

# Assessing psychophysiological effects of malodorous pollutants in residents of Leandrinho, Bahia, Brazil: A Pilot Study using a WhatsApp-based Questionnaire

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## INTRODUCTION

This study is centered in Leandrinho located in Camacari, Bahia, Brazil. Leandrinho is a small rural town and a tight-knit socially active community. The primary language spoken is Portuguese.

Camacari is home to the largest industrial chemical complex in the southern hemisphere. Leandrinho is located near a metallurgy company (2 km) and cellulose processing plant (3.9 km) that emits SO<sub>2</sub> and H<sub>2</sub>S. The SO<sub>2</sub> levels in Leandrinho frequently exceed the US hourly SO<sub>2</sub> standards.

Using a community-based participatory research approach, the research team aimed to quantify the exposures to air pollution. The team also assessed the health impacts reported by Leandrinho residents during periods of malodor. No tool currently exists for residents to systematically record these incidents of malodor as well as the health impacts experienced. This pilot study evaluated the feasibility of using a questionnaire designed through WhatsApp, a free Wi-Fi/cellular based text-messaging application used among residents.



Figure 1. Mural in Leandrinho.



Figure 2. Research team meeting with ACL.



Figure 3. View of a paper mill factory from Leandrinho.

## BACKGROUND

Environmental malodors can cause acute health symptoms such as wheezing, increased blood pressure and eye irritation<sup>1,2</sup>. They can also affect cognition and emotion<sup>3</sup>. Specifically, odor annoyance can result in negative psychological changes. Odors are often regulated as nuisances, thus diminishing the presumed health impacts.

Little is known about the respiratory impacts that result from odor annoyance. The US CDC describes environmental odors as substances that can impact quality of life, but states that most “do not cause harm”<sup>4</sup>. We contend that substances that affect quality of life may impact mental well-being, and thus can cause harm.

In Brazil, the cost of SMS is 55 times more than in North America and is virtually too expensive for most residents<sup>5</sup>. Consequently, WhatsApp became a primary method of communication for 96% of Brazilians with smartphone access<sup>5</sup>. WhatsApp is an instant cross-platform messaging mobile application that allows users to exchange short message service (SMS) messages free of charge. Not much is known about its usefulness in the environmental health monitoring setting. Considering its popularity in Brazil and user-friendly functions, the research team wanted to evaluate the feasibility of using WhatsApp as a data collecting tool for this study.

## OBJECTIVES

- Evaluate the feasibility of using WhatsApp as a data collecting tool.
- Discuss the adverse health effects experienced by Leandrinho residents that co-occur during periods of malodorous emissions from nearby petrochemical industries.

## METHODS

**COMMUNITY MEETING:** A community meeting was held to present the results of current air quality monitoring conducted by the community/university research collaboration. Action plans for the research as well as methods for recording odor complaints were also discussed.

**RECRUITMENT/TRAINING:** UFBA graduate students conducted study recruitment and consent by going door to door through the community. Participants were consented, reviewed general information on air pollution and health, and were taught the format for the WhatsApp odor responses or the paper questionnaire.

**INCLUSION CRITERIA:** Leandrinho residents must spend most of their days in the town. Participants must be between that ages of 18 to 50.

**RANDOMIZATION:** Using RedCap, participants were randomized into two groups for completing the daily questionnaire: by paper or using WhatsApp.

**QUESTIONNAIRE:** The mobile application-based questionnaire was designed to assess odor exposure by having the participants characterize odor when detected in Leandrinho. Participants were asked to complete the questionnaire on a daily basis. We designed a complementary odor paper diary to observe the participants’ preference over documenting odor detection through Whatsapp or on paper.

**DATA COLLECTION:** The study period was 7 weeks. Reminders were sent through WhatsApp to all participants at least three times per week.

Questions asked on questionnaire (English translation):

- Did you smell an odor in the study today? (s or n)
- What time of day did you smell the odor? (HHMM)
- Where were you when you smelled the odor? (name of city)
- What was the intensity of the odor? (1-not strong, 5-very strong)
- How did the odor make you feel?
- After smelling the odor, did you have any of the following symptoms?

1. Você sentiu um odor na área de estudo hoje? Exemplo: s.0845.Lamarao.4.Estressado Nervoso.Pele irritada  
 2. Que hora do dia você sentiu o odor?  
 3. Onde você estava quando sentiu o cheiro?  
 4. Qual foi a intensidade do odor? (1 - não forte, 5 - muito forte)  
 5. Como o odor fez você se sentir?  
 6. Depois de sentir o cheiro, você teve algum dos seguintes sintomas?

Feliz	Incapaz de se concentrar	Perda de apetite	Dor de cabeça
Estressado	Cansado	Nausea/vômito	Tonto
Nervoso	Energético	Diarreia	Sensação de mal estar geral
Triste	Relaxado	Pele irritada	
Bravo	Ansioso	Erupção cutânea (na pele)	Irritação nos olhos
Irritado	Incomodado	Congestão	Irritação no nariz
			Garganta irritada
			Tosse excessiva

Exemplo: s.0845.Lamarao.4.Estressado Nervoso.Pele irritada

Figure 4. Sample of Questionnaire sticker that was given to each WhatsApp participant. Message format also provided.

## PRELIMINARY RESULTS

- The daily response rate from the study participants was low. The average number of replies per day was 5.5, and the highest number of responses received on a single day was 12. Only 6 of the 30 participants sent replies on at least 50% of the days. Of the 42 participants, only 30 sent at least one reply over the course of the study.
- Participants reported experiencing odor. Odor was reported on 24 study days; however, 16 of those days were reported only by one person. Of the 39 responses where odor was detected, reported ratings ranged from 1 to 5, and 2 was the most common rating. Out of the 269 total responses, 39 of them detected odor.
- Participants reported both physical and emotional impacts. Of the 39 responses, reported emotions included: sad, silly, normal, and bothered. Symptoms included: irritated nose, irritated eyes, irritated throat, headache, nausea, dizziness; headache and irritated nose were the most reported symptoms.
- Of the 24 participants randomized into the paper group, only two participants recorded using the paper forms, citing WhatsApp was easier and more convenient.

Table 1. Study population summary.

	Total	Male	Female
Study population	42	16	36
Mean Age	32	33	32
Median Age	30	35	29

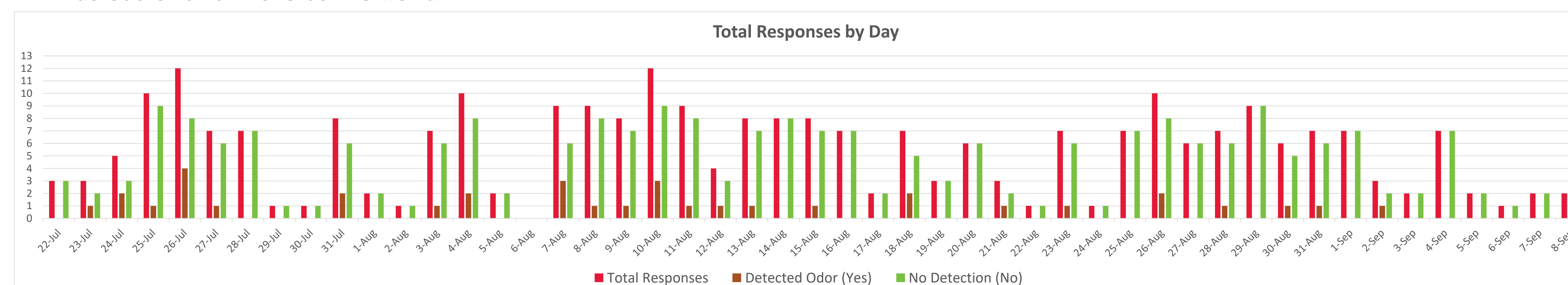


Figure 5. Summary of Responses received per day.

## CONCLUSION

- Few participants actually followed the required format for the Whatsapp responses. As a result, most responses did not contain enough information to describe odors when detected.
- Additionally, participants resorted to writing responses in a conversational tone. For instance, some participants used descriptive words (e.g. “very strong”) instead of using the odor intensity scale.
- Given the low response rate, determining the days when an odor occurred was difficult to determine.
- Participant responses were only frequently sent after sending out a reminder.
- Evaluating the feasibility of a data collecting tool that is widely available and user-friendly is important for addressing the environmental concerns experienced by Leandrinho and for highlighting the need for such tool to be further developed.
- Further development could result in a more accurate representation of the experiences of Leandrinho and other communities alike.

## FUTURE RESEARCH

- QUESTIONNAIRE:** Future research will investigate the style in which Leandrinho residents communicate with each other through Whatsapp. This knowledge will help construct a more comprehensive format for the residents to follow.
- LIMITATIONS OF WHATSAPP:** Future research will investigate the technological capabilities of Whatsapp. The mobile-based application currently does not have features that would be essential for this study, including survey design or an automated message system.
- PARTICIPANT TRAINING:** Conducting group trainings did not generate an adequate number of participants. Participants were more responsive to private indoor trainings. Future research will investigate more feasible options for participants to undergo necessary training.
- Based on findings from this pilot study, we anticipate to advance the scientific knowledge on exposure and olfactory detection of OSP on respiratory health and stress response.

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