sobre variables socioeconómicas, consumo de tabaco y alcohol, dieta, actividad física, índice de masa corporal (IMC), presión arterial, glucosa en ayunas y colesterol total. El análisis estadístico incluyó pruebas descriptivas e inferenciales para evaluar las asociaciones entre variables demográficas y clínicas [5]. **Resultados:** La prevalencia de factores de riesgo para el desarrollo de enfermedades crónicas no transmisibles, como las enfermedades cardiovasculares, fue alta. Entre los factores conductuales se identificó consumo diario de tabaco (40.69%), consumo de alcohol (45.07%) y bajo consumo de frutas y verduras (76.59%). Las medidas físicas mostraron altas tasas de obesidad abdominal (50.51%), obesidad general (34.25%) y presión arterial elevada (20.34%). Los análisis bioquímicos evidenciaron prevalencia de glucosa elevada (41.26%) y colesterol elevado (73.47%) [9]. **Conclusiones:** Los hallazgos destacan la necesidad de intervenciones de salud pública dirigidas a los factores de riesgo modificables en zonas rurales del Ecuador. Se recomienda fortalecer los programas de promoción de la salud y mejorar el acceso a los servicios sanitarios con el fin de reducir los riesgos cardiovasculares [10].

Palabras Clave: factores de riesgo cardiovascular, enfermedades no transmisibles, metodología STEPS de la OMS, Ecuador, salud rural

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INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of death worldwide, claiming an estimated 17.9 million lives annually. A striking 77% of these deaths occur in low- and middle-income countries (LMICs), where structural inequalities and under-resourced health systems contribute to a growing burden of non-communicable diseases (NCDs) [1][2]. These conditions are often preventable, yet persist due to a complex interplay of social, economic, and environmental factors.

In Latin America, this public health transition is particularly evident. While infectious diseases once dominated mortality statistics, NCDs now account for the majority of deaths. Rapid urbanization, changes in dietary patterns, and increasingly sedentary lifestyles have led to rising rates of hypertension, obesity, and type 2 diabetes. These shifts affect both urban and rural populations, though not equally. In many cases, rural communities bear a disproportionate burden due to limited access to healthcare services and preventive strategies [3][4].

Ecuador follows this regional trend. According to national estimates, around 68% of all deaths are attributed to NCDs, with cardiovascular conditions representing a significant portion. Surveys such as ENSANUT and WHO STEPS have helped document health risks at the national level, particularly in urban contexts. However, data on rural populations remain sparse, limiting efforts to design interventions that reflect the realities of these communities [5][6][7].

The rural parish of “La Independencia” in Esmeraldas Province exemplifies the challenges faced by underserved regions. Home to both Mestizo and Afro-Ecuadorian populations, the area relies heavily on agricultural work, often under precarious economic conditions. Access to healthcare is limited, and social determinants such as poverty and low levels of formal education create environments in which modifiable CVD risk factors—like smoking, poor diet, and physical inactivity—are common and largely unaddressed [8][9].

Studies across Latin America have shown that rural populations often experience higher rates of tobacco use, obesity, and insufficient physical activity, compared to their urban counterparts [10][11]. These disparities are shaped by cultural norms, infrastructural gaps, and inconsistent public health policies. Despite this, Ecuador lacks specific data on these trends in its rural regions, leaving a critical void in public health planning and policy [12].



This study aims to address this gap by analyzing the prevalence and distribution of CVD risk factors in “La Independencia.” Applying the WHO STEPwise approach, it assesses behavioral, anthropometric, and biochemical indicators to generate evidence that can inform targeted community-level strategies and support broader health policy development.

METHODS

Study Design and Setting

This was a cross-sectional, community-based study conducted between October 2018 and May 2019 in “La Independencia”, Esmeraldas Province, Ecuador. This rural parish is home to approximately 7,000 residents, predominantly mestizo and Afro-Ecuadorian. The local economy is centered on agriculture, and the community experiences significant socioeconomic disparities [8][13].

Adults aged ≥ 18 years who had resided in “La Independencia” for at least six months were eligible to participate. Pregnant women, individuals with severe illness, and those unwilling to provide informed consent were excluded. Rather than employing census-based household visits, the study followed a census approach. The research team visited each household across all identified neighborhoods in “La Independencia”. Adults meeting the inclusion criteria were invited to participate, and informed consent was obtained before data collection. This approach ensured a broad representation of the community while prioritizing voluntary participation and ethical compliance.

Adults aged ≥ 18 years who had resided in “La Independencia” for at least six months were eligible to participate. Pregnant women, individuals with severe illness, and those unwilling to provide informed consent were excluded [4][14].

This approach sampling ensured representation from both central and peripheral neighborhoods. The sampling was designed to capture a diverse demographic profile, accounting for variations in socioeconomic status and healthcare access [15].

Sample Size

A sample size of 1,568 was calculated using a 95% confidence level, a 1.45% margin of error, and an estimated overweight/obesity prevalence of 31% in rural Ecuador [5]. This sample size provided sufficient statistical power to analyze subgroup differences.

Data Collection

The WHO STEPSwise questionnaire was carefully adapted to the cultural and socioeconomic context of a rural parish, “La Independencia”. For example, questions about dietary intake were adjusted to include local staples and traditional eating habits. Additionally, the terminology was simplified and translated to Spanish to ensure clarity and comprehension among participants, many of whom had limited formal education.

Behavioral Risk Factors: The WHO STEPSwise questionnaire was adapted to collect data on:

Tobacco Use: Defined as current daily smoking or use of smokeless tobacco.

Alcohol Consumption: Hazardous drinking was categorized as ≥ 15 drinks/week for men and ≥ 8 drinks/week for women [16].

Dietary Intake: Low fruit/vegetable intake was defined as fewer than five servings per day [17].

Physical Activity: Measured using the Global Physical Activity Questionnaire (GPAQ), with inactivity defined as < 150 minutes of moderate activity/week [18].

Anthropometric and Physical Measurements:

To ensure the quality and precision of the measurements, all field personnel underwent rigorous training sessions on data collection protocols. Instruments such as digital scales and automated blood pressure monitors were standardized and calibrated prior to and during the data collection period. Regular supervisory visits were conducted to verify adherence to protocols and address any discrepancies.

Body Mass Index (BMI): Calculated as weight (kg)/height (m^2). Obesity was defined as BMI ≥ 30 [19].

Waist Circumference: Abdominal obesity was defined as > 102 cm in men and > 88 cm in women [20].

Blood Pressure: Hypertension was defined as systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg, measured with three readings averaged.

Biochemical Measurements: Fasting glucose and cholesterol levels were measured. Hyperglycemia was defined as fasting glucose ≥ 126 mg/dL, and hypercholesterolemia as total cholesterol ≥ 200 mg/dL.

RESULTS

The final sample included 1,568 participants, with a mean age of 42.7 ± 17 years. Women represented 60.3% of the study population, and the majority (88.4%) identified as mestizo. Educational attainment was generally low; over half of the participants (55.8%) had completed only primary education.



In terms of occupation, most individuals reported working in agricultural or informal sectors, consistent with the rural profile of the study site [16].

Several modifiable cardiovascular risk factors were identified. Tobacco use was reported by 40.7% of participants, with a significantly higher prevalence among men (46.7%) than women (35.1%; $p < 0.01$).

Alcohol consumption was reported by 45.1%, with hazardous drinking behaviors particularly concentrated among men (57.3%). Poor dietary patterns were also widespread, as 76.6% of participants consumed insufficient amounts of fruits and vegetables, slightly more prevalent among women.

Regarding anthropometric and clinical findings, 34.3% of participants met the criteria for obesity, with significantly higher rates among women (41.9%). Hypertension was present in 20.3% of the sample, with a notable age-related increase, reaching 37% among older adults.

Biochemical markers revealed elevated levels of cardiovascular risk: 41.2% had hyperglycemia, rising to 52% in older individuals, while hypercholesterolemia affected 38.9% of the sample, with no marked gender differences [21][22].

Table 1 Position

Table 1 Socio-demographic information on participants in study of cardiovascular disease risk factors, La Independencia, Ecuador, 2018

Socio-demographic variables	Female (N = 946 - 60.33%)		Male (N = 622 - 39.67%)		Both Genders (N = 1568)	
	n	%	n	%	n	%
Age group						
18–29	262,00	27,70	179,00	28,78	441,00	28,13
30–44	313,00	33,09	160,00	25,72	473,00	30,17
45–59	214,00	22,62	143,00	22,99	357,00	22,77
≥ 60	157,00	16,60	140,00	22,51	297,00	18,94
Total	946,00	60,33	622,00	39,67	1568,00	100,00
Education						
No formal schooling	112,00	11,88	63,00	10,19	175,00	11,21
Primary school	513,00	54,40	358,00	57,93	871,00	55,80
Secondary school	63,00	6,68	52,00	8,41	115,00	7,37
Higher education	255,00	27,04	145,00	23,46	400,00	25,62
Total	943,00	60,41	618,00	39,59	1561,00	100,00
Ethnicity						
Indigenous	6,00	0,64	8,00	1,29	14,00	0,90
Afroecuatoriano	43,00	4,56	54,00	8,71	97,00	6,21
Mestizo	856,00	90,87	525,00	84,68	1381,00	88,41
Other	37,00	3,93	33,00	5,32	70,00	4,48
Total	942,00	60,31	620,00	39,69	1562,00	100,00

Marital Status						
Never married	241,00	25,53	178,00	28,66	419,00	26,77
Currently married or cohabitating	578,00	61,23	407,00	65,54	985,00	62,94
Widowed or separated	125,00	13,24	36,00	5,80	161,00	10,29
Total	944,00	60,32	621,00	39,68	1565,00	100,00
Occupation/labour market position/status						
Student	55,00	5,84	36,00	5,80	91,00	5,83
Self-employed	182,00	19,34	253,00	40,74	435,00	27,85
Employed	127,00	13,50	220,00	35,43	347,00	22,22
Housewife or homemaker	487,00	51,75	6,00	0,97	493,00	31,56
Retired	7,00	0,74	19,00	3,06	26,00	1,66
Unemployed	83,00	8,82	87,00	14,01	170,00	10,88
Total	941,00	60,24	621,00		1562,00	100,00

Table 2 Position

Table 2 Prevalence of cardiovascular disease risk factors stratified by socio-demographic variables, La Independencia, Ecuador, 2018

STEP 1: Behavioural Risk Factors (% 95 CI)					STEP 2: Physical Measurements (% 95 CI)				STEP 3: Laboratory Measurements (% 95 CI)	
Socio-demographic variables	Current daily smoker	Current alcohol consumption	Low fruit and vegetable consumption	Low level of physical activity	Overweight	Obesity	Abdominal obesity	Raised blood pressure	Glucose elevated	Cholesterol elevated
Prevalencia total	40,69(32,61-49,15)	45,07(41,62-48,54)	76,59(74,41-78,67)	41,07(38,62-43,55)	37,82(35,41-40,27)	34,25(31,90-36,65)	50,51(48,00-53,01)	20,34(18,38-22,42)	41,26(38,81-43,74)	73,47(71,21-75,64)
Gender										
Female	44,00 (24,40-65,07)	35,10(30,70-39,69)	79,39(76,77-81,92)	37,31(34,22-40,48)	35,94(32,88-39,09)	41,96(38,80-45,18)	65,96(62,84-68,98)	18,28(15,87-20,90)	37,33(34,64-40,91)	73,25(70,31-76,05)
Male	40,00(31,17-49,34)	57,34(52,10-62,44)	72,34(68,65-75,83)	46,78(42,81-50,79)	40,67(36,79-44,65)	27,00(19,28-25,99)	27,00(23,56-30,68)	23,47(20,19-27,00)	46,62(42,65-50,63)	73,79(70,15-77,21)
Age group										
18–29	26,31(13,40-43,10)	51,59(45,60-57,54)	75,97(71,69-79,88)	36,96(32,44-41,65)	31,97(27,64-36,55)	21,08(17,37-25,20)	29,93(25,69-34,44)	4,70(29,71-71,87)	56,23(51,46-60,92)	72,10(67,67-76,25)
30–44	40,00 (24,86-56,67)	50,88(44,90-56,84)	76,53(72,45-80,28)	45,45(40,90-50,06)	40,59(36,13-45,17)	41,64(37,16-46,24)	56,65(52,06-61,18)	19,00(15,59-22,86)	41,23(36,75-45,81)	72,72(68,47-76,69)
45–59	46,15(30,094-62,82)	31,54(24,60-39,15)	76,75(72,02-81,03)	39,21(34,12-44,49)	41,17(36,02-46,48)	40,05(34,93-45,34)	61,06(55,79-66,15)	27,45(22,88-32,39)	31,65(26,86-36,75)	75,63(70,83-79,99)
≥ 60	53,57(33,87-72,49)	31,03(21,54-41,86)	77,44(72,26-82,07)	42,42(36,73-48,26)	38,04(32,50-43,83)	35,01(29,60-40,74)	58,58(52,75-64,24)	37,03(31,53-42,80)	30,64(25,44-36,22)	74,07(68,70-78,96)
Education										
No formal schooling	61,90(38,43-81,89)	22,64(12,28-36,21)	73,71(66,54-80,07)	45,71(38,18-53,40)	31,43(24,63-38,86)	46,85(39,29-54,53)	62,85(55,24-70,03)	31,42(24,63-38,86)	35,42(28,36-43,00)	77,14(70,20-83,14)
Primary school	34,61(24,20-46,24)	50,79(46,33-55,25)	76,69(73,74-79,46)	42,13(38,83-45,49)	37,19(33,98-40,50)	30,88(27,83-34,07)	45,80(42,46-49,18)	15,61(13,26-18,20)	45,46(42,12-48,84)	71,75(68,64-74,72)
Secondary school	25,00(06,30-80,59)	57,75(45,44-69,39)	74,78(65,83-82,41)	55,65(46,09-64,91)	49,56(40,11-59,04)	21,73(14,59-30,40)	40,00(30,98-49,55)	16,52(10,25-24,59)	47,82(38,42-57,34)	77,39(68,65-84,67)
Higher education	41,46(26,31-57,89)	31,77(25,25-38,86)	78,00(73,61-81,96)	32,75(28,17-37,59)	38,75(33,95-43,72)	39,25(34,43-44,22)	58,00(52,99-62,89)	26,75(22,47-31,37)	32,5(27,93-37,33)	74,25(69,67-78,47)
Ethnicity										
Indigenous	0,00(0,00-97,5)*	28,57(03,67-70,96)	50,00(23,04-76,96)	42,85(17,66-71,13)	64,28(35,14-87,24)	35,71(12,76-64,86)	64,28(35,14-87,24)	14,28(01,78-42,81)	42,85(17,66-71,14)	92,85(66,13-99,82)
Afroecuatoriano	56,52(34,49-76,80)	44,07(31,15-57,60)	72,16(62,14-80,79)	36,08(26,57-46,46)	32,98(35,14-87,24)	26,80(18,31-36,76)	37,11(27,52-47,52)	23,71(15,66-33,42)	54,64(44,21-64,78)	79,38(69,97-86,93)
Mestizo	39,13(30,16-48,67)	45,58(41,91-49,29)	77,48(75,18-79,66)	41,63(39,02-44,29)	38,01(35,45-40,63)	34,68(32,17-37,26)	51,26(48,59-53,93)	20,13(18,04-22,34)	39,60(37,02-42,24)	72,84(70,42-75,18)
Other	16,66(04,21-64,12)	40,74(22,39-61,20)	71,42(59,38-81,59)	37,14(25,89-49,52)	35,71(24,61-48,07)	37,14(25,89-49,52)	52,85(40,55-64,91)	22,85(13,66-34,45)	54,28(41,94-66,25)	72,85(60,90-82,80)



Marital Status										
Never married	21,21(89,80-39,90)	50,00(43,14-56,86)	78,28(74,02-82,14)	35,79(31,20-40,60)	31,98(27,54-36,68)	26,73(22,55-31,24)	37,23(32,59-42,06)	16,70(13,26-20,63)	45,82(40,98-50,73)	71,36(66,77-75,64)
Currently married or cohabitating	47,06(37,10-57,19)	44,51(40,25-48,82)	75,73(72,93-78,38)	43,53(40,43-46,71)	40,91(37,82-44,06)	36,64(33,63-39,74)	54,21(51,04-57,36)	20,00(13,26-20,63)	40,81(37,72-43,95)	74,01(71,15-76,72)
Widowed or separated	40,00(12,15-73,76)	34,84(23,53-47,58)	77,01(69,74-83,27)	38,50(30,96-46,49)	34,16(26,88-42,04)	38,50(30,96-46,49)	62,11(54,14-69,63)	31,67(24,58-39,46)	32,30(25,15-40,11)	75,15(67,74-81,62)
Occupation/labour market position/status										
Student	0,00(0,00-0,84)*	50,91(37,07-64,65)	78,02(68,11-86,03)	26,37(17,68-36,65)	16,48(09,53-25,72)	23,07(14,89-33,09)	26,37(17,68-36,65)	04,39(01,21-10,87)	42,85(32,53-53,66)	63,73(52,99-73,56)
Self-employed	46,27(33,99-58,88)	52,00(45,61-58,34)	71,49(67,00-75,92)	44,83(40,09-49,64)	41,37(36,71-46,17)	34,02(29,58-38,68)	46,89(42,13-51,71)	25,74(21,70-30,13)	39,31(34,69-44,07)	73,33(68,91-77,43)
Employed	32,69(20,33-47,10)	54,31(47,66-60,84)	78,38(73,68-82,60)	51,58(46,19-56,95)	41,21(35,98-46,59)	24,20(19,79-29,07)	34,00(29,03-39,25)	15,85(12,17-20,12)	48,70(43,33-54,10)	75,79(70,93-80,21)
Housewife or homemaker	57,14(28,86-82,34)	27,15(21,40-33,52)	78,29(74,39-81,85)	32,86(28,73-37,20)	36,71(32,45-41,13)	45,03(40,58-49,54)	70,99(66,77-74,96)	18,45(15,13-22,17)	38,94(34,62-43,41)	74,03(69,93-77,85)
Retired	N/A	66,67(09,43-99,15)	65,38(44,33-82,78)	57,69(36,92-76,65)	46,15(26,59-66,63)	30,77(14,33-51,79)	57,69(36,92-76,65)	26,92(11,57-47,79)	34,61(17,21-55,67)	73,07(52,21-88,43)
Unemployed	33,33(74,85-70,07)	40,35(27,56-54,18)	82,35(75,78-87,76)	38,82(31,46-46,59)	35,29(28,13-42,98)	30,00(23,22-37,49)	45,88(38,23-53,68)	29,41(22,68-36,87)	37,06(29,79-44,79)	71,76(64,36-78,39)

DISCUSSION

To address these gaps, targeted interventions that include culturally sensitive health promotion programs, enhanced community involvement, and infrastructure development are crucial. For example, successful tobacco control campaigns in rural Colombia and dietary interventions in Peru offer models for adaptation in Ecuador. Furthermore, gender disparities demand specific strategies, such as increasing opportunities for physical activity among women and addressing the social acceptance of tobacco use among men. Structural barriers, including economic constraints and limited healthcare access, need policy-level solutions to reduce health inequities in rural settings. A deeper understanding of the structural barriers in rural settings is essential. These include limited access to healthcare, economic instability, and inadequate policy enforcement that exacerbate health disparities. For example, rural communities often face geographic isolation and lack of transportation, which hinder access to preventive services.

The high prevalence of cardiovascular risk factors observed in “La Independencia” is deeply rooted in structural determinants such as poverty, limited access to healthcare, and low levels of education. These factors create barriers to healthy living, including inadequate access to nutritious foods and safe spaces for physical activity. Addressing these structural issues requires multi-sectoral approaches that integrate health, education, and economic development policies.



For instance, investment in infrastructure, such as transportation networks and healthcare facilities, can improve access to preventive and curative services. Furthermore, community-led initiatives can empower residents to address local challenges effectively.

We present here an in-depth analysis of modifiable cardiovascular disease (CVD) risk factors in “La Independencia,” Ecuador. The findings reveal a high prevalence of tobacco use, alcohol consumption, low fruit and vegetable intake, obesity, and biochemical abnormalities. These results align with trends observed in rural Latin America, but also present unique features shaped by the local sociocultural and economic context.

Comparison with Previous Studies

The prevalence of tobacco use (40.7%) in “La Independencia” significantly exceeds the national average reported in urban Ecuador (13.7%) and mirrors findings from rural Colombia, where rates of 37% have been observed [16][17]. This difference may reflect weaker enforcement of tobacco control policies in rural areas, combined with cultural norms that normalize smoking, particularly among men [18]. Similarly, alcohol consumption (45.1%) aligns with patterns reported in rural Peru and Bolivia, where hazardous drinking is closely tied to occupational stress and social traditions [19][20].

The low fruit and vegetable intake (76.6%) is consistent with studies across rural Latin America, where economic constraints and limited agricultural diversity restrict access to fresh produce [21]. In Ecuador, regional disparities in food security exacerbate these dietary challenges, with rural households often relying on high-calorie, low-cost processed foods [22].

Obesity rates (34.3%) in “La Independencia” are comparable to findings from rural Colombia and Brazil but exceed the prevalence reported in urban Ecuador (26%) [23][24]. The gender disparity, with women exhibiting significantly higher rates of obesity (41.9% vs. 22.5% in men), reflects broader sociocultural dynamics in Latin America, where caregiving roles, limited mobility, and dietary patterns disproportionately affect women [25][26].

Explaining Discrepancies and Patterns

The observed gender differences in risk factors highlight the influence of cultural norms on health behaviors. Higher tobacco and alcohol use among men may be attributed to social acceptability and occupational stress in agricultural settings, where men are more likely to engage in physically



demanding labor [27]. Conversely, the higher prevalence of obesity and abdominal obesity among women highlights the cumulative impact of caregiving responsibilities, reduced access to recreational spaces, and restricted opportunities for physical activity [28][29].

Age-specific trends are also notable. Older adults (≥ 60 years) exhibited markedly higher rates of hypertension (37%), hyperglycemia (52%), and hypercholesterolemia (38.9%). These findings align with the cumulative effect of unmanaged risk factors over time, compounded by limited healthcare access in rural areas [30][31]. In contrast, younger adults (18–29 years) reported higher tobacco and alcohol use, reflecting the early adoption of harmful behaviors driven by cultural and social influences [32][33].

Implications for Public Health

Successful examples from similar settings include tobacco taxation initiatives in rural Colombia, which reduced smoking rates, and community-led dietary education programs in Peru that improved fruit and vegetable consumption. Adapting such models to Ecuador's rural context could address the observed disparities.

CONCLUSIONS

This study sheds light on the significant burden of cardiovascular risk factors in the rural community of La Independencia. The high prevalence of tobacco and alcohol use, poor dietary patterns, obesity, hypertension, and metabolic disorders such as hyperglycemia and hypercholesterolemia signals a growing public health challenge in underserved areas of Ecuador.

While the situation is complex, the findings point to practical and realistic entry points for action. Community-based health promotion—especially when culturally adapted and led by trusted local figures—can be an effective strategy to improve awareness and encourage healthier behaviors related to diet, physical activity, and substance use [34][35].

In addition, integrating low-cost screening and early detection services into existing rural healthcare systems is both feasible and impactful. Mobile clinics, community health brigades, or telemedicine could support the identification and management of hypertension, diabetes, and dyslipidemia in settings with limited infrastructure [38].



At the policy level, these local data can support broader advocacy efforts. Strengthening regulations around tobacco and alcohol, improving access to affordable healthy food, and addressing marketing of unhealthy products remain essential to tackling structural determinants of health [36][37].

Finally, this study contributes baseline evidence to guide future public health planning, and highlights the need for continued research—both quantitative and qualitative—to understand how rural communities in Ecuador experience and respond to cardiovascular risk factors over time.

Limitations and Future Directions

Future studies should investigate the long-term impact of community-based interventions on reducing cardiovascular risk factors in rural Ecuador. Additionally, qualitative studies exploring barriers to healthy lifestyles can provide insights into cultural and social determinants. Future research should explore the implementation and outcomes of culturally adapted interventions in rural Ecuador. Longitudinal studies could assess the impact of community-based programs on cardiovascular risk reduction over time. Qualitative research could uncover deeper insights into the lived experiences and health-related behaviors of rural populations.

This study's cross-sectional design limits the ability to establish causal relationships between risk factors and outcomes. Additionally, reliance on self-reported data for behavioral factors may introduce recall or social desirability bias. Despite these limitations, the use of the WHO STEPSwise approach ensures comparability with other studies and provides a robust framework for understanding risk factor prevalence.

Future research should focus on longitudinal studies to track changes in CVD risk factors over time and evaluate the impact of targeted interventions. Comparative analyses between rural and urban populations within Ecuador would also provide valuable insights into regional disparities and inform national strategies [39][40].

Ethics Statement

This study was approved by the Ethics Committee of the Pontificia Universidad Católica del Ecuador (PUCE) and the Ministry of Public Health of Ecuador, CEISH-574-2018. All participants provided informed consent prior to data collection. The study adhered to ethical principles outlined in the Declaration of Helsinki for research involving human subjects.



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Conflict of Interest Statement

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

Author Contributions

Carlos Vinicio Erazo: Principal author and corresponding author. Responsible for the conceptualization and planning of the study, statistical analysis, manuscript writing, and overall project supervision.

Raúl Ruíz de Zárate del Cueto: Contributed to data collection, analysis of sociodemographic variables, and critical review of the manuscript.

Gonzalo Montero: Participated in the methodological design, preparation of the theoretical framework, and analysis of results. Contributed to writing the results section.

Victor Hugo Mena: Managed administrative tasks for the study, coordinated with local authorities for participant recruitment, and critically reviewed the manuscript.

Nelly Sarmiento: Assisted in the collection and processing of biochemical data, preliminary drafting of the discussion section, and final manuscript review.

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