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Knowledge about Air Pollution, Myths, and Fatalistic Beliefs: Evidence from Vulnerable Communities in Southern Chile

Jesús HERRERA-BRAVO[1], Carlos VALDEBENITO[2], Iván NEIRA[3], Luis Mario CASTELLANOS-ALVARENGA[4*]

Abstract

Air pollution is one of the most critical environmental problems, with severe impacts on human health and quality of life worldwide. This study aimed to explore the relationship between knowledge about air pollution, myths, and fatalistic beliefs in adults from Temuco and Padre Las Casas of the Araucanía Region, Chile. The research employed a quantitative, cross-sectional design with a correlational-explanatory scope. The sample consisted in 255 participants (58.4% women, 41.6% men) with a M_{age} of 45.20 years (SD = 1.88). Regression analysis revealed that a lower level of education was significantly associated with a higher prevalence of fatalistic beliefs about air pollution (β = -.223, p = .003), while myths about air pollution were positively related to these beliefs (β = .123, p = .043). However, knowledge of the Atmospheric Decontamination Plan (PDA), gender, and age were not significant predictors. This finding highlights the importance of implementing evidence-based educational interventions to address misconceptions and foster individual and collective responsibility for reducing air pollution.

Keywords: air pollution; fatalistic beliefs; environmental education; myths and misinformation; public perception.

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Introduction

Air pollution caused by fine particulate matter (PM2.5) is one of the leading environmental threats to human health and a significant contributor to global morbidity and mortality (World Health Organization [WHO], 2021). This issue is closely linked to an increase in non-communicable cardiovascular and respiratory diseases, which rank among the leading causes of death worldwide (IQAir, 2023). When inhaled, PM2.5 can penetrate deep into the lungs and bloodstream, increasing the risk of both respiratory and cardiovascular conditions (Münzel *et al*., 2021). Mortality risks associated with PM2.5 exposure are estimated to be two to five times higher than those related to other pollutants such as NO_2, CO, and O_3 (Zhao *et al*., 2017). Short-term exposure to PM2.5 increases the risk of heart attacks, arrhythmias, heart failure, and cardiac death, while long-term exposure exacerbates these acute risks and contributes to the development of chronic cardiometabolic conditions such as diabetes and hypertension (Brook *et al*., 2017), and atherosclerosis (Bai & Sun, 2016).

Beyond physical health impacts, PM2.5 also has significant implications for mental health. Accordingly, it has been associated with an increased risk of hospitalization for mental disorders, particularly those related to schizophrenia (Wu *et al*., 2024). Thus, Chilean authorities have implemented measures to monitor and manage PM2.5 pollution. The Ministry of the Environment, through the National Air Quality Information System (SINCA), gathers data to manage critical air pollution episodes, which are declared using a daily statistical forecasting model. For PM2.5, the categories of Alert, Pre-emergency, and Emergency are activated when daily concentrations reach 80–109, 110–169, and 170 μg/m³ or higher, respectively (DS N°12, 2014).

Additionally, the primary air quality standard for fine particulate matter sets the annual limit at 20 micrograms per cubic meter (20 μg/m³) and the 24-hour limit at 50 micrograms per cubic meter (50 μg/m³). To address emergency episodes, authorities have implemented Air Pollution Management Plans (Planes de Descontaminación Atmosférica, PDA), which include measures such as setting moisture requirements for firewood, replacing old wood-burning stoves, temporarily banning the use of firewood, and improving the thermal insulation of homes (Reyes *et al*., 2019). Unfortunately, stove replacement programs and thermal insulation efforts have not been uniformly implemented across southern Chile and have shown inconsistent distribution over time (Jorquera, 2021). Although insulation standards were updated in 2019, many homes were built before 2000 and are not subject to the regulation, this maintains high firewood consumption and limits the effectiveness of the thermal retrofit program (Reyes *et al*., 2019).

Temuco and Padre Las Casas were officially declared saturated zones due to daily PM2.5 concentrations (DS No. 2/2013, Ministry of the Environment). In Temuco, 85% of air pollution originates from firewood combustion (Villalobos *et al*., 2017),

and PM2.5 levels consistently exceed both the World Health Organization (WHO) guidelines and Chilean national air quality standards. In this complex context, compliance with stove replacement and thermal insulation programs has reached only 15% and 10%, respectively (Jorquera, 2021) Although the stove replacement program has not proven effective in reducing air pollution, it has contributed to improved quality of life by increasing thermal comfort in Temuco (Mardones, 2021). In 2023, Temuco reported an annual average PM2.5 concentration of 16.8 μg/m³, ranking 30th among the most polluted cities in Chile. In contrast, Padre Las Casas reached 29.4 μg/m³, ranking 3rd nationally. On a Latin American scale, these cities ranked 43rd and 4th, respectively, in the same year (IQAir, 2023).

In addition to environmental challenges, social and psychological factors further complicate the situation. Fatalistic beliefs and myths can significantly hinder the implementation and effectiveness of public policies aimed at improving quality of life and promoting social development. Fatalism is defined as the belief that events are predetermined and inevitable for human being (Slothuus, 2024). Studies have shown that fatalistic attitudes inhibit proactive behavior and are associated with lower democratic engagement, thus weakening the social mobilization needed to support effective public policies (Ríos *et al*., 2014). Research has also shown that public perceptions of air pollution are shaped by personal, attitudinal, and contextual factors. Variables such as age, educational attainment, and health status, alongside individual beliefs about the causes and consequences of pollution, can significantly influence how the problem is perceived (Liu *et al*., 2023; Quintyne & Kelly, 2023). These perceptions are often subject to cognitive biases such as the halo effect, which leads individuals to underestimate pollution levels in their own homes and neighborhoods compared to the broader city context (Boso *et al*., 2018; Hofflinger *et al*., 2019).

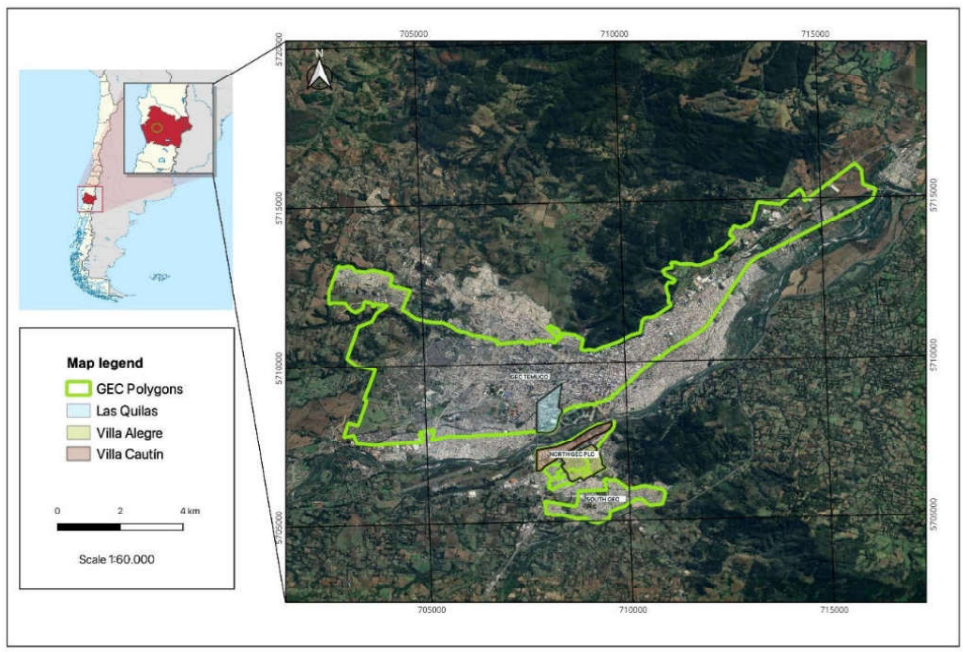
The present study aims to analyze the relationship between myths, fatalistic beliefs, and knowledge of the Atmospheric Decontamination Plan (PDA) related to air pollution among adults residing in the municipalities of Temuco and Padre Las Casas. Based on the background described, it was expected that individuals with lower levels of education would exhibit higher levels of fatalistic beliefs about air pollution (H1). Likewise, a greater endorsement of myths related to air pollution would be positively associated with fatalistic beliefs (H2). Additionally, higher levels of knowledge about the Atmospheric Decontamination Plan (PDA) were expected to be inversely associated with fatalistic beliefs, indicating that increased awareness may serve as a protective factor against such beliefs (H3).

Methodology

Participants and Study Areas

The research employed a quantitative, cross-sectional design with a correlational-explanatory scope (Hernández, 2014). The sample size was calculated a priori to ensure reliable estimates, resulting in a final sample of 255 participants (58.4% women, 41.6% men) with a M_{age} of 45.20 years (SD = 1.88). Inclusion criteria required participants to reside in areas historically exposed to elevated levels of air pollution, specifically proximity to the Cautín River, and belong to populations identified as being at socioeconomic and health-related risk, being 18 years or older, and possessing the cognitive capacity to provide informed consent. Sample characteristics are presented in Table 1.

This study was conducted in three restriction zones defined by the Regional Office of the Ministry of the Environment (SEREMI-MA) in the La Araucanía Region, specifically in the cities of Temuco and Padre Las Casas, due to their high levels of air pollution. The selected zones included the Las Quilas sector in Temuco and the Barrio Cautín and Villa Alegre sectors in Padre Las Casas (Figure 1).



Note: The macrozones defined by the Regional Ministry of the Environment (SEREMI) are highlighted in green, while the specific study zones - Las Quilas (Temuco), Villa Alegre, and Barrio Cautín (Padre Las Casas) -are outlined in black. Scale 1:100,000, Datum WGS 84, UTM Zone 18S.

Figure 1. Study areas in Temuco and Padre Las Casas, La Araucanía Region, Chile

Table 1. Characteristics of the sample

Variable	Frequency	Percentage
Gender		
Female	149	58.4%
Male	106	41.6%
Municipality		
Temuco	124	48.6%
Padre Las Casas	131	51.4%
Monthly Income		
Less than $330 USD	137	53.7%
$331–$500 USD	45	17.7%
$501–$670 USD	37	14.5%
$671–$830 USD	11	4.3%
More than $830 USD	25	9.8%
Educational level		
Secondary education	90	35.3%
University education	61	23.9%
Primary education	50	19.6%
Technical or vocational training	47	18.4%
No formal education	4	1.6%
Postgraduate education	3	1.2%
Employment Status		
Homemaker	72	28.2%
Self-employed	43	16.9%
Salaried employee	65	25.5%
Retired	18	7.1%
Student	36	14.1
Unemployed	21	8.2%

Note: Percentages may not total 100% due to rounding. Monthly income categories are expressed in U.S. dollars. Educational level and employment status were self-reported.

Variables and Instruments

To develop the first version of the questionnaire, four focus groups were conducted in Las Quilas (Temuco) and Barrio Cautín (Padre Las Casas). These focus groups targeted established community members with the aim of creating spaces for open discussion to capture participants' experiences, perceptions, and interpretations of their daily lives. This approach encouraged self-explanation and was intended to generate both qualitative and quantitative data. As a criterion for scientific rigor, the interview guide was submitted for expert review by professionals from Universidad Santo Tomás, the Regional Ministry of Health and the Regional Ministry of the Environment.

Following the focus groups, the data were analyzed, and a questionnaire was developed. This instrument underwent content validation through the participation of 10 expert judges from academia and relevant public agencies. Each expert independently evaluated the coherence, sufficiency, and clarity of each item. The level of agreement among the judges' ratings was estimated using Aiken's V coefficient (Aiken, 1985), which quantifies the relevance of items within a specific content domain based on ratings from a panel of *N* experts. Items with a reliability index below 0.6 were removed.

Scale of Knowledge, Myths, Beliefs, and Perceived Risk Regarding the Health Effects of Air Pollution

Initially, the scale consisted of 24 items developed from a prior qualitative study conducted with participants who shared similar characteristics to those in the present research. Following an Exploratory Factor Analysis (EFA), only items with factor loadings above 0.30 were retained to ensure an adequate item-construct relationship (Lloret-Segura *et al*., 2014).

After this process, the scale was structured into three dimensions, each comprising four items, all formatted using a four-point Likert scale (ranging from "Strongly agree" to "Strongly disagree"). The *Fatalistic Beliefs* dimension obtained a McDonald's Omega reliability coefficient of $\omega = 0.583$. An example item from this dimension is: *"Air pollution will remain the same, no matter what is done."* Although this reliability index falls below the generally accepted threshold of 0.70, it is worth noting that all item factor loadings exceeded 0.30, which suggests that the lower internal consistency may be attributable to the wide age range of respondents (18 to over 73 years old). The *Myths about Air Pollution* dimension showed a McDonald's Omega of $\omega = 0.592$. An example item is: *"Air pollution does not affect people who are physically healthy."* The *Knowledge of the Atmospheric Decontamination Plan* dimension achieved a McDonald's Omega of $\omega = 0.741$. An example item is: *"I am aware of the subsidies provided by the atmospheric decontamination plan."*

Data Collection Procedure

All procedures were approved by the Research and Ethics Committee of the sponsoring health institution which adheres to the principles of the Declaration of Helsinki.

Data collection was carried out through door-to-door visits, during which participants completed the instruments. The estimated response time was approximately 15 minutes. All participants signed an informed consent form. Participation was voluntary, and no financial compensation was offered.

Data Analysis Plan

Data analysis was performed using SPSS software, version 29. Initially, descriptive analyses of the variables were conducted to compute means and explore their main characteristics. In addition, Pearson's bivariate correlation analysis was carried out to identify preliminary relationships between variables. As part of the preliminary analyses, multivariate outliers were detected and removed using Mahalanobis distance (Leal *et al*., 2014). To test the research hypotheses, multiple linear regression analysis was employed. This method is particularly suitable for explaining the variance of a dependent variable based on a set of theoretically relevant predictors, and it provides standardized coefficients that allow comparison of the strength of the relationships between variables (Cohen & Cohen, 2003).

Multicollinearity was controlled by examining the variance inflation factor (VIF) and tolerance values, ensuring that interrelations among predictors did not adversely affect the model estimates (Hair *et al*., 2022). Furthermore, the fundamental assumptions of linearity, homoscedasticity, and normality of residuals were tested, according to recommendations to ensure the inferential validity and stability of the proposed model (Barker & Shaw, 2015).

Results

A thematic summary of responses (Padre Las Casas: n = 131; Temuco: n = 124) highlights the following key findings.

Table 2. Scale of Myths, Fatalistic Beliefs, and Knowledge about Air Pollution

Municipality	Padre Las Casas		Temuco	
	Frequency	Percentage	Frequency	Percentage
	(n)	(%)	(n)	(%)
1. I am familiar with the Atmospheric Decontamination Plan (PDA).				
Strongly disagree	67	51	53	43
Disagree	13	10	11	9
Neither agree nor disagree	20	15	12	10
Agree	12	9	8	6
Strongly agree	19	15	40	32
Total	131	100	124	100
2. Air pollution will remain the same, no matter what is done.				
Strongly disagree	25	19	49	40
Disagree	23	18	2	2
Neither agree nor disagree	28	21	20	16
Agree	18	14	13	10
Strongly agree	37	28	40	32
Total	131	100	124	100
3. Compared to firewood, heating methods that use gas, pellets, kerosene, or electricity may be less effective.				
Strongly disagree	16	12	23	19
Disagree	11	8	3	2
Neither agree nor disagree	33	25	21	17
Agree	23	18	8	6
Strongly agree	48	37	69	56
Total	131	100	124	100
4. People will not change their use of firewood for heating because they have always used it.				
Strongly disagree	16	12	25	20
Disagree	11	8	8	6
Neither agree nor disagree	39	30	12	10
Agree	12	9	5	4

Strongly agree	53	40	74	60
Total	131	100	124	100
5. Air pollution can cause serious harm to health.				
Strongly disagree	0	0	0	0
Disagree	0	0	0	0
Neither agree nor disagree	10	8	3	2
Agree	14	11	3	2
Strongly agree	107	82	118	95
Total	131	100	124	100
6. Compared to firewood, heating with gas, pellets, kerosene, and/or electricity can be more expensive.				
Strongly disagree	10	8	5	4
Disagree	12	9	3	2
Neither agree nor disagree	31	24	19	15
Agree	11	8	8	6
Strongly agree	67	51	89	72
Total	131	100	124	100
7. Other forms of pollution may be more detrimental than air pollution.				
Strongly disagree	16	12	16	13
Disagree	18	14	1	1
Neither agree nor disagree	31	24	17	14
Agree	16	12	10	8
Strongly agree	50	38	80	65
Total	131	100	124	100
8. The process of applying for the household heater replacement subsidy entails significant financial burden				
Strongly disagree	42	32	40	32
Disagree	14	11	5	4
Neither agree nor disagree	26	20	43	35
Agree	12	9	6	5
Strongly agree	37	28	30	24
Total	131	100	124	100

9. The use of pellets, kerosene, or electricity for residential heating is generally associated with higher costs compared to firewood-based heating.				
Strongly disagree	11	8	13	10
Disagree	7	5	6	5
Neither agree nor disagree	27	21	16	13
Agree	19	15	9	7
Strongly agree	67	51	80	65
Total	131	100	124	100
10. The enforcement strategy implemented during critical air pollution episodes has been effective in reducing air pollution levels.				
Strongly disagree	50	38	54	44
Disagree	5	4	10	8
Neither agree nor disagree	27	21	24	19
Agree	12	9	12	10
Strongly agree	37	28	24	19
Total	131	100	124	100
11. I am concerned about the air quality in my municipality.				
Strongly disagree	0	0	0	0
Disagree	0	0	0	0
Neither agree nor disagree	6	5	4	3
Agree	12	9	6	5
Strongly agree	113	86	114	92
Total	131	100	124	100
12. The measures adopted within the framework of the Atmospheric Decontamination Plan have been appropriate and effective in contributing to the reduction of air pollution.				
Strongly disagree	32	24	52	42
Disagree	21	16	9	7
Neither agree nor disagree	41	31	27	22
Agree	15	11	12	10
Strongly agree	22	17	24	19
Total	131	100	124	100

13. Air pollution affects only individuals with chronic illnesses and older adults.				
Strongly disagree	78	60	109	88
Disagree	10	8	3	2
Neither agree nor disagree	16	12	2	2
Agree	10	8	2	2
Strongly agree	17	13	8	6
Total	131	100	124	100
14. Heating with firewood provides more warmth than other heating sources.				
Strongly disagree	15	11	15	12
Disagree	15	11	3	2
Neither agree nor disagree	21	16	9	7
Agree	16	12	10	8
Strongly agree	64	49	87	70
Total	131	100	124	100
15. There is widespread misinformation regarding air pollution and the measures included in the Atmospheric Decontamination Plan.				
Strongly disagree	10	8	14	11
Disagree	6	5	7	6
Neither agree nor disagree	20	15	18	15
Agree	12	9	10	8
Strongly agree	83	63	75	60
Total	131	100	124	100
16. Air pollution does not affect individuals who are physically healthy.				
Strongly disagree	78	60	77	62
Disagree	8	6	3	2
Neither agree nor disagree	22	17	2	2
Agree	5	4	2	2
Strongly agree	18	14	40	32
Total	131	100	124	100
17. Air pollution causes only respiratory problems.				
Strongly disagree	37	28	73	59
Disagree	9	7	15	12

Neither agree nor disagree	40	31	13	10
Agree	18	14	5	4
Strongly agree	27	21	18	15
Total	131	100	124	100
18. Educational initiatives play a crucial role in mitigating air pollution.				
Strongly disagree	0	0	0	0
Disagree	3	2	1	1
Neither agree nor disagree	13	10	5	4
Agree	24	18	9	7
Strongly agree	91	69	109	88
Total	131	100	124	100
19. Younger individuals are more aware of air pollution issues.				
Strongly disagree	27	21	53	43
Disagree	17	13	3	2
Neither agree nor disagree	33	25	25	20
Agree	13	10	8	6
Strongly agree	41	31	35	28
Total	131	100	124	100
20. It is very difficult to qualify for subsidies aimed at improving household thermal insulation.				
Strongly disagree	17	13	17	14
Disagree	14	11	9	7
Neither agree nor disagree	41	31	40	32
Agree	16	12	5	4
Strongly agree	43	33	53	43
Total	131	100	124	100
21. Using dry firewood is the best option for heating while protecting air quality.				
Strongly disagree	16	12	16	13
Disagree	10	8	6	5
Neither agree nor disagree	26	20	9	7
Agree	19	15	7	6

Strongly agree	60	46	86	69
Total	131	100	124	100
22. Air pollution occurs only at night.				
Strongly disagree	58	44	87	70
Disagree	10	8	15	12
Neither agree nor disagree	24	18	4	3
Agree	12	9	3	2
Strongly agree	27	21	15	12
Total	131	100	124	100
23. I am knowledgeable about the subsidies included in the Atmospheric Decontamination Plan.				
Strongly disagree	44	34	65	52
Disagree	11	8	2	2
Neither agree nor disagree	22	17	18	15
Agree	18	14	10	8
Strongly agree	36	27	29	23
Total	131	100	124	100
24. I possess knowledge about the restrictions established under the Atmospheric Decontamination Plan that are subject to enforcement at the household level				
Strongly disagree	32	24	53	43
Disagree	14	11	6	5
Neither agree nor disagree	27	21	12	10
Agree	13	10	9	7
Strongly agree	45	34	44	35
Total	131	100	124	100

Familiarity with the PDA

Familiarity is generally low. In Padre Las Casas, 61% of respondents disagreed or strongly disagreed with being familiar with the PDA, compared to 52% in Temuco.

Fatalistic Beliefs

Agreement with fatalistic statements was high. For example, 68% of respondents in Temuco and 42% in Padre Las Casas agreed or strongly agreed that "air pollution will remain the same, no matter what is done.

Myths

Myths such as "firewood heats better" were widely endorsed. In Temuco, 70% strongly agreed with this statement versus 49% in Padre Las Casas. Additionally, 65% in Temuco and 38% in Padre Las Casas strongly agreed that "other types of pollution are more harmful than air pollution."

Perceptions of Heating Costs

A large majority consider alternative heating more expensive. In Temuco, 72% strongly agreed with this, while in Padre Las Casas, the figure was 51%.

Perceived Health Risks

Strong consensus exists on health impacts. In Temuco, 95% and in Padre Las Casas 82% strongly agreed that air pollution can seriously harm health.

Perceived Effectiveness of Public Measures

Public policy measures are viewed skeptically. In Temuco, 44% strongly disagreed that enforcement during pollution episodes has been effective, compared to 38% in Padre Las Casas. Additionally, 42% of respondents in Temuco and 24% in Padre Las Casas strongly disagreed that the PDA measures are appropriate and effective.

Environmental Concern and Education

Environmental concern is very high. 92% of Temuco respondents and 86% of those in Padre Las Casas strongly agreed that they are concerned about air quality in their municipality. Similarly, 88% in Temuco and 69% in Padre Las Casas strongly agreed that education plays a crucial role in pollution mitigation.

Relationships between variables of interest

Table 3 presents the correlations between the study variables, providing a preliminary view of the associations between knowledge of the Atmospheric Decontamination Plan (PDA).

Table 3. Correlation of the study variables

Variable	Knowledge of the Atmospheric Decontamination Plan	Myths about Air Pollution	Fatalistic Beliefs
Knowledge of the Atmospheric Decontamination Plan	-	-.137*	-.110
Myths about Air Pollution		-	.152*
Fatalistic Beliefs			-
Mean	2.7529	2.1471	3.5098
Standard Deviation (SD)	(1.3614)	(0.9863)	(0.8754)

*Note: * $p < .05$.*

Knowledge of the Atmospheric Decontamination Plan (PDA) was significantly and negatively correlated with myths about air pollution ($r = -.137$, $p < .05$) but not significantly related to fatalistic beliefs ($r = -.110$, $p > .05$). A significant positive correlation was found between myths and fatalistic beliefs ($r = .152$, $p < .05$). Descriptive statistics showed moderate knowledge of the PDA ($M = 2.75$, $SD = 1.36$), high levels of fatalistic beliefs ($M = 3.51$, $SD = 0.88$), and lower endorsement of myths ($M = 2.15$, $SD = 0.99$).

Results of the Linear Regression Model

The overall model yielded a coefficient of determination ($R^2 = 0.138$), indicating that the set of predictor variables explains 13.8% of the variance in fatalistic beliefs. This result was statistically significant according to the model fit test ($F(6, 247) = 6.564$, $p < .001$), suggesting that the model is appropriate for predicting the dependent variable.

The multiple linear regression analysis assessed the relationship between knowledge of the Atmospheric Decontamination Plan (PDA), myths about air pollution, and various sociodemographic variables with fatalistic beliefs. The results showed that knowledge of the PDA was not significantly associated with fatalistic beliefs ($\beta = -0.034$, $p = .589$), suggesting that greater awareness of the plan does not necessarily reduce these beliefs. However, myths about air pollution showed a direct and significant relationship with fatalistic beliefs ($\beta = 0.123$, $p = .043$), indicating that stronger adherence to such myths increases the likelihood of adopting fatalistic attitudes toward air pollution. Regarding sociodemographic variables, gender did not show a significant effect on fatalistic beliefs ($\beta = -.056$, $p = .369$), while education level emerged as a significant protective factor ($\beta = -.223$, $p = .003$). This suggests that higher educational attainment is associated with a lower tendency to endorse fatalistic narratives related to air pollution.

Income showed an inverse trend (β = -0.121, p = .052), although it did not reach strict statistical significance. This indicates that individuals with higher income may be less inclined to hold such beliefs, though further investigation is warranted. Age was not significantly associated with fatalistic beliefs (β = 0.070, p = .326). Collinearity diagnostics were conducted to ensure the independence of predictors. Variance inflation factor (VIF) values ranged from 1.054 to 1.537, well within the acceptable range (below 10). Tolerance values, which ranged from 0.650 to 0.949, also indicated adequate independence among variables. Additional diagnostics showed that the highest condition index was 18.528, suggesting no severe multicollinearity issues.

Table 4. Regression Coefficients

Variable	B	SE	Beta	t	p (Sig.)	Tolerance	VIF
(Constant)	4.166	0.341	–	12.214	< .001	–	–
Knowledge of the PDA	-0.022	0.04	-0.034	-0.541	0.589	0.883	1.132
Myths about Air Pollution	0.109	0.054	0.123	2.031	0.043	0.949	1.054
Gender	-0.099	0.109	-0.056	-0.9	0.369	0.916	1.091
Education Level	-0.172	0.056	-0.223	-3.041	0.003	0.65	1.537
Income	-0.213	0.109	-0.121	-1.949	0.052	0.901	1.11
Age	0.033	0.033	0.07	0.983	0.326	0.696	1.437

Note. *B = unstandardized coefficient; SE = standard error; Beta = standardized coefficient.*

Discussion

This study aimed to explore the relationship between knowledge about air pollution, myths, and fatalistic beliefs in adults from Temuco and Padre Las Casas of the Araucanía Region, Chile. The findings support Hypothesis 1 (H1), which posited that lower levels of education would be associated with higher levels of fatalistic beliefs about air pollution. Regression analysis confirmed a significant negative association between educational attainment and fatalistic beliefs. This aligns with previous international evidence indicating that education fosters greater environmental awareness and self-efficacy, contributing to more proactive behaviors (Qian *et al*., 2016; Wang *et al*., 2015). In the local context, educational level emerges as a key variable for the design of interventions aimed at reducing passivity and enhancing individual and collective participation in the face of environmental threats. These results highlight the importance of implementing

more effective educational campaigns tailored to the characteristics of each community to improve both public perception and compliance with environmental policies. It is also essential to facilitate understanding of the rights and obligations established in the PDA, a valid but complex document for the general public, which may explain the survey results related to PDA awareness. Supporting the centrality of educational variables in shaping environmental attitudes, Alp *et al*. (2006) conducted a structured analysis of students in Turkey across 6th, 8th, and 10th grades. Their findings revealed that educational progression was positively associated with both environmental knowledge and pro-environmental attitudes, while female students consistently exhibited more favorable dispositions toward environmental responsibility. Complementing this evidence, Shabani-Isenaj *et al*. (2024) demonstrated in a study from Pristina, Kosovo, that higher levels of parental education significantly predicted adolescents' environmental concern and engagement, underscoring the intergenerational transmission of environmental values through educational attainment.

In another hand, Hypothesis 2 (H2) was also supported, endorsement of myths about air pollution was positively associated with fatalistic beliefs. This suggests that misinformation plays a critical role in reinforcing feelings of helplessness and inevitability, undermining trust in public policy. Given this, merely increasing factual knowledge may be insufficient if not accompanied by interventions that address underlying attitudes and misperceptions. The findings highlight the importance of incorporating cognitive and affective components into educational strategies, moving beyond information delivery to directly challenge unverified beliefs.

In contrast, Hypothesis 3 (H3), which proposed that greater knowledge about the Atmospheric Decontamination Plan (PDA) would be associated with lower fatalistic beliefs, was not supported. Knowledge of the PDA did not significantly predict fatalistic beliefs. This finding may reflect the superficial or fragmented nature of that knowledge, suggesting that awareness of the plan's existence does not necessarily imply a meaningful understanding of its objectives or impact. It also suggests that cognitive variables such as trust in institutions and perceived efficacy may moderate the relationship between knowledge and beliefs, an area worthy of further investigation.

Additionally, the high levels of public concern about air quality observed in both municipalities suggest a latent potential for community mobilization. This concern, however, must be channeled through structured efforts in environmental literacy to convert awareness into engagement. The observed pattern indicates that while concern exists, it coexists with fatalistic and myth-based thinking, which can paralyze action unless explicitly addressed through multidimensional strategies.

This situation reflects the ongoing challenges in controlling air pollution in the region, despite significant efforts made by health authorities to reduce fine particulate matter (PM2.5) levels.

Although quantitative analyses indicate significant reductions in PM10 (79.2%) and PM2.5 (73.9%) concentrations in areas where decontamination plans (PDAs) have been implemented, these results are not always directly attributable to the plans. There are also major ongoing challenges in thermal comfort and indoor air quality, with indoor PM2.5 concentrations often exceeding outdoor levels. This is particularly the case in homes with thermal insulation, which, while improving airtightness, thermal efficiency, and humidity may facilitate the accumulation of particulates indoors (Martinez-Soto *et al*., 2021). In contrast, homes without insulation experience indoor temperatures below comfort levels, elevated carbon dioxide (CO_2) due to poor ventilation, and PM2.5 concentrations that greatly exceed WHO recommendations. This highlights the need for comprehensive measures to improve both thermal efficiency and indoor air quality (Martinez-Soto *et al*., 2021).

Future Directions

Based on the findings of this study three key projections are proposed to strengthen future research and support decision-making in the public sector. First, there is a need to expand the sample size, which would increase the representativeness and robustness of the results and allow for a more accurate reflection of perceptions and knowledge across different population segments. Second, the georeferencing of survey responses is proposed, enabling analysis based on the geographical location of participants. This approach would provide valuable information for regulatory authorities to efficiently prioritize the allocation of limited human resources, in alignment with the objectives of the Atmospheric Decontamination Plan (PDA).

Finally, it is considered relevant to improve the survey by including new items that could increase the explained variance, currently at 13.8%. This adjustment would enhance the ability to capture and predict the factors associated with myths, fatalistic beliefs, and knowledge about air pollution, thereby supporting the design of more effective educational strategies and public policies.

Limitations of the Study

This study presents limitations that should be considered when interpreting the results. First, the small sample size may limit the generalizability of the findings to the broader population of Temuco and Padre Las Casas. Additionally, the cross-sectional design used makes it difficult to establish causal relationships between the variables analyzed, restricting the conclusions to correlational associations. Another important limitation is that the study was conducted in a small portion of the territory of Temuco and Padre Las Casas, which may not reflect the perceptions of the entire region.

Conclusion

Despite the progress achieved through the implementation of Atmospheric Decontamination Plans (PDAs), significant challenges remain both in reducing fine particulate matter (PM2.5) levels and in improving public perception of their effectiveness. Fatalistic beliefs represent a major obstacle to the acceptance of environmental measures. These beliefs are more strongly associated with myths and misinformation than with knowledge levels, highlighting the need for educational programs that not only inform but also shift attitudes and correct misconceptions. In this context, educational attainment stands out as a key determinant: higher levels of education are consistently associated with lower prevalence of fatalistic beliefs and greater knowledge about air pollution, underscoring its potential as a critical level for fostering informed, responsible, and proactive environmental behavior. Finally, the data show that despite the presence of fatalistic beliefs, there is a high level of concern about air quality in both municipalities. This concern presents an opportunity to transform awareness into concrete action. Addressing sociodemographic and contextual differences will be essential for designing tailored interventions that strengthen public trust in environmental policies and maximize the impact of implemented strategies.

References

Aiken, L. R. (1985). Three coefficients for analyzing the reliability and validity of ratings. *Educational and Psychological Measurement*, *45*(1), 131-142, https://doi.org/10.1177/0013164485451012

Alp, E., Ertepinar, H., Tekkaya, C., & Yilmaz, A. (2006). A Statistical Analysis of Children's Environmental Knowledge and Attitudes in Turkey. *International Research in Geographical and Environmental Education*, *15*(3), 210–223, https://doi.org/10.2167/irgee193.0

Bai, Y., & Sun, Q. (2016). Fine particulate matter air pollution and atherosclerosis: Mechanistic insights. *Biochimica et Biophysica Acta - General Subjects*, *1860*(12), 2863-2868, https://doi.org/10.1016/j.bbagen.2016.04.030

Barker, L. E., & Shaw, K. M. (2015). Best (but oft-forgotten) practices: checking assumptions concerning regression residuals. *The American journal of clinical nutrition*, *102*(3), 533-539, https://doi.org/10.3945/ajcn.115.113498

Boso, À., Hofflinger, A. Q., Oltra, C., Alvarez, B., & Garrido, J. (2018). Public support for wood smoke mitigation policies in south-central Chile. *Air Quality, Atmosphere and Health*, *11*(9), https://doi.org/10.1007/s11869-018-0612-2

Brook, R. D., Newby, D. E., Rajagopalan, S., BL, B., & A, P. (2017). The Global Threat of Outdoor Ambient Air Pollution to Cardiovascular Health. *JAMA Cardiology*, *2*(4), 353, https://doi.org/10.1001/jamacardio.2017.0032

Cohen, J., & Cohen, P. (2003). Applied multiple regression/correlation for the behavioral sciences. *Hillsdale, NJ: Lawrence Earlbaum*.

DS N°12. (2014). Norma Primaria de Calidad Ambiental para material particulado fino respirable MP 2,5. *Biblioteca Del Congreso Nacional*, https://www.bcn.cl/leychile/navegar?idNorma=1176988

Hair, J. F., Anderson, R. E., Babin, B. J., & Black, W. C. (2022). Multivariate Data Analysis, Multivariate Data Analysis. In *Book* (Vol. 87, Issue 4).

Hernández, R., F. C. & B. M. (2014). *Metodología de la Investigación* (McGRAW-HILL., Ed.; 6a ed).

Hofflinger, Á., Boso, À., & Oltra, C. (2019). The Home Halo Effect: how Air Quality Perception is Influenced by Place Attachment. *Human Ecology*, *47*(4), https://doi.org/10.1007/s10745-019-00100-z

IQAir. (2023). World Air Quality Report 2023. *IQAir*. http://bit.ly/40Tq8Sl

Jorquera, H. (2021). Air quality management in Chile: Effectiveness of PM2.5 regulations. *Urban Climate*, *35,* 100764, https://doi.org/10.1016/j.uclim.2020.100764

Leal, E., Leal, N., & Sánchez, G. (2014). Estimación de normales y reducción de datos atípicos en nubes de puntos tridimensionales. *Informacion Tecnologica*, *25*(2), 39-46, https://doi.org/10.4067/S0718-07642014000200005

Liu, Y., Kwan, M. P., & Kan, Z. (2023). Inconsistent Association between Perceived Air Quality and Self-Reported Respiratory Symptoms: A Pilot Study and Implications for Environmental Health Studies. *International journal of environmental research and public health*, *20*(2), 1491, https://doi.org/10.3390/ijerph20021491

Lloret-Segura, S., Ferreres-Traver, A., Hernández-Baeza, A., & Tomás-Marco, I. (2014). El análisis factorial exploratorio de los ítems: Una guía práctica, revisada y actualizada. *Anales de Psicologia*, *30*(3), https://doi.org/10.6018/analesps.30.3.199361

Mardones, C. (2021). Ex-post evaluation of residential insulation program in the city of Temuco, Chile. *Energy for Sustainable Development*, *62*, 126-135, https://doi.org/10.1016/j.esd.2021.04.003

Martinez-Soto, A., Avendaño Vera, C. C., Boso, A., Hofflinger, A., & Shupler, M. (2021). Energy poverty influences urban outdoor air pollution levels during COVID-19 lockdown in south-central Chile. *Energy policy*, *158*, 112571, https://doi.org/10.1016/j.enpol.2021.112571

MMA. (2024). I*nforme del estado de calidad del aire Temuco y Padre Las Casas, Septiembre 2024*, https://ppda.mma.gob.cl/wp-content/uploads/2024/10/INFORME-DEL-ESTADO-DE-CALIDAD-DEL-AIRE-SEPTIEMBRE-2024.pdf

Münzel, T., Hahad, O., Daiber, A., & Lelieveld, J. (2021). Air pollution and cardiovascular diseases. *Herz*, *46*(2), 120-128, https://doi.org/10.1007/s00059-020-05016-9

Qian, X., Xu, G., Li, L., Shen, Y., He, T., Liang, Y., Yang, Z., Zhou, W. W., & Xu, J. (2016). Knowledge and perceptions of air pollution in Ningbo, China. *BMC Public Health*, *16*(1), https://doi.org/10.1186/s12889-016-3788-0

Quintyne, K. I., & Kelly, C. (2023). Knowledge, attitudes, and perception of air pollution in Ireland. *Public health in practice (Oxford, England)*, *6*, 100406, https://doi.org/10.1016/j.puhip.2023.100406

Reyes, R., Schueftan, A., Ruiz, C., & González, A. D. (2019). Controlling air pollution in a context of high energy poverty levels in southern Chile: Clean air but colder houses? *Energy Policy*, *124*, https://doi.org/10.1016/j.enpol.2018.10.022

Ríos, M. L., Moreno, M. del P., & Vallejo, M. (2014). Fatalismo, Creencias en un Mundo Justo y factores sociodemográficos relacionados con la participación comunitaria y sociopolítica. *Boletín de Psicología*, *112*(1), https://www.uv.es/seoane/boletin/previos/N112-3.pdf

Shabani Isenaj, Z., Moshammer, H., Berisha, M., & Weitensfelder, L. (2024). Determinants of Knowledge, Attitudes, Perceptions and Behaviors Regarding Air Pollution in Schoolchildren in Pristina, Kosovo. *Children*, *11*(1), https://doi.org/10.3390/children11010128

Slothuus, L. (2024). Political fatalism and the (im)possibility of social transformation. *Contemporary Political Theory, 24*, 41-59, https://doi.org/10.1057/s41296-024-00685-1

Villalobos, A. M., Barraza, F., Jorquera, H., & Schauer, J. J. (2017). Wood burning pollution in southern Chile: PM2.5source apportionment using CMB and molecular markers. *Environmental Pollution*, *225*, 514-523, https://doi.org/10.1016/j.envpol.2017.02.069

Wang, R., Yang, Y., Chen, R., Kan, H., Wu, J., Wang, K., Maddock, J. E., & Lu, Y. (2015). Knowledge, attitudes, and practices (KAP) of the relationship between air pollution and children's respiratory health in shanghai, china. *International Journal of Environmental Research and Public Health*, *12*(2), https://doi.org/10.3390/ijerph120201834

World Health Organization [WHO]. (2006). *Air quality guidelines: global update 2005: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. World Health Organization*, https://www.who.int/publications/i/item/WHO-SDE-PHE-OEH-06.02

World Health Organization [WHO]. (2021). *WHO global air quality guidelines: particulate matter (PM2. 5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*, https://www.who.int/publications/i/item/9789240034228

Wu, K., Tao, J., Wu, Q., Su, H., Huang, C., Xia, Q., Zhu, C., Wei, J., Yang, M., Yan, J., & Cheng, J. (2024). A stronger association of mental disorders with smaller particulate matter and a modifying effect of air temperature. *Environmental Pollution*, *347*, https://doi.org/10.1016/j.envpol.2024.123677

Zhao, Y., Cheng, Z., Lu, Y., Chang, X., Chan, C., Bai, Y., Zhang, Y., & Cheng, N. (2017). PM10 and PM2.5 particles as main air pollutants contributing to rising risks of coronary heart disease: a systematic review. *Environmental Technology Reviews*, *6*(1), 174-185, https://doi.org/10.1080/21622515.2017.1334711