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Port and industrial compound of Pecém: an epidemiological survey

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Abstract *This research aimed to analyze the dwellers' knowledge of the territories, Pecém Port and Industrial Compound (CIPP), the quality of life of the communities living in the vicinity of the enterprises, and the prevalence of hypertension and overweight. This is a home-based, epidemiological survey of four areas of the Family Health Strategy (ESF) in São Gonçalo do Amarante and one area of the ESF in Caucaia, Ceará, Brazil. The study was carried out between 10/2017 and 03/2018. Anthropometric and blood pressure measurements were performed, and sociodemographic data and knowledge about community, the CIPP, and quality of life were collected. A total of 69.8% of the 503 adults interviewed were female, and the mean age was 44 years. Parada was the area reporting the highest percentage of problems related to air particles (51.1%), the worst concept regarding the CIPP (40.1% bad), the highest percentage of worse quality of life (29, 1%), and greater desire to move to another place (31.5%). Pecém had the highest percentage of community problems related to violence, consumption of illicit drugs, and prostitution. We concluded that there are signs of impact on local populations' health and quality of life without more significant direct work/income benefits.*

Key words *Environmental Health, Health Impact Assessment, Epidemiological Surveys*

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Introduction

The implementation of the Pecém Industrial and Port Compound (CIPP) in the state of Ceará started in 1996 under the responsibility of the State government and in line with the Federal Government's "Brazil in Action" Plan. The implantation of CIPP follows the state developmentalist policy, a national policy of the 1960s, attracting more than 600 new industries to Ceará[1].

The CIPP area is located in the municipalities of Caucaia, and São Gonçalo do Amarante, Ceará. It Port Terminal is installed in the district of Pecém, an old fishing village, on the west coast of the state, 60 kilometers from the capital. Pecém was chosen to implement the project due to its privileged position regarding the main global markets (European Community and the United States) and its geographic characteristics[2].

From an economic viewpoint, the CIPP targets the distribution of the production with the expanded market and the diversification of the export agenda. Currently, the port terminal and an export processing zone (ZPE), thermoelectric plants, steel and metallurgy, ceramics, cement, and other industries are part of the CIPP[2]. Several traditional communities were removed from their territories, and others attracted several workers to new job opportunities[3] to install the various enterprises.

In the territories chosen for the location of large enterprises with polluting potential, the prospect of generating employment and income in social contexts weakened by the historically constructed poverty brings to the fore only the positive economic impacts arising from the installation of these industries[4]. However, they result in new risks of diseases and health problems, disrupting community organization, escalating social inequalities, environmental impacts, and government policies to favor large corporations[3,5]. The benefits are generally distributed heterogeneously among the inhabitants, generating different perceptions concerning the enterprises.

Expropriations and resettlements have severe consequences for communities since the new occupied spaces and landscapes force these people to change their practices, daily habits, and culture, which can adversely affect their health, well-being, and quality of life. Other consequences of this process can be observed in health due to changes in the quality of air, water, and soil by industrial pollutants, whether through raw material activities (extraction) or by burning fuels in production and transportation, which ends up also resulting in changes in the sociodemographic, cultural, and economic profile of the region[1,3].

The study of the impacts on human health resulting from large enterprises helps to understand the burden of diseases associated with economic activities installed and being installed in the territories[6]. Likewise, they point to the need to expand and qualify health care networks to address the population's problems arising from the environment and work[3].

The perceptions of communities involved in environmental problems, which affect health and quality of life, have been used to support political decision-making processes[7]. When studying environmental impacts on human health, we should include the perception of the population and workers living in the vicinity of the enterprises[8,9]. Di Giulio et al.[10] reinforce this importance by exemplifying that the few Brazilian studies on the health and working conditions of sugar cane cutters did not consider individuals' risk perception.

Contact with the Health Secretariats of Caucaia and São Gonçalo do Amarante revealed a knowledge gap concerning the impacts on the health of the population living in the vicinities of the CIPP and difficulties of the Family Health Strategy (ESF) teams in addressing territorial changes: urban violence, prostitution, drug use, and changes in food consumption. The sudden swelling in the local population of workers for the Port Terminal and other enterprises hinders ESF activities, such as home visits, as a household no longer consists of families, but of 10, 15, or 20 workers temporarily residing in the region.

Given the above, the following questions are asked: How is the health of the surrounding population? How do they perceive the incoming enterprises? What changes have occurred? This study was proposed to answer such questions, fill the existing knowledge gap, and collaborate in the territories of the Family Health Strategy. It aimed to analyze, through an epidemiological survey, the knowledge of residents about the territory, the CIPP, quality of life of the communities living in the vicinity of the enterprises, and the prevalence of hypertension and obesity.

Methods

This is an epidemiological survey, with home-based data collection, with the perspective of subsidizing the Health Impact Assessment (HIA).

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The study population consisted of those residing in the area surrounding the CIPP and involved four areas of the Family Health Strategy (ESF) of the Municipality of São Gonçalo (Praia, Planalto, Parada, Acende-Candeia) and an area of the ESF Caucaia (Matões). Sampling was performed by cluster, and households were selected at random in each community. All residents within the selection criteria were eligible to participate in the study.

We included randomly selected households that had a resident over 18 years of age who was able to respond to the form during the researchers' visit. In this case, all the household residents were eligible to participate in the research, regardless of age group. Homes that remained closed after three contact attempts or had people over 18 years of age with physical or mental disabilities that prevented communication were excluded. Only adult data will be analyzed in this paper.

Between October 2017 and March 2018 and after the pilot study, eight trained researchers interviewed residents at their homes and performed anthropometric (weight and height) and blood pressure measurements. The questionnaire was developed to collect sociodemographic information (e.g., age, ethnicity/skin color, and professional activity), perception of residents regarding the housing communities (e.g., main problems and those responsible for them), perception about the CIPP, and quality of life, in this case with the use of the "Short Form Health Survey" (SF36) quality of life inventory in the dimensions of overall health perception, limitations of daily activities, limitations of performance due to emotional problems and limitations of social activities[11], and questions about alcohol and drugs use, and depression[12]. Portable electronic devices were used to collect data and send information securely to a server. The questionnaire was set up within the ODK platform, a set of open-source tools that help organizations collect and manage data[13].

Field activities started with the mapping of the communities, mainly for defining their territorial limits. Then, the households were randomly selected. When starting a new subarea, the first 14 households were used to make a draw, and one of them was selected to start the interviews. The visits always continued on the right side of the street until the end and then on the other side to cover both sides of the street. The collection was carried out covering all the parallel streets and then the perpendicular ones within the study areas.

The study was carried out in the areas covered by the ESF teams from Praia and Planalto (Pecém), Parada, Acende Candeia, and Matões. A total of 18,000 residents were estimated in the communities in 2017. A 95% confidence level, a sampling error of 5%, and an expected proportion of 0.5 were considered in calculating the sample size. The calculation of the correction for finite population considered 18,000 people, with 20% added to the final calculation to cover eventual losses in the interviews. A design effect of 2.5 was also included since the type of sampling was clustered. The design effect is calculated using the formula: DEFF=1+ (M-1) ρ (M=cluster size; ρ=intraclass correlation coefficient). The values of M=4 and ρ=0.5 were considered in this study. Thus, the final sample size was defined as 1,140 people, distributed in 384 households (ESF families). The survey considered the size of the communities according to the number of families registered in each ESF team to ensure a proportional distribution of this sample among the communities.

While selecting households in the sample was carried out with great care, and following a well-defined protocol, many refusals of household residents occurred during data collection, especially among males. Thus, a systematic collection error was observed by gender and age group, which can be explained by the greater ease of finding and interviewing women at home, especially housewives. Thus, although it is a probabilistic sample, we could not expand the sample by sampling weights due to possible deviations in estimates concerning population parameters.

Data were analyzed within each community, and the frequencies were compared according to the studied variable. Comparisons were made using the Chi-square test for categorical variables, and the analysis of variance (ANOVA) was employed for continuous variables. The SF36 results were assessed by assigning scores for each question and subsequently transformed into a scale of 0-100, where zero is the worst quality of life, and 100 is the best[14]. The mean, standard deviation, and median of each dimension were calculated, and each was analyzed separately. The level of significance adopted was 0.05. The analyses were performed using the STATA 13.0 program.

The research project was submitted to the Research Ethics Committee of the University of Fortaleza (UNIFOR). All participants signed the Informed Consent Form (ICF).

Results

Six hundred eighty-seven individuals were interviewed (72.3% of the expected sample). The data presented here refer to the 503 over 18 included, 205 (41%) in Pecém, 127 (25.2%) in Parada, 88 (17.5%) in Matões, and 83 (16.5%) in Acende Candeia. The overall mean age was 44, with a predominance of females (351/69.8%) in the sample, with no significant gender variation within communities. The predominant ethnicity/skin color was brown, but with no difference in the distribution among communities. While not significant, the community of Matões showed the lowest proportion of older adults (14.8%). Acende Candeia (60.2%) and Parada (66.1%) had a predominance of Catholics, and Matões (46.6%) and Pecém (38.0%) had a large proportion of evangelicals. Acende Candeia was the community with the largest number of farmers (24.1%), and all had a low number of fishers, builders, and CIPP collaborators. Acende Candeia was also the community with the highest proportion of self-employed residents (41.7%) and with formal contracts (29.2%), while Parada had the highest percentage of civil servants (23.2%). Matões had the highest percentage of residents receiving the *Bolsa Família* (Family Grant) (23.9%) (Table 1).

Thirty-nine respondents (47%) in Acende Candeia, 56 (44%) in Parada, and 35 (39.77%) have lived in the community since they were born. The lowest percentage was found in Pecém (57, 27.8%), and this difference was statistically significant by community (p=0.000).

Air pollution (28.3%) and dust (22.8%) were Parada residents' biggest complaints (Table 2). Violence was the most reported complaint in Pecém (31.7%). The corresponding municipality was identified as the main responsible for the problem reported in Acende Candeia (39.0%) and Matões (37.5%), while the CIPP was reported most frequently in Parada (36.4%). Alcohol and illicit drug use were more frequent problems in Matões (67.0 and 83.0%, respectively) and Pecém (62.0 and 84.9%, respectively). Acende Candeia was the community that identified prostitution as a problem the least (16.9%). Matões and Parada were identified as unsafe concerning violence.

Matões (87.5%) and Pecém (84.4%) were the communities with the best concept regarding the CIPP, while Parada (40.1%) was the worst evaluated CIPP community (Table 3). Reinforcing the negative perception regarding the CIPP, Parada was the area surveyed with the lowest percentage of improved standard of living with the implementation of the CIPP (22.0%) and the most significant deterioration of this variable (29.1%). It was also the community with the highest desire to move to another place (31.5%), while Matões achieved the lowest (13.6%).

Regarding quality-of-life measures, only the dimension "emotional problems" was statistically significant and Pecém had the lowest mean (62) among the communities (Table 4). Overweight (33.7%), obesity (44.5%), and hypertension (28.7) were more frequent in Pecém.

Discussion

The data presented are related to four communities surrounding the CIPP, three in areas close to the compound and one more distant. The Pecém community, in São Gonçalo do Amarante, is the most urbanized and the largest of all, and our data indicate the perception of the most common problems among its residents, similar to indicators of more urbanized areas, such as violence (31.7%), alcohol (62%), illicit drugs (84.9%), and prostitution (61%). It was also the community with the worst value in the dimension of limited performance due to emotional problems (62.2), with the highest proportion of obese (44.5%), indicating factors that may be affecting the quality of life of the local population. Alcohol (67%), illicit drugs (83%), and recent insecurity (72.8%) were identified as social problems for the community of Matões in the municipality of Caucaia.

Pecém and Matões are the two territories closest to the Port Terminal, only five kilometers away. They have been directly affected by its installation in the region. Collaborating with the perception of the communities of Pecém and Matões, in a study carried out on a drug with 323 Pecém adolescents, 33 (10.2%) of the adolescents identified themselves as consumers of licit and illicit drugs, where the most consumed licit drugs are alcohol (28 - 84.8%) and cigarettes (9 - 27.3%). Marijuana is the most consumed (15 - 45.5%) for those who self-declared illicit drug users, followed by glue-sniffing (4 - 12.1%)[15].

This reality was also found in other studies after implementing the Rio de Janeiro Petrochemical Compound (COMPERJ)[16-18]. In the study in Porto das Caixas and Sambaetiba, located in Itaboraí-RJ, in all focus groups and 60% of the key informants in the interviews considered that

Table 1. Sociodemographic information, by community. São Gonçalo do Amarante and Caucaia, Ceará, 2018.

Variable	Acende Candeia (n=83)	Matões (n=88)	Parada (n=127)	Pecém (n=205)	p-value
	n (%)	n (%)	n (%)	n (%)	
Gender					0.129
Female	49 (59.0)	65 (74.0)	90 (71.0)	147 (71.7)	
Male	34 (41.0)	23 (26.0)	37 (29.0)	58 (28.3)	
Age					0.073
15-29 (Young people)	30 (36.1)	27 (30.7)	28 (22.0)	47 (22.9)	
30-59 (Adults)	34 (41.0)	48 (54.5)	66 (52.0)	116 (56.6)	
60 and over (Older adults)	19 (22.9)	13 (14.8)	33 (26.0)	42 (20.5)	
Ethnicity/Skin color					0.218
Brown	66 (79.5)	63 (71.6)	105 (82.6)	148 (72.7)	
White	12 (14.5)	14 (15.9)	18 (14.2)	33 (16.1)	
Black	4 (4.8)	10 (11.4)	4 (3.2)	19 (9.3)	
Other	1 (1.2)	1 (1.1)	0 (0.0)	5 (1.9)	
Marital status					0.416
Single	25 (30.1)	28 (31.8)	29 (22.8)	67 (32.7)	
Married/common-law marriage	50 (60.3)	49 (55.7)	85 (66.9)	118 (57.6)	
Widower	5 (6.0)	5 (5.7)	11 (8.7)	13 (6.3)	
Separated or divorced	3 (3.6)	6 (6.8)	2 (1.6)	7 (3.4)	
Religion					0.011
Catholic	50 (60.2)	39 (44.3)	84 (66.1)	106 (51.7)	
Evangelical	22 (26.5)	41 (46.6)	39 (30.7)	78 (38.0)	
Other	0 (0.0)	0 (0.0)	1 (0.8)	2 (1.0)	
No religion	11 (13.3)	8 (9.1)	3 (2.4)	19 (9.3)	
Schooling					0.738
Does not know how to read	11 (13.3)	9 (10.2)	16 (12.6)	20 (9.7)	
Incomplete Elementary School	25 (30.1)	25 (28.4)	43 (33.9)	64 (31.2)	
Elementary School complete	5 (6.0)	10 (11.4)	12 (9.4)	20 (9.8)	
Incomplete High School	12 (14.5)	8 (9.1)	8 (6.3)	20 (9.8)	
Complete High School	28 (33.7)	32 (36.4)	37 (29.1)	66 (32.2)	
Higher Education	2 (2.4)	4 (4.5)	11 (8.7)	15 (7.3)	
Professional activity					<0.001
Fisherman	0 (0.0)	0 (0.0)	1 (0.8)	3 (1.5)	
Construction worker	0 (0.0)	6 (6.8)	0 (0.0)	4 (1.9)	
Farmer	20 (24.1)	11 (12.5)	13 (10.2)	6 (2.9)	
Merchant	0 (0.0)	0 (0.0)	4 (3.2)	5 (2.4)	
CIPP Collaborator	9 (10.8)	3 (3.4)	1 (0.8)	2 (1.0)	
Retired	13 (15.7)	16 (18.2)	23 (18.1)	30 (14.6)	
Housekeeper	17 (20.5)	31 (35.2)	42 (33.1)	67 (32.7)	
Student	5 (6.0)	2 (2.3)	5 (3.9)	3 (1.5)	
Inactive	9 (10.9)	9 (10.2)	7 (5.5)	27 (13.2)	
Other	10 (12.0)	10 (11.4)	31 (24.4)	58 (27.8)	

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there was an increased risk of battery, sexual violence, unemployment, prostitution, and robberies after the implantation of the COMPERJ[16]. The following psychosocial impacts were identified in Itaboraí and COMPERJ surrounding areas: unemployment, physical and sexual violence, escalating crime, and increased drug consumption and trafficking. These reports were weighted by other factors associated with the coming of large enterprises, such as urban disorder, favelization,

Table 1. Sociodemographic information, by community. São Gonçalo do Amarante and Caucaia, Ceará, 2018.

Variable	Acende Candeia (n=83)	Matões (n=88)	Parada (n=127)	Pecém (n=205)	p-value
	n (%)	n (%)	n (%)	n (%)	
Employment[a]					0.004
Self-employed	20 (41.7)	11 (29.7)	22 (39.3)	37 (35.6)	
Formal worker	14 (29.2)	7 (18.9)	7 (12.5)	19 (18.3)	
Informal worker	2 (4.2)	4 (10.8)	5 (8.9)	10 (9.6)	
Employer	0 (0.0)	1 (2.7)	0 (0.0)	0 (0.0)	
Public servant	1 (2.1)	3 (8.2)	13 (23.2)	4 (3.9)	
Unemployed	2 (4.2)	0 (0.0)	1 (1.8)	6 (5.7)	
Other/did not respond	9 (18.6)	11 (29.7)	8 (14.3)	28 (26.9)	
Social Security					0.439
No	47 (56.6)	50 (56.8)	72 (56.7)	121 (59.3)	
Family grant	14 (16.9)	21 (23.9)	25 (19.7)	38 (18.6)	
Retirement pension	21 (25.3)	17 (19.3)	25 (19.7)	32 (15.7)	
Pension	0 (0.0)	0 (0.0)	2 (1.6)	8 (3.9)	
Other	1 (1.2)	0 (0.0)	3 (2.3)	2 (1.0)	

[a]N=249; excluding retired, housekeeper, and students; n=48 (AC), n=46 (M), n=57 (PA) and n=105 (PE).

Source: Elaborated by the authors.

labor displacement, increased contact of people from outside the region with residents, and lack of application of resources in local infrastructure[17].

The community of Parada, located partly towards the dispersion plume of the CIPP steel mill, has a peculiar pattern, with a large number of public servants (23.2%), retired (18.1%), and housekeepers (33.1%). Parada was, among the communities that most reported complaints related to air quality (pollution and dust; 51.1%), the one that most identified the CIPP as responsible for the problem (36.4%), that life worsened after the CIPP (29.1%), and negatively assessed the CIPP (bad - 40.1%). Due to the proximity of the steel mill and wind direction, this area suffers the most from the direct effects of atmospheric pollution in the CIPP, which is why we found a more critical opinion regarding the projects.

Risk perception varies according to climate change and proximity of events, in which the population identifies more significant risks when its surroundings evidence temperature changes over time, or they are areas prone to natural disasters or have high carbon dioxide emissions[19]. Thus, the direct relationship between risk perception, the presence of high emissions of pollutants in the atmosphere, and proximity to events, occurred in Parada.

As in Parada, in the study on the participatory socio-environmental and health risk diagnosis of communities surrounding the COMPERJ Petrochemical Compound, most participants (89% of the focus groups and 60% of the interviews) identified deteriorated air quality[16]. In a cross-sectional study carried out with 240 residents in locations in the municipality of Itaboraí-RJ, 37.1% considered the air quality to be poor, with different perceptions between the areas, as they made a negative assessment of air quality[18] in Porto das Caixas (32.1%) and Manilha (45%). A study carried out in 2006 in the area of influence of the petrochemical industry in Guamaré, Rio Grande do Norte, identified that respiratory symptoms in children and adolescents in the communities around the hub, even in low concentrations of air pollutants, was associated with residing in the preferred wind direction[20].

In the study that estimated the daily concentration of 2.5 fine particulate matter (FPM) in the atmosphere, in three areas of influence of the CIPP (São Gonçalo do Amarante, Paracuru, and Paraipaba and Caucaia), from 2006 to 2017, the highest concentration peak was identified in the region of São Gonçalo do Amarante, from 2011 to 2017 (period of highest consolidation of industrial operations), during the drought period (September to February)[21]. This study corrobo-

Table 2. Perceptions about the community. São Gonçalo do Amarante and Caucaia, Ceará, 2018.

Variable	Acende Candeia (n=83)	Matões (n=88)	Parada (n=127)	Pecém (n=205)	p-value
	n (%)	n (%)	n (%)	n (%)	
Main problem in the community					<0.001
None	6 (7.2)	8 (9.1)	9 (7.1)	8 (3.9)	
Air pollution	8 (9.6)	9 (10.2)	36 (28.3)	48 (23.4)	
Lack of water	12 (14.5)	4 (4.5)	1 (0.8)	4 (2.0)	
Mosquitoes	3 (3.6)	12 (13.7)	3 (2.4)	18 (8.8)	
Violence	2 (2.4)	17 (19.3)	5 (4.0)	65 (31.7)	
Dust	13 (15.6)	19 (21.6)	29 (22.8)	31 (15.1)	
Other	39 (76.1)	19 (21.6)	44 (34.6)	31 (15.1)	
Responsible for the problema					<0.001
State	3 (3.9)	7 (8.8)	16 (13.6)	29 (14.7)	
Municipality	30 (39.0)	30 (37.5)	14 (11.9)	26 (13.2)	
CIPP (general)	14 (18.2)	2 (2.5)	43 (36.4)	41 (20.8)	
Other/Did not answer	30 (38.9)	41 (51. 2)	45 (38.1)	101 (51.3)	
Considers alcohol abuse a problem in the community					0.001
No	29 (35.0)	26 (29.5)	65 (51.2)	76 (37.0)	
Yes	47 (56.6)	59 (67.0)	55 (43.3)	127 (62.0)	
Did not answer	7 (8.4)	3 (3.5)	7 (5.5)	2 (1.0)	
Considers illicit drug use a problem in the community					<0.001
No	23 (27.7)	12 (13.7)	35 (27.6)	30 (14.6)	
Yes	45 (54.2)	73 (83.0)	82 (64.6)	174 (84.9)	
Did not answer	15 (18. 1)	3 (3.3)	10 (7.8)	1 (0.5)	
Considers a prostitution a problem in the community					<0.001
No	61 (73.5)	45 (51.1)	50 (39.4)	70 (34.0)	
Yes	14 (16.9)	38 (43.2)	62 (48.8)	125 (61.0)	
Did not answer	8 (9.6)	5 (5.7)	15 (11.8)	10 (5.0)	
Has felt insecure or afraid in the last year in the community					<0.001
Yes (once/few times)	24 (29.0)	13 (14.8)	38 (30.0)	52 (25.4)	
Yes (many times)	29 (35.0)	51 (58.0)	52 (41.0)	51 (24.8)	
No	30 (36.0)	24 (27.2)	37 (29.0)	102 (49.8)	
Believes own community is violent					<0.001
No	68 (82.0)	49 (55.7)	76 (60.0)	151 (73.6)	
Yes	15 (18.0)	39 (44.3)	51 (40.0)	54 (26.4)	

[a]Acende Candeia (n=77); Matões (n=80); Parada (n=118); Pecém (n=197).

Source: Elaborated by the authors.

rates the popular perception of Parada's community because, while the annual mean estimated concentrations, even in São Gonçalo do Amarante, are lower than established by national legislation[22] in the studied areas, some studies already emphasize the urgent need to review safe human health standards[23,24]. The study also highlights the importance of evaluating the establishment of fine particles and their possible association with adverse effects on the health of the population surrounding the CIPP[21].

Finally, Acende Candeia is the most differentiated community of all. It is located furthest from the CIPP, containing the highest percent-

Table 3. Perceptions about the CIPP, by community. São Gonçalo do Amarante and Caucaia, Ceará, 2018.

Variable	Acende Candeia (n=83)	Matões (n=88)	Parada (n=127)	Pecém (n=205)	p-value
	n (%)	n (%)	n (%)	n (%)	
Considers the CIPP					<0.001
Good	39 (47.0)	77 (87.5)	33 (26.0)	173 (84.4)	
Neither good nor bad	28 (33.7)	10 (11.4)	43 (33.9)	28 (13.6)	
Bad	16 (19.3)	1 (1.1)	51 (40.1)	4 (2.0)	
Current life compared to before the CIPP					<0.001
Better	33 (39.8)	36 (40.9)	28 (22.0)	76 (37.1)	
Same	26 (31.3)	35 (39.7)	52 (41.0)	45 (21.9)	
Worse	18 (21.7)	4 (4.5)	37 (29.1)	13 (6.3)	
Did not live here	6 (7.2)	13 (14.9)	10 (7.9)	71 (34.7)	
Would like to move from this place					0.029
Yes	21 (25.3)	12 (13.6)	40 (31.5)	53 (25.9)	
No	62 (74.7)	76 (86.4)	87 (68.5)	152 (74.1)	

Source: Elaborated by the authors.

Table 4. Characterization of the sample according to anthropometric, clinical and quality of life variables, by community. São Gonçalo do Amarante and Caucaia, Ceará, 2018.

Variable	Acende Candeia (n=83)	Matões (n=88)	Parada (n=127)	Pecém (n=205)	p-value
	n (%)	n (%)	n (%)	n (%)	
SF-36[b] General perception of health					0.082[a]
mean/SD; median	59.4/22.8; 62	67.3/24.4; 72	64.9/23.2; 67	66.7/23.3; 72	
SF-36[b] Limited daily activities					0.373[a]
mean/SD; median	70.2/28.9; 80	76.2/27.9; 90	76.7/26.7; 85	74.3/27.3; 85	
SF-36[b] Limited performance due to emotional problems					<0.001[a]
mean/SD; median	72.3/36.7; 100	78.4/37.5; 100	76.6/37.2; 100	62.0/35.2; 66.7	
SF-36[b] Limited social activities					0.321[a]
mean/SD; median	79.2/25.5; 100	84.2/23.2; 100	85.7/24.7; 100	82.4/27.5; 100	
BMI[c]					0.008
Normal	28 (35.4)	28 (32.6)	32 (26.0)	44 (21.8)	
Overweight	35 (44.3)	37 (43.0)	49 (39.8)	68 (33.7)	
Obesity	16 (20.3)	21 (24.4)	42 (34.2)	90 (44.5)	
Blood pressure (BP)					0.222
Normal	42 (51.2)	33 (37.9)	47 (37.0)	80 (39.6)	
Overweight	27 (32.9)	34 (39.1)	47 (37.0)	64 (31.7)	
Obesity	13 (15.9)	20 (23.0)	33 (26.0)	58 (28.7)	

[a] ANOVA analysis; [b] Quality of Life Inventory "Short Form Health Survey" (SF-36); [c] Body Mass Index.

Source: Elaborated by the authors.

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age of farmers (24.1%) and retirees (25.3%) and residents who report living there since they were born (47%). They were also the residents who most identified the lack of water as a problem (14.5%) in the community and that the municipality was responsible for the issue (39%). It was the second community that rated the CIPP the worst (poor - 19.3%; life worsened after the CIPP - 21.7%). Regarding the quality of life, Acende Candeia was the community with the worst mean results in the dimensions of overall health perception (59.4) and limitations of daily activities (70.2). This territory is the most rural area of this study, suffering the effects of drought in the Northeastern Sertão, and is in the direction of the plume of dispersion of the enterprises. This reality may be reflected in the assessment of the quality of life in the territory.

In a study with residents in a rural area above the age of 18 in Atibaia-SP, the domain overall health perception (73.1), limitations of daily life (84.4), limitations due to emotional problems (83.8), social limitations (87.7) were better than the means found in all territories of this study, despite similar populations[25]. A study with older adults linked to the ESF in Cruz Alta-RS[26] achieved higher domains of overall health status (86.0), limitations of daily life (87.5), and limitations of social activities (86.9) in all the territories studied. Cruz Alta's older adults were only below the population studied in the limitations due to emotional problems (77.7), below only Matões (78.4).

Overweight was found in large proportions in all evaluated communities. In Pecém, 78.2% of people were overweight. In this community, obesity was found in 44.5% of the sample compared to others (p=0.008). Being overweight is considered a severe public health problem globally. Several authors have found results similar to this study, confirming our findings and reiterating that intervention measures should be considered to reverse this situation[27,28]. Literature has shown that being overweight is directly associated with health problems, such as acute myocardial infarction, stroke, systemic arterial hypertension, and diabetes mellitus[29].

Blood pressure is also considered an important variable when it comes to assessing people's health. It is known that increased blood pressure levels contribute to adverse health outcomes, such as stroke[30,31]. The National Health Survey[32], which assessed the prevalence of arterial hypertension in the Brazilian adult population, identified 22.8% for measured arterial hypertension, a value slightly below this study (24.6%), but with a higher prevalence in Pecém (28.7%).

We show a sectional population study, where we attempted to use sampling techniques and data collection consistent with this type of study and interview all the residents in the households, which was not possible. Our sample mostly consists of women (69.8%), 52.4% aged between 30 and 59 years, and, perhaps, our result cannot be generalized for the whole studied territories. However, it is a representative sample of the people who stay most at home, probably most affected by local problems. The study design is also a limitation. Although the causal link is more evident in complaints related to air pollution in the community of Parada, the same cannot be said of variables related to effective measures such as BMI, blood pressure, or quality of life. About 35% of Pecém residents and 15% of Matões residents did not live in the territory before installing the CIPP, pointing to a level of migration to the area by the compound without a previous study on the health of these populations.

The reality of this study sample hinders relationships between professional activity and the communities, which showed the highest percentage of housekeepers (31.2%), retirees (16.3%) and inactive workers at the time of the research (10.3%), and the Pecém community evidenced the highest percentage of inactive (13.2%). The low percentage of CIPP employees in all communities is noteworthy, and it cannot be said whether CIPP hardly employs its residents or if they were working at the time of data collection. Finally, some inconsistencies were identified in the responses, such as the contradiction between the feeling of insecurity among the residents of Pecém and the low percentage (26.4%) of identifying the territory as violent, besides the apparent discrepancy between the number of reported retirees in benefits (25.3%) and the identification of retirees in professional activity (15.7%), which perhaps can be explained if we add the 10.9% of the answers of "no activity".

The sample calculation of our study was based on the records of the local Family Health Strategy, which facilitates the diagnosis and local planning of the ESF teams, emphasizing that these communities have different aspects from other rural communities in Ceará. The results were presented in meetings with the ESF teams, managers, residents, and the local population. This ESF partnership was essential since the health professionals in the strategy are responsible for the clinical follow-up of the local population affected by the

enterprises, and they are in a better condition to detect such determinants early.

The importance of prospective studies that assess the perceptions, living, and health conditions of residents around the CIPP is reinforced, as they will be the first to feel the impacts on health. Silveira and Araújo Neto[33] show the importance of the participation of the health sector in the environmental licensing processes of large enterprises, as it is the first sector to feel the consequences of environmental impacts on the surrounding population.

Although close, the characteristics of the four communities differ widely and seem to be related to the location of the territories vis-à-vis the CIPP. The more urbanized communities of Pecém and Matões have a larger population. They are closer to the Port terminal, and reports similar to large urban centers, such as violence, prostitution, and high consumption of alcohol and illicit drugs, were more frequent. The community most affected by particulate matter pollution, Parada, showed the most negative opinion on the CIPP due to its location in the direction of the dispersion plume of the CIPP steel mill. Quality of life data and primary anthropometric health information point to a considerable level of impairment in the health of the local population. The remotest community (Acende Candeia) presented mostly farming work and fishing activity before the construction of the CIPP. Contrary to expectations, few people in all communities had work activities directly related to the CIPP, which may have to do with the current stage of activities in the compound geared to those demanding more specialized labor.

Conclusion

Although the study design used does not allow for causal statements, this research showed signs of impact on local populations' health and quality of life without more significant direct benefits from work/income resulting from employability in the compound. The problems related to the limitations of the study also reinforce the importance of health impact assessments before the installation of large enterprises so that future impacts can be mitigated and future monitoring can show causal relationships between health indicators and the presence of the enterprises.

Collaborations

SAS Nuto, EB Barreira Filho, BFA Oliveira, RWJF Freitas, LO Couto, LSV Jacobson, SS Hacon, and ARS Périssé participated in the design, planning, data collection, analysis, and interpretation and contributed to the elaboration, review, and approval of the final version of the manuscript.

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