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Short Communication

Noise Pollution and its Implication on Cognitive Development

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Introduction

Modern life constantly demands our attention. Think about all the things currently competing for your attention: the work you have to do, phone calls, emails to read, television, music, and the countless websites you want to visit. We all have too much to do and very little time to do it.

Noise pollution is a growing issue in today's world, and it's one of the most insidious problems. It affects the global population, regardless of age or gender, but it particularly impacts certain groups, such as children. They are adversely affected from prenatal life through their development.

Exposure to high noise levels is increasingly common, yet regulations worldwide are scarce, as are research studies on the subject. Argentina has one of the noisiest cities inthe world, Buenos Aires, where there is more information about the issue. However, studies regarding how it affects the population and the cognitive development of childrenseem to be lacking; we couldn't find evidence of it.

In our region, the situation is similar, and there isn't enough research on how noise pollution affects health and daily life. In Spain, specifically, various studies have been conducted, showing results that demonstrate how noise exposure affects the cognitive development of children and how other areas are implicated in negatively impacting development.

The cognitive functions most affected by noise are memory and attention, both of which are essential for learning and subsequent development.

Noise pollution

To begin, we will define noise pollution, also known as acoustic pollution, as the presence of unwanted or disruptive sounds, deafening noises, and the simultaneous proliferation of excessive noise in a specific area, primarily affecting people's auditory quality, among other aspects.

Certain levels of noise are inevitable in urban living due to population growth, but when they reach very high volumes, they can be considered to have physical, emotional, and psychological effects, interfering with people's activities and learning. In fact, there are international organizations warning about the gradual loss of human hearing capacity due to noise pollution. Some reports from organizations like the World Health Organization (WHO) consider the tolerable noise limit to be 70 decibels (dB), although the ideal level for rest and human communication is 55 dB.

Sound and noise are both waves transmitted through the air, reaching our ears and creating the sensation of hearing. They are characterized by their frequency, their soundpressure level (commonly known as energy, intensity, or volume), and their duration. The unit used to measure them is the decibel (dB). However, these two concepts differin several aspects.

Sound can be differentiated in three aspects: pitch, intensity, and duration. Pitch refersto the tone of the sound, intensity is the volume, and duration is the time considered harmonious, carrying a message and a desirable sound. In contrast, noise lacks these elements and can be divided into three types: continuous, intermittent, and impact noise.In the fields of telecommunications, communications, and physics, noise is defined as a disturbance that disrupts human activities, primarily affecting communication and causing discomfort, among other aspects as further developed later on.

It's important to consider that the human auditory system is adapted to receive and perceive sounds and noises within a certain range of intensities. Exceeding these levels can have harmful effects on health. One of the contributing factors to hearing loss is constant exposure to noise, whether due to living or working in high-noise environments.

Noise pollution in cities

In recent decades, cities have experienced significant growth, especially in more developed countries. With this population and urban expansion, human interaction has led to an increase in noise pollution. Unlike previous centuries where most noise pollution came from physical labor, in this century, it mainly stems from communications.This shift represents a change in the noise pollution paradigm.

The reality of rapidly expanding cities is compounded by population density. Today,more people live in relation to the space they occupy, which contributes to the problem. Noise pollution is an understudied issue, with limited legislative attention. Only a fewcountries have comprehensive public policies to address it. These policies should gobeyond regulating specific sources of noise, such as nightclubs or private parties, andconsider the overall impact on people's daily lives.

Some city models aim to reduce noise pollution by implementing alternative mobility measures, reducing private and public transportation use, encouraging biking, and increasing green spaces. However, the daily lives and quality of life of city inhabitants worldwide are affected to varying degrees by noise pollution.

Currently, noise pollution is one of the leading causes of environmental pollution, insidiously affecting most people and negatively impacting various aspects of life. This isevident in a new condition of our century called Central Auditory Processing Disorder (CAPD), where there is a disconnect between what is heard and what is understood. It's not a hearing problem but rather a processing issue.

A report by the Spanish news portal Eltiempo.es in 2017 stated, "City noise increases stress levels, reduces concentration, and can affect heart rate."

Another study from Barcelona in the same year revealed a direct link between certain diseases and their relationship with noise pollution, with transportation noise and construction activities being the main sources of high-intensity sounds. This study also demonstrated the impact on public health services and the potential economic benefitsof reducing noise pollution.

Despite the evidence, the general population, government authorities, and professionalsinvolved often fail to fully grasp the extent and significance of this issue. Consequently, research and efforts to address noise pollution remain limited.

Noise pollution in Argentina

Noise pollution is a global issue, but in Argentina, there is no national law regulating highnoise levels. The first bill related to noise pollution was introduced in the National Congress in 2006. Since then, initiatives from various political parties have been presented, and on four occasions, they reached the approval of the Lower House but failed to progress in the Senate. It's intriguing to understand the reasons for these rejections. One possible cause for this lack of interest in the issue might be the insufficient awareness and information due to limited research and data on the problem and its consequences.

The only jurisdiction in Argentina with legislation addressing noise pollution is the City of Buenos Aires. This city is one of the ten noisiest cities in the world, and it received 4,037complaints about noise disturbances through the Unique Citizen Service System in 2021. The City of Buenos Aires has had Law No. 1,540 in effect since December 2, 2004. Article 1 states: "The purpose of this Law is to prevent, control, and correct noise pollution that affects both people's health and the environment, protecting them from noise and vibrations from fixed and mobile sources, as well as regulating specificactions related to noise and vibrations within the jurisdiction of the Autonomous City of Buenos Aires."

It is essential and highly necessary to have regulations that consider the specific characteristics of each location. A national law and tailored regulations for each city and province are needed.

Noise map

The noise map created in the City of Buenos Aires is a tool that allows for assessing the annual average noise levels in public spaces and identifying, controlling, and correcting the causes of noise pollution. The data comes from the Interactive Noise Map of the Citypresented by the Buenos Aires Ministry of Environment and Public Space. This map was developed using a simulation method with specialized software validated with long- term sound measurements. The city set up noise monitoring stations to measure noise simultaneously at 162 geographical points. The map displays daytime environmental noise levels on the city streets, measured and processed according to ISO 1996-2 standards, resulting in twelve noise measurement levels in decibels (dBA). The information is processed by the city's districts, and the results are added to the map as each district's data is concluded.

The results of the map will be used to establish Acoustic Quality Standards, from which Special Acoustic Situation Zones can be defined. These zones will prioritize planningand implementing noise mitigation measures. The information is represented on a map, with different colors indicating sound emissions, ranging from green to dark blue according to their intensity.

In some areas of Buenos Aires, such as around major avenues, the average noise level exceeds 80 decibels. However, quieter neighborhoods like La Boca, Barracas, or Parque Chas have a more peaceful environment, and the further one is from the main avenues, the quieter it becomes. The Comprehensive Center for Acoustic and Sound Technology Services (CISTAS) emphasized the importance of preserving quiet sanctuaries, places with little to no noise pollution from city activities.

The Environmental Protection Agency (APrA) has undertaken various projects to reduce noise, such as acoustic interventions on the Carranza and Libertador Viaducts and the repavement of streets and avenues using sound-absorbing asphalt. The installation of sound-absorbing panels on the Carranza/Libertador Viaducts reduced noise by up to 3.9decibels during the day and 4.6 decibels at night. Sound-absorbing asphalt was used onVélez Sársfield Avenue, resulting in a 2.1 dB noise reduction.

Noise pollution in the city of Paraná

Noise pollution in the city of Paraná is a problem that has received limited attention in terms of research, measures, and awareness. Despite the existence of an ordinance since 1987 that prohibits unnecessary or excessive noise, the city faces significant challenges when it comes to noise pollution.

Compared to other cities, Paraná has a high density of vehicles, many of which circulatewith loose or modified exhaust systems, generating high-intensity noises that impact auditory health. The city's urban planning has not adequately considered environmental noise issues.

In other parts of Argentina, measures have been taken, and noise maps have been created using decibel meters to assess noise incidence in the environment. These mapshelp identify areas with high noise levels that can affect people's quality of life and health.

The control of noise pollution should be the responsibility of the government, whichcould implement regulations to control noise in the city. Citizen groups like "Basta de Ruido Paraná" have attempted to address the issue and pressured for the enforcement of existing ordinances. However, the lack of expertise and knowledge in the field has limited their impact, and significant progress has not been achieved.

Despite some controls conducted in the city center in January 2020, there have been nosubsequent updates, and the ordinance continues to be violated. The issue of noise pollution in Paraná is a challenge that requires increased awareness and efforts from local authorities and the community to effectively address it.

Impact of noise pollution on cognitive development

Cognitive development is the process by which humans acquire knowledge through learning and experience. It is related to cog-

nitive abilities, which encompass memory, language usage, perception, problem-solving, and planning. Cognitive development involves the evolution of intellectual capacities, with intelligence being one of the most critical aspects.

Various authors have developed theories about cognitive development, with one of the most well-known being Jean Piaget, a renowned Swiss researcher in the field of human behavior. Piaget proposed that cognitive development begins at birth and is influenced by a combination of environmental factors and biological maturation processes. He posited that cognitive processes progressively organize themselves, such that it is not possible to acquire the skills associated with one stage without first passing through the preceding stage. These stages have become a guide for assessing children's cognitive development.

The World Health Organization asserts that children are the most vulnerable to noise because their bodies and psychological structures are still in the process of formation. The National Academy of Sciences Report states that noise levels that do not interfere with adults' language perception can significantly affect children. Noise can also interferewith the development of speech, language fluency, and other language-related skills.

The entire population, in general, suffers the negative effects of noise pollution, but children are the most deeply affected and are likely to suffer irreversible consequences. This is because their bodies (including the brain, auditory system, limbic system, and others) are not fully mature and are still in development. It is known and has been demonstrated that noise pollution affects individuals even during intrauterine life. Babies born to mothers exposed to noise during pregnancy can experience two possibilities: if exposure starts early in gestation, the baby may become accustomed to noise, whereas exposure later in pregnancy can result in lower birth weight, hypersensitivity to noise, increased crying, and other problems that directly impact health and development.

Today's children are exposed to noise levels that none of the previous generations experienced due to the development of technologies, the growth of virtual communication and relationships, creating a population increasingly immersed in their homes and exposed to constant stimuli from technological devices. In modern households, noise pollution has become a permanent feature. We can no longer speak of one or two sources of contrasting sounds and stimuli, as was the case with television and radio in the past. Nowadays, children are exposed from a very early age to multiple screens, constant use of tablets and cell phones with videos that feature high-frequency sounds, and every game has background noise. Additionally, there has been an increase in noisy toys in the industry.

Children living in noisy environments, whether in the streets, in the privacy of their homes, or at school, have reduced opportunities to develop the attention required for proper learning and development. The negative effects of noise pollution in early childhood have not been extensively studied concerning their long-term implications.

From a psychological perspective, noise is highly destabilizing for infants and young children and can be a source of stress, panic attacks, and other varying degrees of disturbance. Considering that these situations occur during a crucial stage of cognitive development, it directly affects this process.

A study conducted in Barcelona, which gained significant attention as the first of its kind in this field, investigated school academic performance and its relation to noise pollution,mainly from traffic. The results indicated that children attending schools in noisier areas had slower cognitive development by one year compared to those attending quieter schools. Fluctuating and changing traffic noise had a more negative impact on cognitive functions. Among the cognitive functions most affected are working memory and attention capacity, two critical pillars of learning and development.

According to researchers, attention capacity enables selective focus on specific stimulior the ability to concentrate on a particular task for extended periods. Working memory, or operational memory, is the system that allows for the maintenance and manipulation of information over short periods. When it is necessary to process information stored in working memory continuously and effectively, it is referred to as complex working memory.

"Our study reinforces the hypothesis that childhood is a vulnerable period during which external stimuli such as noise can affect the rapid cognitive development that takes place before adolescence," stated one of the researchers, Jordi Sunyer.

One explanation for why noise affects children's cognitive development in this manner isreflected in other issues caused by this type of pollution. These problems include: Frequent or constant headaches, which can worsen when attempting to focus attention. Headaches are one of the primary symptoms resulting from noise exposure.

Stress: Children experience more stress symptoms when their lives are immersed in noisy environments. They process stress differently than adults, displaying more irritability, restlessness, and increased anxiety, among other forms.

Hearing loss induced by noise exposure, ranging from mild to total. A child with progressive hearing loss often fails to recognize it, but it can manifest as difficulty understanding instructions, communication problems, language issues, introversion, etc.Sleep problems: An increasing number of children experience sleep disturbances due toexposure to auditory and visual stimuli. This directly impacts learning performance and cognitive development.

Difficulty in oral communication: Noise disrupts conversation and, consequently, communication, which is an essential element in all stages of life, especially in a child's formative and learning stage. Noise is a hindrance to developing effective communication skills.

Therefore, it is evident that noise pollution affects various aspects of the body andhealth, with implications for [1-7].

Conclusion

From the thematic analysis presented, we can conclude that noise pollution directly affects cognitive development, as well as various aspects of health, creating long-term issues and even irreversible alterations that harm the lives of many individuals.

It can be affirmed that noise pollution is a growing issue, primarily in densely populated areas, and the most significant sources of noise are technological devices, particularly when they are used and abused from an early age.

Currently, the situation in the country regarding government treaties and public policiesis of little significance. Its treatment and research are scarce on a global level, and specifically regarding how it affects people's lives, especially children, which is even more limited. This should alert, concern, and encourage us to continue our involvement in the problem.

We also agree that this reality affects us all but does not prioritize making this issue interesting. We know that people do not pay attention to what is not interesting, which is why we must make an effort to draw attention to the problem with our knowledge and emphasize the issues that are arising. This is important so that legislators.

Understand the future damage that is being done. We can either change this or remain passive, but we have no right to complain because a significant percentage of the problems arising from this situation require our professional competence.

Bibliography

1. Verónica Fuentes. "Traffic Noise at Schools Worsens Children's Attention andMemory" (2022).
2. Miguel Ángel Criado. "Car Noise Affects Children's Cognitive Development. ElPaís (2022).
3. RTVE. "Children in Schools Affected by Traffic Noise Have Slower CognitiveDevelopment. RTVE (2022).
4. Mercedes Borja. "Stress, Cognitive Deficiencies... How Noise Pollution AffectsHealth. 20minutos (2021).
5. Estefanía Esteban. "Effects of Noise on Children's Health (and CognitiveDevelopment). Guía infantile (2022).
6. Barcelona Institute for Global Health. "How Traffic Noise Affects the CognitiveDevelopment of Boys and Girls in School? ISGOBAL (2022).
7. Nora Bär. "Buenos Aires City and Noise Pollution: 8 Out of 10 Claim to HaveSuffered Complications. El destape (2022).