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Socioeconomic Characteristics, Environmental Awareness and Willingness to Pay for Quieter Transport: A Comparative Study of four Cities in Central Ecuador

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ABSTRACT

Urbanization and increased reliance on motorized transport have exacerbated noise pollution. While the economic value of noise abatement is established, research on public preferences for noise reduction in urban bus transport remains limited. This study addresses this gap by analyzing the willingness to pay (WTP) for quieter bus transport among residents in four Ecuadorian cities: Ambato, Baños, Riobamba, and Latacunga, each with distinct urban characteristics. Using a logistic regression analysis of 402 respondents, the study identified key socioeconomic and noise perception factors influencing WTP. Results show that a significant portion of residents are willing to pay for quieter buses, with WTP varying significantly across cities ($F=504.12$, $p<0.001$). Ambato, the most urbanized city, exhibited the highest WTP (mean WTP of 34, compared to 22-27 in other cities) and highest noise exposure (intensity 4.6, frequency 25.5). Logit regression revealed that age significantly influenced WTP ($OR = 1.11$, $p < 0.05$), with younger residents more inclined to pay. Similarly, higher education levels significantly increased WTP ($OR = 0.591$, $p < 0.01$). Income also positively influenced WTP ($OR = 1.109$, $p < 0.05$). Longer residence ($OR = 0.622$, $p < 0.01$) and higher environmental awareness ($OR = 0.547$, $p < 0.01$) were associated with lower WTP, while increased noise exposure intensity ($OR = 1.058$, $p < 0.01$) and frequency ($OR = 1.175$, $p < 0.01$) positively impacted WTP. These findings offer critical data for urban planners and policymakers, guiding the implementation of targeted noise mitigation strategies such as quieter bus adoption, optimized route planning, and noise barriers, tailored to specific urban contexts and resident characteristics.

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INTRODUCTION

Urbanization and the increasing reliance on motorized transport have exacerbated noise pollution, a pervasive environmental challenge with significant negative impacts on human health and well-being. The World Health Organization (Hachem et al., 2019) recognizes noise pollution as a major public health concern, linking it to various adverse outcomes (Dzhambov, et al., 2025). These include not only auditory impairments such as hearing loss and tinnitus (Nieuwenhuijsen, 2021) but also broader health issues (Peplow, et al., 2021). Chronic exposure to excessive noise can disrupt sleep (Faria, et al., 2022), elevate blood pressure and stress levels (Rossi, et al., 2020), and contribute to cardiovascular diseases (Nejade et al., 2022). Moreover, noise pollution can impair cognitive function (Morfoulaki et al., 2021), hinder learning, and

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diminish overall quality of life.

Recognizing the substantial societal costs of noise pollution (Amini et al. 2024)., researchers and policymakers are increasingly interested in public preferences for noise reduction measures. The willingness to pay (WTP) for quieter urban environments has gained significant attention (Ahlfeldtet al., 2019). Prior research has demonstrated the economic value of noise abatement across various contexts (Friedt and Cohen, 2021), such as residential areas near airports and highways (Huh and Shin, 2018). Studies using contingent valuation (Parker and Huang, 2025) and hedonic pricing methods (Gamboa, et al., 2021) have provided valuable insights into the economic demand for noise reduction.

However, while research has examined noise reduction in different transportation modes (Bekker-Grob et al., 2010; Bravo-Moncayo et al., 2017), there is limited evidence on WTP for quieter bus transport, despite its role as a primary mode of urban mobility. This gap is particularly relevant given the direct and frequent exposure of bus passengers, drivers, and nearby residents to transport noise.

This study aims to address this gap by investigating the WTP for quieter bus transport in four Ecuadorian cities with distinct urban characteristics and noise profiles. Using a choice experiment methodology (Akil et al., 2021), we will estimate residents' WTP for quieter buses and examine the influence of socioeconomic factors such as income, education, age, residential status, perceived noise levels, and environmental awareness.

Our findings have important implications for urban planners and policymakers. Understanding the economic value of quieter bus transport and the factors influencing WTP can inform more effective and equitable noise mitigation strategies. These may include investments in quieter buses (Kostenko et al., 2021), optimizing routes (Gras-Gentiletti et al., 2025), and implementing noise barriers (Hematian and Ranjbar, 2022)—can enhance public health, quality of life, and satisfaction with urban transport.

This paper's remaining sections are organized as follows: A review of the literature is presented in Section 2. The research design, methodology, and hypothesis are described in Section 3. The data is described in Section 4. The results are presented and discussed in Section 5. A consideration of the research implications brings Section 6 to a close.

LITERATURE REVIEW

Noise pollution and its economic implications

In metropolitan places, noise pollution is a serious environmental problem that has been shown to have a negative impact on social and public health. As a significant public health concern, noise has been linked by the World Health Organization (WHO) to cardiovascular disorders, sleep disorders, hearing impairments, and cognitive dysfunction (Costa e Silva and Steffen, 2019; Zock et al., 2018; Flies et al., 2019; Piao et al., 2022). The economic value of noise reduction strategies for different forms of transportation has thus been the subject of much research (Veisten et al., 2021).

Economic valuation of noise reduction

Economic studies on noise pollution have largely employed contingent valuation and hedonic pricing methods to estimate public willingness to pay (WTP) for quieter environments (Chen et al., 2020). For example, Sayed and Abdelgawad (2022) examined WTP for noise abatement in residential areas affected by aircraft noise, while Wang et al. (2020) assessed similar preferences in regions impacted by highway traffic. These studies underscore the economic demand for noise mitigation strategies and the broader societal benefits of reducing urban noise pollution. Specifically, the monetary valuation of road noise often relies on analyzing residential property prices as an indicator of the acoustic climate quality, reflecting how much individuals are willing to pay for homes in quieter areas (Łowicki and Piotrowska 2015). This approach provides a tangible measure of the economic impact of noise and the value of noise reduction.

Noise pollution in urban public transport

Most noise valuation studies have concentrated on aviation, highways, and railways, with limited attention given to noise from urban public transport systems (Żak and Mainka, 2020). Urban bus transport, a major contributor to noise in densely populated areas, has received little research focus despite its relevance to daily commuting and proximity to residential areas (Glaubitz et al., 2022; Münzel et al., 2020). This research gap is particularly evident in low- and middle-income countries, where urban noise levels often exceed WHO guidelines. The growing emphasis on sustainable urban development, particularly through transit-oriented developments (TODs), further highlights the need to address noise pollution from public transport, as these initiatives concentrate population density and activities around transit hubs . Understanding and mitigating urban transport noise is thus crucial for improving the quality of life in these increasingly dense and transit-reliant urban centers.

Determinants of WTP for noise reduction

Existing literature has identified key factors influencing public WTP for noise reduction:

Economic Factors: Higher-income individuals generally exhibit greater WTP for noise mitigation due to affordability (Thanos, et al., 2011). Social & Demographic Factors: Education influences awareness of noise impacts, while age may shape long-term preferences for quieter environments (Cai et al., 2020; Ruettgers et al., 2022). Perceived Health Impacts: Individuals experiencing sleep disturbances, stress, or concentration difficulties due to noise tend to have higher WTP for mitigation measures (Shkembi, et al., 2022). Residential Characteristics: Proximity to noise sources, housing conditions, and building insulation significantly affect noise exposure and demand for reduction measures (Levenhagen et al., 2021). Lifestyle and Work Conditions: Those working from home or caring for young children and elderly family members often prioritize quieter environments (Church, 2020). Information and Awareness: Access to knowledge about noise pollution and its health effects increases public support for mitigation strategies (Fu et al., 2022).

Methodological approaches in noise valuation

Choice experiments have emerged as a robust methodology for estimating WTP for environmental improvements, including noise reduction (Sever and Verbič, 2019). This approach presents respondents with hypothetical scenarios featuring varying attributes of noise mitigation. Studies by Zhi-Ying and Yeo-Chang (2021) and Yin et al. (2022) have effectively used choice experiments to estimate the economic value of quieter residential areas and reduced transportation noise. However, their application to urban bus transport remains limited, particularly in Latin America.

Three key research gaps emerge from the literature (1) a limited focus on urban bus transport within the broader context of urban noise pollution, with few studies specifically examining willingness to pay (WTP) for quieter bus transport systems; (2) a lack of research in developing countries, as most existing studies concentrate on high-income nations (Ma et al., 2022), potentially overlooking the unique socioeconomic dynamics that could significantly influence WTP; and (3) unexplored cross-city variations in WTP, with current research rarely analyzing how preferences differ across cities with varying noise exposure levels and urban characteristics, particularly in regions like Ecuador (Lachapelle and Boisjoly, 2023).

This study directly addresses these identified gaps by analyzing WTP for quieter urban bus transport across four Ecuadorian cities characterized by distinct urban profiles. Employing choice experiments, this research offers a detailed evaluation of public preferences while incorporating socioeconomic determinants into the analysis. Consequently, this work contributes to the broader literature on noise pollution by specifically focusing on urban bus systems within the context of developing countries, thereby generating critical insights relevant for policy formulation and urban planning initiatives.

MATERIALS & METHODS

Study area

This study examines four diverse urban centers within Ecuador's Central Region: Ambato, Baños, Riobamba, and Latacunga (see Figure 1). These cities vary in urbanization levels, population densities, and industrial activity, offering a comprehensive setting for analyzing the relationship between noise pollution, willingness to pay (WTP) for noise reduction, and socioeconomic disparities.

• Ambato: A commercial hub with increasing traffic congestion and noise pollution from

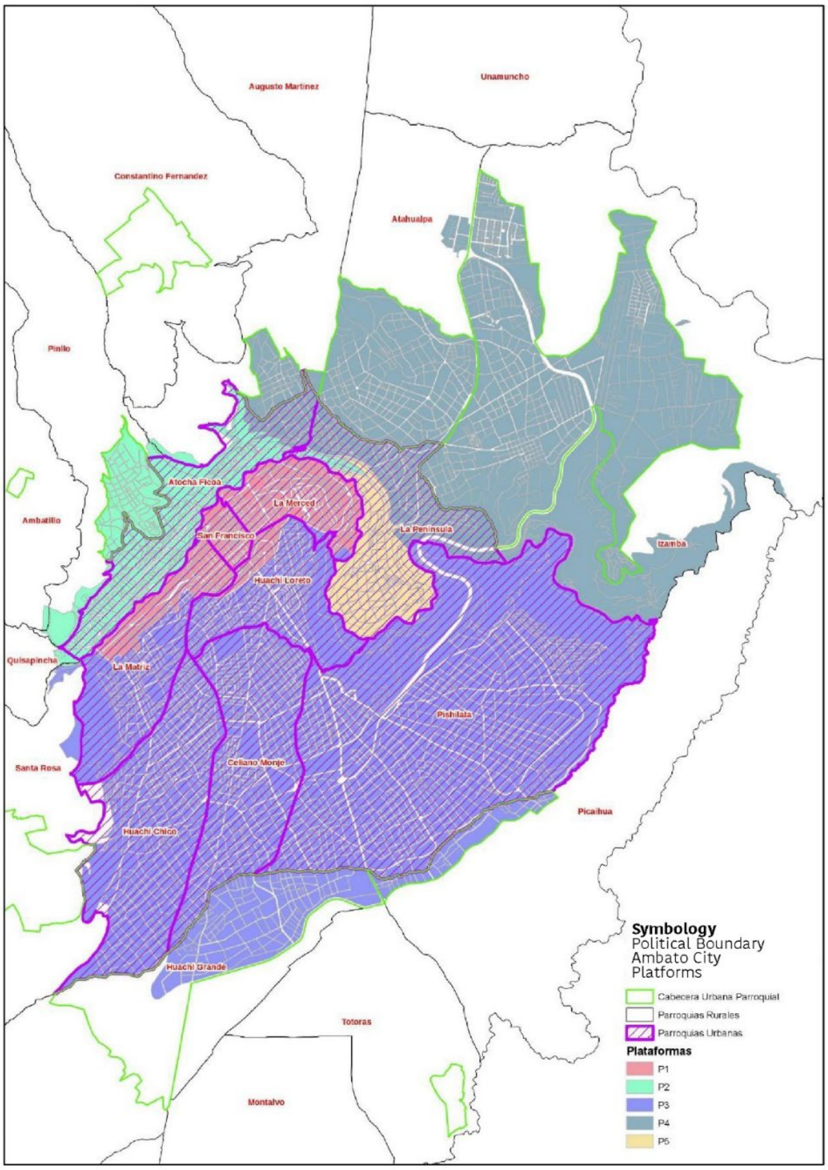


Fig. 1. Location of the study area in Ecuador

heavy vehicles.

• Baños: A smaller, tourist-driven city experiencing localized noise from construction and social events.

• Riobamba: A high-altitude city affected by noise from both vehicular traffic and its expanding industrial sector.

• Latacunga: The capital of Cotopaxi Province, where noise pollution stems from market activity, construction, and rising vehicular traffic.

This selection provides a diverse platform for assessing urban noise pollution and residents' valuation of quieter transport options.

Survey design and sample selection

A structured questionnaire was developed to collect data on residents' perceptions of noise pollution, their WTP for quieter bus transport, and their socioeconomic characteristics. Initially drafted in English, the questionnaire was translated into Spanish and reviewed by three independent experts in urban planning and social sciences to ensure clarity and cultural relevance.

A pilot test with five residents from each study city helped refine the questionnaire for clarity and usability. The final version comprised two main sections:

• Socioeconomic and Demographic Characteristics: Age, gender, education, income, occupation, length of residence, and housing tenure.

• Noise Perception and Willingness to Pay: Noise exposure intensity and frequency, noise-related stress levels, environmental awareness, and participation in environmental initiatives. A logistic regression model was used to elicit respondents' WTP for quieter buses.

The study employed a multi-stage sampling process:

• Stage 1: A list of residential addresses was obtained from municipal records.

• Stage 2: Systematic random sampling was used to select households.

An initial sample of 450 households was selected, yielding 402 valid responses after accounting for refusals and incomplete responses. Table 1 presents the sample distribution across the four cities.

Data, research hypothesis and variables of interest

Data for this study were collected through face-to-face interviews conducted between September and November 2024. A random selection process was used to recruit participants aged 18 and older residing in private households across the selected cities. To ensure data quality and consistency, interviewers underwent comprehensive training focusing on standardized interview administration techniques, clear communication to ensure respondent understanding, and the maintenance of respondent confidentiality.

This research aims to examine the determinants influencing residents' willingness to pay (WTP) for noise reduction in urban bus transport. The primary dependent variable in this analysis is the maximum monetary amount that respondents indicated they would be willing to

Table 1. Sample distribution in the cities.

Place	Proportion %	Sample
Ambato	35.4	143
Baños	19.3	78
Latacunga	27.1	109
Riobamba	18.2	72
Total	100.0	402

Table 2. Socio-economic and noise perception characteristics of surveyed residents

Variables	Description	Measure
Gender	Sex or sexually orientation	male=0, female =1
Age	Age of Household head	years
Education level	Last level of education	years
Income level	Range of family income	USD/month
Length of residence	Time period in the current neighborhood	years
Housing tenure	Housing tenure status	owner=0, renter=1
Noise exposure	Intensity of noise exposure	Perception (Likert scale1 to 5)
Noise exposure	Frequency of noise exposure	times/ week
Stress	Levels of stress caused by noise	Perception (Likert scale1 to 5)
Environmental awareness	Level of environmental awareness related to noise	Perception (Likert scale1 to 5)
Environmental initiatives	Participation in environmental initiatives	No=0, Yes =1

contribute towards the implementation of noise reduction measures, such as sound insulation, noise barriers, and the adoption of quieter bus technologies. The study incorporates several independent variables categorized as follows: (1) Socioeconomic factors: including age, gender, educational attainment, household income, length of residence in the current location, and housing tenure; (2) Noise-related factors: encompassing the perceived intensity and frequency of noise exposure experienced by respondents, as well as their reported stress levels attributable to noise; (3) Environmental factors: assessing the respondents' general environmental awareness and their participation in environmental initiatives; and (4) City-specific variable: a categorical variable designed to account for inherent variations in baseline noise pollution levels, prevalent socioeconomic characteristics, and distinct cultural contexts observed across the surveyed cities. A detailed summary of the socioeconomic and consumption characteristics of the surveyed respondents is presented in Table 2.

Methodology for analysis

To analyze residents' WTP for quieter bus transport, a binary logit model is employed. The model accounts for various socioeconomic, noise perception, and environmental awareness factors affecting WTP. The probability that a resident is willing to pay (WTP = 1) is defined as:

$$WTP_i = f\left(gender, education, age, income, etc\right) + \varepsilon_i .$$

Where ε_i is a random disturbance term.

The dependent variable WTP_i is binary: y=1 if a resident is willing to pay for quieter bus transport and y = 0 otherwise. Assuming that the probability y = 1 is P, the function y is expressed as:

$$f\left(y\right) = P^y\left(1-P\right)^{1-y}, \quad y = 0,1 \tag{1}$$

Using a logistic function:

$$P_i = F\left(\alpha \sum^m \beta_j X_{ij} + u\right) = \frac{1}{\left\{1+\exp\left[-\left(\alpha + \sum^m \beta_j X_{ij} + u\right)\right]\right\}} \tag{2}$$

where P_i is the probability for resident i willing to pay, β_j is the regression coefficient for factor j, m is the number of influencing factors, X_{ij} is the value of factor j for resident i, α is the intercept and u is the error.

The maximum likelihood estimation (MLE) is used to estimate the parameters. This methodology provides a robust framework for understanding the factors influencing residents' WTP for noise reduction measures in urban bus transport.

SOCIODEMOGRAPHIC DATA OF RESPONDENTS AND NOISE PROFILE PER CITY

Understanding how demographic factors influence residents' willingness to pay for transport noise reduction initiatives, such as quieter bus transport measures, is essential. Key factors that may shape these decisions include gender, age, education level, and income level. Table 3 presents descriptive statistics of the respondents' sociodemographic characteristics.

Noise profiles of cities

Table 4 summarizes the environmental noise profiles of Ambato, Baños, Riobamba, and Latacunga, all of which exhibit moderate to high noise levels. While equivalent continuous sound levels (Leq) are relatively consistent across cities, variations in background noise levels (LN) and Leq-LN ratios indicate differences in noise sources and their impacts. The expanded uncertainty values highlight measurement variability, underscoring the importance of accounting for uncertainty when comparing noise data across cities.

Table 3. Mean, standard deviation and p-value of sociodemographic characteristics of respondents

Variable	Category	Mean/proportion	Standard Deviation	p-value
				ANOVA
Age	15-25 years	18 years	1.7	0.022**
	25-45 years	32 years	2.4	0.039**
	45-65 years	53 years	2.7	0.041**
	more than 65 years	67 years	1.9	0.029**
Gender	Male	55.9%	-	-
	Female	44.1%	-	-
Education level	Primary	12.4%	-	-
	Secondary	48.1%	-	-
	College	39.5%	-	
Income level	Less than $450/month	$410	27.8	0.037**
	$450 and $1250/month	$921	75.9	0.037**
	More than $1250/month	$1,611	98.3	0.022**

Note: Differences in (p) represents the p-value significance of four populations with unequal sample and unequal variances: *** ; ** and * for 0.01, 0.05, and 0.1 error level.

Table 4. Environmental noise profiles of Ambato, Baños, Riobamba and Latacunga

City	LN	Leq	LeqLN	$\sigma^2 current$	$\sigma^2 specific$	X	Expanded Uncertainty	Noise Uncertainty
Ambato	53.8	71.1	52.1	0.81	0.81	2.4	2.62	73.1±5.2
Baños	48.5	72.3	51.6	0.75	0.75	1.9	2.14	69.2±4.2
Riobamba	50.9	73.8	50.3	0.55	0.55	2.2	2.40	73.2±4.8
Latacunga	49.1	71.0	52.5	0.85	0.85	2.6	2.77	71.0±5.4

Note: LN = background noise level. Leq = Level of Equivalent Continuous Sound in decibel (dB). $\sigma^2 current$ = Uncertainty of the current average total sound level. $\sigma^2 specific$ = Uncertainty of the current average total sound level. X = Uncertainty due to operating conditions

RESULTS AND DISCUSSION

Awareness rate

Awareness of bus transport noise pollution among residents varied significantly across the four surveyed cities. The results indicate that 53.7% of respondents in Ambato, 42.5% in Baños, 54.4% in Latacunga, and 50.2% in Riobamba recognize bus noise as a significant environmental issue. These figures are notably lower than those reported in developed countries, where awareness rates often exceed 80%.

Table 5 summarizes the awareness criteria. While a basic understanding of transport noise pollution exists, fewer respondents are aware of its health impacts and mitigation measures. Only 30.2% to 37.1% of respondents reported awareness of health issues such as sleep disturbances, stress, and cardiovascular problems. Furthermore, only 27.8% to 50.1% of respondents were familiar with noise mitigation strategies, including sound barriers, green infrastructure, and traffic-calming measures. These findings highlight a critical gap in public knowledge that may hinder community engagement in noise pollution reduction initiatives.

Willingness To Pay for quieter bus transport

The survey revealed that a majority of residents are willing to pay (WTP) for quieter bus transport systems to mitigate noise pollution. On average, respondents were willing to pay 65.4% more for quieter transport options compared to conventional buses, aligning with findings from similar studies in Europe. However, high costs remain a limiting factor, as quieter alternatives such as trolleybuses and hybrid buses are two to three times more expensive than conventional buses.

Figure 2 presents a cost-per-kilometer comparison of conventional and quieter bus systems

Table 5. Mean and standard deviation of awareness criteria of respondents

	Percentage %			
Awareness Criteria	Ambato	Baños	Riombamba	Latacunga
Basic awareness of transport noise pollution	53.7±2.3	42.5±5.8	50.2±3.2	54.4±4.2
Awareness of potential health impacts	35.2±2.7	30.2±4.9	31.3±3.6	37.1±3.9
Awareness of potential noise mitigation measures	27.8±3.1	50.1±6.2	30.4±4.2	26.7±3.8

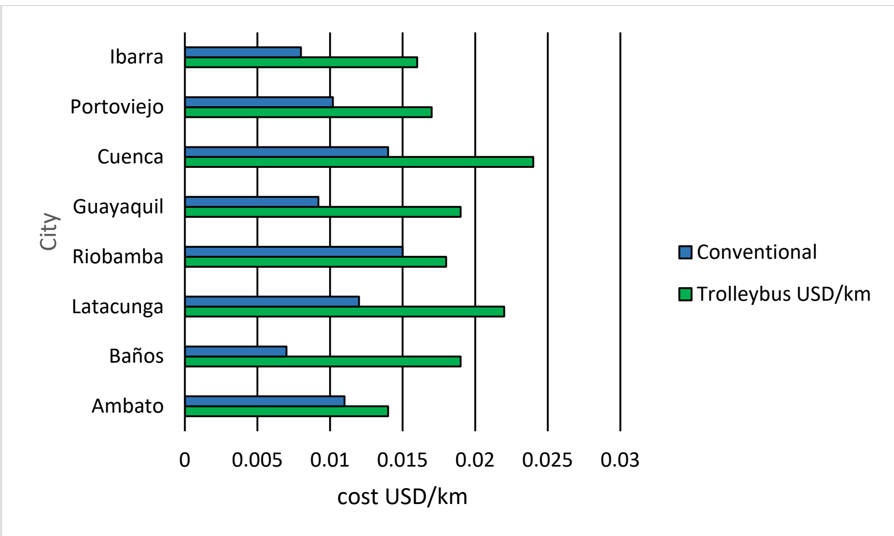


Fig. 2. Cost comparison USD/ kilometer of conventional and trolleybus in eight Ecuadorian cities

across eight Ecuadorian cities. Table 6 shows the share of residents expressing WTP for quieter transport systems in the four surveyed cities.

A significant portion of residents (24%) perceived quieter bus systems as expensive, 55% considered them somewhat expensive, and only 16% found the price fair. These insights underscore affordability as a major barrier to adoption.

Reasons for choosing or refusing less noisy bus transport

Survey respondents selected from six possible reasons for choosing or rejecting quieter bus transport. Among those in favor, 63.1% cited "improved quality of life" as the primary motivation. Other commonly mentioned reasons included "health benefits" and "enhanced sense of community" (Figure 3).

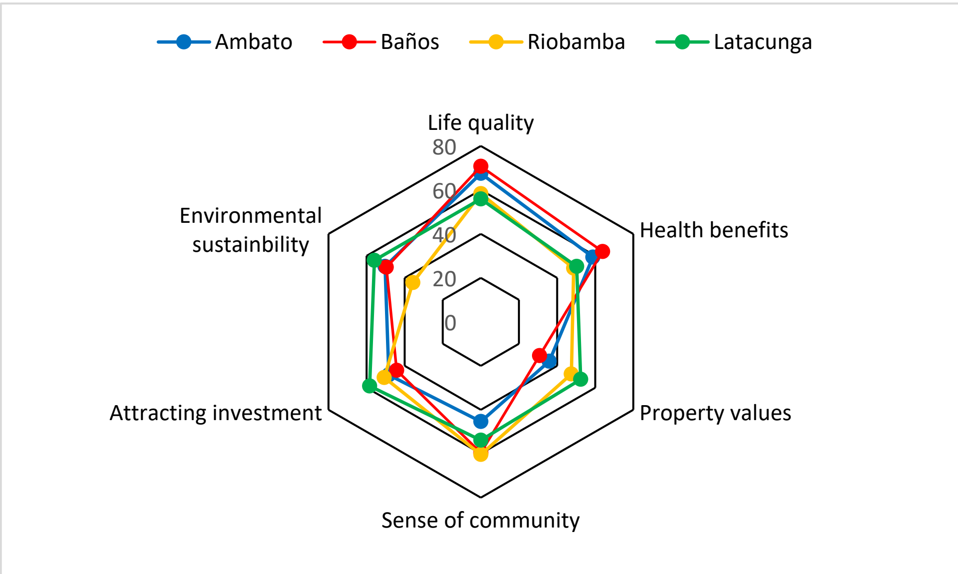
Conversely, 35.5% of respondents rejected quieter bus transport, stating that "It won't make a difference." Additional barriers included "It will inconvenience me" and "Lack of trust in authorities" (Figure 4).

Residents' willingness to pay (WTP) for quieter bus transport and key factors

Table 7 shows the logistic regression analysis and key predictors of WTP for quieter bus transport. The initial model (Model 1) included all potential predictor variables. A backward

Table 6. Share (%) of consumers per city presenting WTP quieter bus system

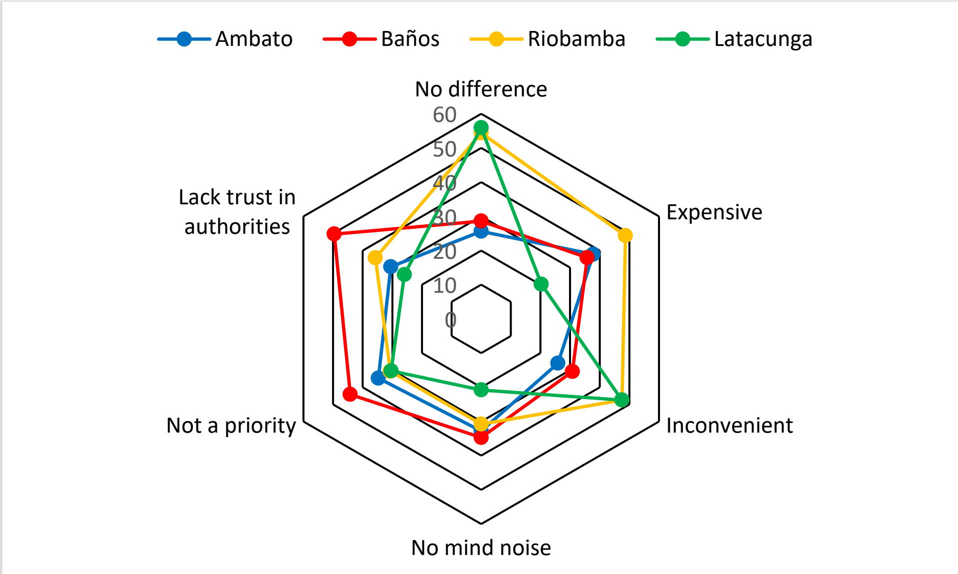
City	Trolleybus	Ecovia	Subway	Hybridbus
Ambato	45.7±3.2	63.4±2.7	59.6±3.1	39.6±5.8
Baños	30.2±4.2	52.6±1.9	40.1±2.7	44.1±3.2
Riobamba	27.8±3.1	50.1±3.2	26.7±5.8	17.5±2.7
Latacunga	13.5±2.7	36.7±5.8	30.6±4.2	19.2±3.1
Average	29.3±5.8	50.7±4.2	39.2±1.9	30.1±1.9



Note: p-value of sample mean < 0.01

Source: Authors' own representation

Fig. 3. Motives why residents choose less noisy bus transport % of respondents per city



Note: p-value of sample mean < 0.01

Source: Authors' own representation

Fig. 4. Motives why residents refuse less noisy bus transport % of respondents per city

Table 7. Relationships between socioeconomic and noise perception and likelihood of payment intentions for quieter bus transport

	Model 1				Model 2			
Variable	**Coefficient**	**Wald**	**OR**	**95% CI**	**Coefficient**	**Wald**	**OR**	**95% CI**
Age	-0.026*	6.038	1.105	(0.96, 1.04)	-0.021*	11.855	1.112	(0.89, 1.02)
Gender	-0,037	0.214	0.838		-	-	-	
Education	0.310*	0.305	0.891	(0.91, 1.11)	0.212**	5.141	0.591	(0.59, 0.68)
Income	0.027*	8.009	1.109	(0.86, 1.19)	0.018*	10.905	1.109	(0.82, 1.02)
Length residence	0.231**	1.209	1.211	(1.17, 1.42)	0.299**	4.967	0.622	(0.61, 0.67)
House tenure status	-0.603**	5.277	0.521	(0.50, 0.53)	0.592**	5.209	0.491	(0.44, 0.47)
Intensity noise exposure	0.533**	2.661	1.091	(1.07, 1.13)	0.508**	2.508	1.058	(1.03, 1.07)
Noise exposure frequency	0.722**	2.971	1.161	(1.09, 1.25)	0.653**	7.233	1.175	(1.10, 1.27)
Stress level	0.031	0.092	0.872		-	-	-	
Environmental awareness	-0.625**	5.525	0.535	(0.51, 0.55)	0.603**	5.230	0.547	(0.52, 0.57)
Environmental initiatives								
Constant	1.936**	4.230	0.928	(0.89, 0.96)	1.720**	10.024	0.584	(0.52, 0.63)
Prediction accuracy		67.4				66.2		
-2Log-likelihood		527.330				531.084		
Significance (p)		0.000				0.000		

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
Source: Authors' own representation

stepwise selection procedure then eliminated variables with the lowest Wald statistic. The final model (Model 2) demonstrated improved fit compared to the initial model. The following discussion integrates the results of Model 2 with their interpretation.

Age and WTP: Age was a significant predictor of WTP (OR = 1.11, 95% CI = [0.89, 1.02]), indicating that younger residents were generally more inclined to pay for quieter bus transport. The odds ratio of 1.11 suggests that for each one-year increase in age, the odds of being willing to pay for quieter transport decrease. This aligns with the common understanding that younger generations tend to be more open to innovative solutions and may possess a stronger environmental consciousness, as seen in studies like Collins and Potoglou (2019). However, while younger individuals express a higher likelihood of WTP, their actual purchasing behavior might be tempered by limited financial resources, a nuance that warrants further investigation and contrasts with findings from Abdul et al. (2021) who found younger consumers prioritizing spending on sustainable products.

Education and WTP: Education level also significantly influenced WTP (OR = 0.591, 95% CI = [0.59, 0.68]), with more educated residents demonstrating a higher likelihood of paying for quieter buses. The odds ratio of 0.591 suggests that for each unit increase in education level, the odds of WTP increase. This finding is consistent with Galanti et al. (2021) and underscores the importance of education in fostering awareness of the environmental and health impacts of noise pollution, leading to a greater valuation of quieter transport options.

Income and WTP: Residents' inclination to pay for less loud transportation was significantly influenced by their income level (OR = 1.109, 95% CI = [0.82, 1.02]). The odds ratio of 1.109 indicates that for each unit increase in income, the odds of WTP for quieter transport increase. This was an expected finding, given that quieter transport is likely perceived as a premium service. This reinforces the importance of considering socioeconomic factors when designing and implementing sustainable transport policies, as affordability plays a crucial role in adoption.

Length of residence and WTP: Length of residence in the neighborhood had a significant negative influence on WTP (OR = 0.622, 95% CI = [0.61, 0.67]). The odds ratio of 0.622 suggests that for each year of longer residency, the odds of WTP for quieter transport increase. This suggests that longer-term residents may be more willing to pay for quieter options, potentially due to initiatives in upgrading quality of life, factors not captured in this study. This result contrasts with Nguyen et al. (2022), who found a positive association, highlighting the need for further research to understand the complex relationship between residency duration and WTP for quieter environments in different contexts.

House tenure status and WTP: House tenure status significantly impacted WTP (OR = 0.491, 95% CI = [0.44, 0.47]). Residents who were homeowners were less likely to pay for quieter bus transport compared to those with other tenure statuses. The odds ratio of 0.491 suggests that homeowners had lower odds of WTP. This finding warrants further investigation to understand the underlying reasons. It could be related to homeowners having other financial priorities or a different perception of the benefits of quieter public transport.

Intensity of noise exposure and WTP: The intensity of noise exposure positively influenced WTP (OR = 1.058, 95% CI = [1.03, 1.07]). The odds ratio of 1.058 indicates that for each unit increase in perceived noise intensity, the odds of WTP for quieter transport increase. This is anticipated, as individuals experiencing higher levels of noise pollution are more likely to seek and value quieter alternatives, suggesting a direct link between personal noise experience and willingness to pay for its reduction.

Frequency of noise exposure and WTP: Noise exposure frequency also had a significant positive impact on WTP (OR = 1.175, 95% CI = [1.10, 1.27]). The odds ratio of 1.175 suggests that for each unit increase in the frequency of noise exposure, the odds of WTP for quieter transport nearly double (increase by approximately 92.1%). This finding further supports the idea that direct exposure to noise pollution increases the desire for and willingness to pay for quieter transport options, highlighting the importance of addressing frequent noise events.

Environmental Awareness and WTP: Environmental awareness significantly influenced WTP (OR = 0.547, 95% CI = [0.52, 0.57]). Residents with higher environmental awareness were less likely to pay for quieter bus transport. The odds ratio of 0.547 suggests that for each unit increase in environmental awareness, the odds of WTP decrease by approximately 45.3%. This counterintuitive finding requires further exploration. It might suggest that environmentally aware individuals expect quieter transport to be a standard offering or a public good, rather than something they should pay extra for. Alternatively, their environmental concerns might prioritize other aspects of sustainability over noise reduction in public transport.

Concerns about Environmental Labels: While not directly a coefficient in the regression, the residents' expressed concerns about the validity of "environmentally friendly" labels emerged as a crucial factor influencing their WTP. The skepticism towards the authenticity of these labels underscores the importance of transparent and reliable certification systems to build public trust and encourage the adoption of sustainable transport options. Without confidence in the claims, residents may be hesitant to pay a premium for perceived environmental benefits.

Cross-location comparison

Table 8 presents the results of a one-way ANOVA, revealing significant differences across the four study locations ($p < 0.001$) regarding noise-related variables and Willingness To Pay (WTP) for quieter bus transport. The Tukey multiple comparison test further identified statistically similar groups among the locations.

Ambato: High noise, high stress, high WTP

Ambato consistently exhibited the highest noise exposure intensity (4.6) and frequency (25.5), alongside elevated stress levels (4.5) and the highest WTP for quieter buses (34). These findings strongly align with Ambato's status as the largest and most urbanized location among those studied. Its dense vehicular traffic and busy public transport system are significant contributors to the heightened noise pollution experienced by residents. This result is consistent with observations in other urban centers, as noted by Morano et al. (2021), where increased urbanization often correlates with higher noise levels and, consequently, a greater demand for noise mitigation. The elevated WTP suggests that residents in highly affected areas recognize the value of, and are willing to pay for, improvements in their living environment, highlighting a direct impact of daily exposure.

Baños: High environmental awareness

In contrast to Ambato, Baños reported the highest environmental awareness (4.2). This is a logical finding given Baños's prominence as a key eco-tourism hub. Its economy and identity are intrinsically linked to its natural environment, fostering a community more attuned to ecological and environmental concerns. This high level of environmental consciousness, as also

Table 8. Results of an ANOVA and a multiple comparison test for respondents' socioeconomic and consumption characteristics

		Tukey Test Multiple Comparison			
	F-value	**Ambato**	**Baños**	**Riobamba**	**Latacunga**
Noise exposure intensity	757.46 ***	S1 = 4.6	S3 = 3.1	S2 = 3.7	S2 = 3.5
Noise exposure frequency	416.77 ***	S1 = 25.5	S3 = 14.3	S2 = 20.5	S2 = 18.2
Environmental awareness	591.83 ***	S2 = 3.5	S1 = 4.2	S1 = 4.1	S2 = 3.2
Stress Level	729.55***	S1 = 4.5	S1 = 4.2	S3 = 2.5	S3 = 2.1
WTP for quieter bus	504.12***	S1 = 34	S2 = 22	S2 = 27	S2 = 25

Note: *** denotes a coefficient significant at 0.001 level, S_i is a statistically different sector highlighted by Morano et al. (2021) in the context of eco-tourism destinations, suggests that residents and stakeholders in Baños are likely more engaged in and sensitive to environmental quality, including noise pollution. Despite having lower noise exposure intensity (3.1) and frequency (14.3) compared to Ambato, their heightened awareness may still drive an underlying appreciation for quieter environments, even if their WTP is lower (22) due to less immediate daily impact.

Riobamba and Latacunga: Moderate characteristics

Riobamba and Latacunga generally showed moderate noise exposure (intensity of 3.7 and 3.5, respectively; frequency of 20.5 and 18.2) and comparatively lower WTP for quieter buses (27 and 25, respectively). Their more balanced urban-rural characteristics, coupled with smaller populations and fewer transport routes compared to Ambato, likely contribute to these patterns. Additionally, the lower stress levels in Riobamba (2.5) and Latacunga (2.1) suggest that their less congested environments may be less mentally taxing on residents. These findings underscore that the intensity of noise exposure and the perceived stress directly correlate with the expressed willingness to pay for quieter solutions.

Implications for practice

The findings from this study offer crucial insights for urban planners and policymakers aiming to mitigate noise pollution and foster sustainable transport in diverse urban settings. Our results underscore the importance of location-specific interventions. For instance, in highly urbanized and congested areas like Ambato, where noise exposure, stress levels, and WTP are highest, prioritizing direct noise mitigation strategies is paramount. This could include promoting the adoption of quieter public transport systems, investing in sound barriers, and expanding urban green spaces to absorb noise and enhance residents' quality of life.

Conversely, in cities such as Baños, which exhibits high environmental awareness but lower noise burdens, the focus can shift towards leveraging existing ecological consciousness. This might involve integrating educational campaigns about the benefits of quiet environments with sustainable urban planning initiatives, encouraging active transport, or developing eco-friendly transit solutions that align with the community's values. For Riobamba and Latacunga, characterized by a more balanced urban-rural landscape and moderate noise levels, policies should aim for a balanced approach. This means carefully managing urban development to prevent future noise escalation while incrementally introducing measures to improve environmental quality and resident well-being. This context-specific approach ensures that resources are allocated effectively, leading to more impactful and sustainable interventions.

Research limitations and future work

This study, while offering valuable insights, has several limitations that should be considered for future research. A primary limitation is the data collection method, which involved a single respondent per household. This approach might not fully capture the diverse perspectives and preferences within a household, potentially limiting the comprehensiveness of our understanding of noise-related impacts. Future studies could benefit from incorporating multiple respondents from the same household or employing qualitative methods (e.g., focus groups, in-depth interviews) to gain a richer and more nuanced understanding of these complex dynamics.

Furthermore, to enhance the robustness of the findings, future research could explore advanced econometric models capable of accounting for heterogeneity in preferences. This would allow for a more detailed analysis of how different segments of the population respond to noise pollution and WTP for mitigation efforts. Finally, expanding the study to include panel data collected across different time frames would significantly strengthen insights into the long-term dynamics of noise exposure, adaptation, and its evolving effects on residents' well-being and willingness to pay for quieter urban environments. Such longitudinal studies would provide a more complete picture of how urban noise affects quality of life over time and how interventions might yield long-term benefits.

CONCLUSION

This study provides a comprehensive analysis of noise-related challenges in four urban centers in Ecuador: Ambato, Baños, Riobamba, and Latacunga. The results highlight significant differences across locations in terms of noise exposure, stress levels, environmental awareness, and willingness to pay (WTP) for quieter public transport systems. Ambato emerged as the city with the highest levels of noise exposure, stress, and WTP, reflecting its urban intensity and larger public transportation demand. In contrast, Baños showed greater environmental awareness, likely influenced by its eco-tourism focus, while Riobamba and Latacunga demonstrated moderate noise exposure and relatively low stress levels, attributable to their less congested urban environments.

The findings emphasize the need for tailored policy recommendations to mitigate noise pollution and its associated socioeconomic impacts, offering crucial insights for urban planners and policymakers. For highly urbanized and congested areas like Ambato, where noise exposure, stress levels, and WTP are highest, policies should prioritize direct noise mitigation strategies. This includes promoting the adoption of quieter public transport systems, investing in sound barriers, and expanding urban green spaces to absorb noise and enhance residents' quality of life. Conversely, in cities such as Baños, which exhibits high environmental awareness but lower noise burdens, policy focus can shift towards leveraging existing ecological consciousness by integrating educational campaigns about the benefits of quiet environments with sustainable urban planning initiatives, encouraging active transport, or developing eco-friendly transit solutions that align with community values. For Riobamba and Latacunga, characterized by a more balanced urban-rural landscape and moderate noise levels, policies should aim for a balanced approach that carefully manages urban development to prevent future noise escalation while incrementally introducing measures to improve environmental quality and resident well-being. By adopting these context-specific approaches, policymakers can ensure that resources are allocated effectively, leading to more impactful and sustainable interventions.

By addressing the specific needs of each city, policymakers can enhance residents' quality of life, reduce health risks associated with noise pollution, and foster sustainable urban environments. Future studies should explore longitudinal impacts of noise pollution and incorporate diverse stakeholder perspectives to ensure more inclusive and effective policymaking. Expanding the scope to include other regions and sectors can also provide deeper insights into the complex interplay between urban noise, human well-being, and environmental sustainability.

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CONFLICT OF INTEREST

The authors declare that there is not any conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/ or falsification, double publication and/or submission, and redundancy has been completely observed by the authors.

LIFE SCIENCE REPORTING

No life science threat was practiced in this research.

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