CHAPTER 1.

THE STUDY AIMS AND LOCATIONAL CONTEXT

Puebla Broad Overview

The state of Puebla is located in East- Central Mexico and is the fourth largest metropolitan area in Mexico ("OECD Reviews of Health Systems: Mexico," 2016). Puebla is the fourth poorest state in Mexico and two thirds of the population live under the poverty level, compared to around half of the population in Mexico ("OECD Reviews of Health Systems: Mexico," 2016). The state of Puebla is greatly affected by systemic health inequalities, including inequity within the built environment and health system, because the state's development is centered on the capital city of Puebla, causing large economic gaps between rural and urban populations. These issues significantly impact low income communities. This inequity manifests itself in lack of access to healthcare and increased infant mortality rates. Puebla is ranked 27th out of 32 states in access to healthcare and has the highest infant mortality rate in the country ("OECD Reviews of Health Systems: Mexico," 2016). To create community-based solutions, we must first understand what lies at the root of these problems through the perspectives of the community members.

Mexico is a country with one of the highest number of people living with non-communicable diseases (NCD), which accounts for 47% of premature deaths from all causes in men and more than 67% of premature deaths in women(Córdova-Villalobos et al., 2008). In response to the high number of people with an NCD, the Mexican government has been prioritizing interventions to improve health. As such, people without formal employment, such as agriculturists, have access to free health services through Seguro Popular Clinics and Hospitals. In Puebla, 72% of employees have an informal job, a 14-percentage point increase from the national average ("Measuring Well-being in Mexican States," 2015) and as a result, 72% of people in Puebla have access to enroll in free health service programs. Despite this healthcare policy, we found that on average, approximately 35% of people utilize private practitioners and not Seguro Popular clinics or hospitals.

Research Project and Primary Research Questions.

With our established community partner, Fundación Comunitaria Puebla (see Preface), we created a mixed method approach to understand the root of the systemic health inequity in Puebla, by examining three rural communities and one urban low-income community. We had three goals with our study:

1. Understand what the perceptions of health needs and priorities among residents.
2. Determine how and where do residents access health care, and what are their health-related behaviors.
3. Explore how the built environment, specifically housing, air and water quality, impact the health and perceptions of health.

Figure 1.1: Map showing locations of all four communities relative to each other and Puebla city. In the top left you can also see the location of the active volcano, Popocatépetl (Image created by Alfonso Rojas Alvarez).

Methodology: A Mixed Methods Approach

An original methodology was created prior to starting the research to Mexico where we had collected and analyzed secondary data such as census data, government reports, reports from NGOs, and health system data. While the secondary data provided a good foundation to prepare for conducting the research in Mexico, we utilized community-based participatory research (CBPR) so we could adapt properly to individual challenges and patterns each community presented. Each step to the methodology featured its own unique ways of being modified to best fit the communities and were conducted in Spanish to best connect with the groups we worked with.

Human Subjects Review Board (IRB) Approval

The research methods were all approved by the Internal Review Board at the University of Texas at Austin. The IRB Approval number is #2019-01-0131.

The Household Survey

The primary survey was created with the help of our community partner, Fundación Comunitaria de Puebla, and made available via Qualtrics, a data collection tool. Drafted originally in English during the Spring 2019 semester, the actual household surveys were conducted on tablets in Spanish (see https://lahn.utexas.org/Puebla/Appendix1/Appdx1.1Final_English.pdf Appendix 1 for copies of the

English survey which were transferred into Qualtrics). The topics covered in the survey ranged from house demographics, health needs and access to healthcare, mental health and wellbeing in the communities, and health-impacting behaviors and housing. Household demographics focused on understanding their household structure including education levels and transportation. Health needs and access to healthcare primarily covered where the community member received healthcare, how they accessed it, and why they received medical attention (chronic versus acute illnesses). The housing section of the survey featured air and water quality tests to better understand the impact of upstream health determinants through direct measurement. In total, 242 surveys were conducted across the four communities.

Photograph 1.1: A UT student and a BUAP student conducting a survey at one of the homes in the communities. Students went into homes and outdoor spaces to receive responses (Image taken by Alfonso Rojas Alvarez).

Intensive Case Studies

Intensive case studies were employed to better understand the intersection of health and housing through detailed data gathering which included videos, photographs, interviewing, and measurements of the lot and precise measurements of the lot, buildings, and room dimensions. This later allowed us to draw up detailed plans and 3D models of houses, highlighting the respective health hazards of households. The five intensive case studies were chosen after having spent a week in each community, so we were able to experience a wide variety of houses and their inhabitants. The houses were selected based on the criteria that they best exemplified certain elements of the intersection of how housing interacts with health (see Chapter 4 for further details on selection). Each case study involved the whole team plus students from BUAP (for whom this was an entirely new research technique). Thus between 5 and 8 team members would be working in site for 2-4 hours. The fieldwork plans were then drawn up in a clean format and upload for the later elaboration of clean architectural plans by architecture student Ms. Melannie Ruiz who was supported with a grant from the SOA to work with the team remotely and developed the plans using software.

Photograph 1.2: A UT student and two BUAP students creating a sketch of the house. The measurements were then used to create 3D sketch- ups (Image taken by Alfonso Rojas Alvarez).

Focus Groups

Focus groups were conducted to collect qualitative data beyond the survey and to expand on themes we found to be important to each community. Two focus groups were conducted per rural community. The topics included air quality, diet and nutrition, immigration, chronic illnesses, street dogs, and alcoholism. Each focus group had 10- 15 participants. The focus groups helped us to understand on a deeper level what the priorities were of the community members and to help identify solutions they might have thought of for topics that were problem-based. Overall, six focus groups were conducted. Two were conducted in Xochiteopan over Diet and Nutrition and Air Quality. Another two were conducted in Colonia Agrarista over Migration and Chronic Illness. Lastly, two were conducted in Santa Ana Coatepec over Alcoholism and Dogs. See appendix 5 for more information about the focus groups (https://lahn.utexas.org/Puebla/App5.html).

Photograph 1.3: A focus group conducted by two BUAP students. Focus groups included Diet and Nutrition, Air Quality, Migration, Chronic Illness, Dogs, and Alcoholism.

Key Informant Interviews

Similar to the focus groups' focus, key informant interviews were used as a means to gather data around a topic beyond what was captured within the survey. Key informant interviews were semi-structured interviews in order to provide informants the space to be as open as possible about their perspectives. The informants were selected once we had spent time within the community and identified them as relevant to information that the surveys had briefly seen but needed further expansion. Key informants ranged from local clinic workers to the person that treated the local water source, and other leaders within the communities.

Data and Information Analysis

Questionnaire design: From Paper to Qualtrics to Tablets

The questionnaire for this project was designed using Qualtrics Survey Software and the Qualtrics mobile app was installed on the tablets that were used to capture data in the field. The questionnaire contained 204 discrete data points and was administered over the course of 45-90 minutes. It was important that the final dataset be de-identified, interpretable by the public and available in many formats, while also being flexible enough to adapt to changes or additions made in the field. A lot of time was spent making sure the questionnaire was able to fill all of these prior to the administration.

Data cleaning and preliminary analysis

The survey data was collected using the survey software Qualtrics, in four Samsung Galaxy tablets. The data was downloaded in CSV format and cleaned using R statistical software, following the principles of tidy data cleaning. First, each row constituted an ith household surveyed, with a set of columns for the descriptives of each of the jth members of the

household. Then, each of the matrix questions were separated into binary variables corresponding to 1 if the person selected a given option, or 0 if they didn't.

Furthermore, an intensive data cleaning process was required to standardize the responses for both numeric and text variables. In many cases, researchers inputted data differently, for example, using commas or periods for decimal numbers. To get around manually cleaning each of these observations, a set of loops were developed to automatically clean and standardize the inputting of the variables in the clean data set. Finally, it also became necessary to set the variables as either factors, categorical, or text, in order for the analysis to correspond to the type of construct each question was aiming to study. Once this initial cleaning was ready, a data dictionary was built in order to guide the interpretation of each variable.

In order to do an exploratory analysis, means and proportions were calculated for all the variables, with the required adjustment in the denominators to account for whether the denominator represented households, household members, or number of people to whom the particular question applied. Then, these summary statistics were divided by community, and then by rural and urban denomination, in order to make comparisons based on those categories, especially the case of Flores Magón as an urban comparison group.

Finally, several graphs and smoothed density estimations were built for each community, in order to visually explore the general distributions that each question followed. For more information about the analysis as well as the redacted dataset, please visit appendix 2 (https://lahn.utexas.org/Puebla/App2.html)

Table 1.1: Survey Metadata about number of households, sex of participants, and number of case studies and focus groups per community and in total.

Survey Metadata					
Community	***Surveys***	***Female Respondents***	***Male Respondents***	***Focus Groups***	***Case Studies***
San Francisco Xochiteopan	81	0.728	0.272	2	3
Colonia Agrarista	55	0.818	0.182	2	1
Santa Ana Coatepec	60	0.7	0.3	2	1
Colonia Flores Magón	46	0.804	0.196	0	0
Total:	241	0.756	0.244	6	5

Source: Household Survey, Focus Groups, Case Studies

Communities Overview

The Study Focus: Three Pueblos

Three of the four communities selected for the study were rural pueblos that rely strongly on agricultural production, both for self-consumption and for economic profit, and predominantly utilize carbon and leña as cooking fuels instead of natural gas or electricity due to financial constraints. One community (Santa Ana Coatepec) is located much closer to Atlixco and is better described as a peri-urban community, albeit primarily dedicated to agriculture. As we shall observe, health behaviors and access are rather different in that pueblo primarily because it is closer to the urban facilities of the town.

The volcano of Popocatéptl looms large across the whole region and its eruptions of ash and its intermittent seismic activity are a near daily feature of life. The two most isolated rural communities are quite literally "Under the Volcano" to quote from Lowrey's novel. These are communities that were also impacted to varying degrees by the September 2017 earthquake, with San Fco. Xochiteopan exhibiting the heaviest impact.

Later in the report, we will examine the differences and similarities between each community with a focus on the intersection between health, housing, and the built environment. But first, we begin by introducing the four communities in Puebla, Mexico.

Photograph 1.4: Photograph of active volcano Popocatéptl by Dr. Peter Ward in July 2019.

Table 1.2: Overview of demographics in each community.

Pueblos and Sites	San Fco. Xochiteopan	Colonia Agrarista	Santa Ana Coatepec	Colonia Flores Magón
Total Population*	984	306	1147	4500**
Classification	Rural	Rural	Peri-Urban	Urban
Average Household Size	3.9	3.7	4	4.4
% of Extended Family / Multiple Lots	42%	33%	28%	32%
% of Households with One House on Lot	56%	65%	72%	67%
% of Households with Two Houses on Lot	28%	22%	22%	17%
% of Households with Three or more Houses on Lot	14%	11%	7%	15%
Average Tenure of Family in Home (years)	27	33	25	34
% of Female Respondents	73%	82%	70%	80%
Average Age of Respondent (years)	49	53	49	52
% of Respondents who Completed Secondary School	25%	29%	35%	54%
% in Possession of Vehicle	35%	20%	52%	46%
Primary Economic Activity of Community	Agriculture	Agriculture	Agriculture	Services
Secondary Economic Activity of the Community (After work in the Home)	In the Home	In the Home	In the Home	In the Home
Primary Agricultural Product	Amaranto (47%) Chia (36%)	Chia (69%) Amaranto (49%)	Corn (80%) Beans (47%)	NA
% with Food Insecurity	17%	18%	15%	9%
Distance from Atlixco (km)	38.5	41.5	11.5	1.5

*= Taken from 2015 Census data

** Approximation by PMW and VMR in February 2020

Source: Household Survey; Table adapted from Alfonso Rojas Alvarez PhD proposal, February 202

San Francisco Xochiteopan

San Francisco Xochiteopan is located in the Municipality of Atzitzihuacán in the state of Puebla. It has a population of about 984 and approximately 354 dwellings. In this community, 81 surveys, 2 focus groups, and 1 key-informant interview were conducted for the study. This community is characterized by their first-level clinic operated by BUAP medical students and the large impact of the 2017 earthquake on the infrastructure - particularly their church - as well as on the mental health of the community.

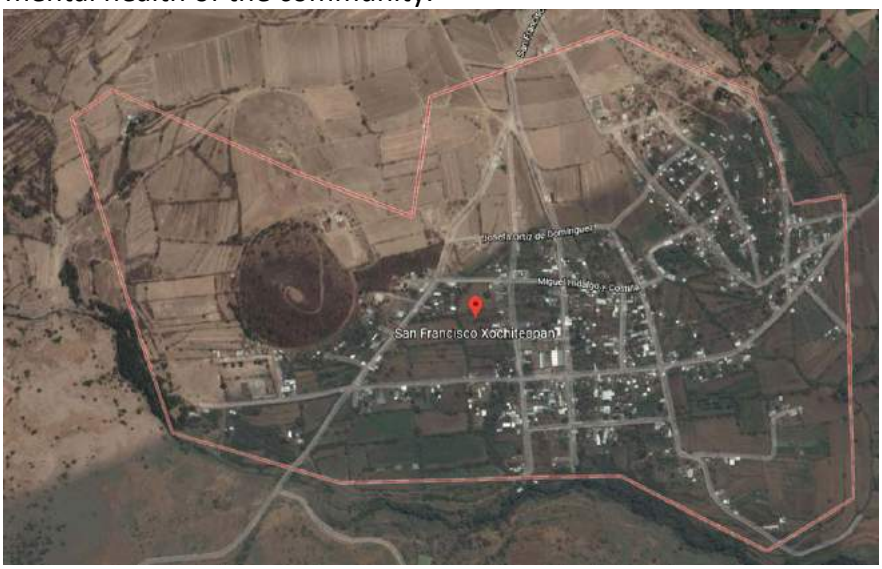

Figure 1.2: Aerial image of San Fco. Xochiteopan

Xochiteopan is a small town deeply connected to their church and their town's saint, San Francisco. After the earthquake hit, many families were left without a home and without the church they worshipped so much. After spending weeks carrying out the surveys, interviews, and focus groups, it became clear that the collapse of this religious complex had a tremendous impact on the mental health of the entire community. The trauma embodied by the fallen church continues to play an immense role in the way Xochiteopan continues moving forward, and it is evident that their number one priority is and has always been to restore this establishment and restore a new sense of hope in the process. Whether this can be achieved or not, Xochiteopan will always be a community of aspiring, dedicated, and generous people that firmly believe in a better tomorrow largely due to the hope instilled by their town church.

Photograph 1.5: Town church deeply affected by the 2017 earthquake (Image taken by Dr. Peter Ward).

As our first community, San Francisco Xochiteopan surprised us with many open doors, offerings of food and drinks, and a street dog who would quickly become the research team's mascot named *Pulga.* Before arriving in Puebla, MX to carry out this project, we had tremendous worries and concerns about the willingness of families to participate. Much to our surprise, this was not the case in Xochiteopan or in any of the communities under study. Almost every single door was answered and almost every single family was willing to spend hours sharing with us their stories, their preoccupations, but also their hopes and dreams. Every interaction was met by children playing with us, mothers giving us bags of fruits and seeds, and a cup or two of Coca Cola. As our first community, San Francisco Xochiteopan made our fears and worries disappear and ignited the excitement we'd had since the day this project was born.

Photograph 1.6: typical setup of dwellings in rural communities – many homes were made of adobe and metal sheets (sometimes combined with concrete), and the lots were generally shared and split by multiple families (Photograph taken by Dr. Peter Ward)

Colonia Agrarista Emiliano Zapata

Widely known by the shorthand Colonia Agrarista or simply Agrarista, the full name carrying Emiliano Zapata is a source of great pride: indeed, the community center has an image of him on the wall. Colonia Agrarista is located in the Municipality of Atzitzihuacán. It has a population of about 306 and approximately 115 dwellings. The smallest of the three rural pueblos studied, Colonia Agrarista emerged around 40-50 years ago as they separated from San Fco. Xochiteopan following land disputes and moved into neighboring land uphill. The newcomers divided the land in the designated urban area (the zona urbana ejidal) equally amongst themselves with 50m x 50m (2500m2) plots. And, as part of the land reform program each ejidatario was allocated a series of agricultural parcels.

Figure 1.3: Aerial image of Colonia Agrarista from Google Maps.

Colonia Agrarista counts with a small *Casa de Salud* operated by an appointed member of the community who has no professional medical experience and therefore has limited resources and power in relation to what she can and cannot treat for patients. Significantly between our first visits and return in October a brand-new Casa de Salud had been constructed (see Chapter 2). This establishment works closely with the 1st-level clinic in San Fco. Xochiteopan to which patients from Col. Agrarista are referred for more serious illnesses. The overarching characteristics of this community were the migration of relatives, water quality and perceptions, and the level of difficulty in accessing health-related services due to their location.

Photograph 1.7: Recently constructed Casa de Salud that opened in August 2019 (Image taken by Dr. Peter Ward).

Although Colonia Agrarista exhibited an urgent need of better and more accessible infrastructure and healthcare services, it also exhibited the greatest optimism of all the communities we were able to work with. During our community entrance event, we introduced ourselves and the project, and when we opened the panel for questions, the first things they asked where: "*Where are you going to sleep while you work here?*", "*what will you eat?*", "*do you have any allergies for when we make you food?*". And as the close-knit community that they are, they offered to take turns letting us sleep in their homes and cooking for us. And although this was not necessary since we had housing and food arrangements prepared beforehand, we knew Colonia Agrarista would truly have taken us in as their own. This community cohesion and hospitality was truly inspiring and gratifying to see.

Photograph 1.8: UT Austin students and faculty with collaborators and community members after receiving two large buckets of home-grown fruits as a gift (October Return Visit).

Santa Ana Coatepec

Santa Ana Coatepec is a peri-urban community in the municipality of Huaquechula, located approximately 6.2 miles from downtown Atlixco with a population of around 1200 inhabitants. Santa Ana represented an interesting case in the study since it exhibited a mix between some of the benefits and challenges of being located close to the Atlixco urban center, while it also had high proportions of its population dedicated to small-scale ejidal agriculture. Its agricultural sector is not largely dissimilar from that of San Francisco Xochitoepan and Colonia Agrarista, but much more diversified in terms of products, and access to water sources, as reported in the findings of this document.

Figure 1.4 Aerial image of Santa Ana Coatepec from Google Maps.

However, in comparison to those communities, it was possible to observe large housing structures, in numbers much larger than found in the rural communities. This might be a consequence of more lucrative economic activities which are possible given the community's proximity to Atlixco, and, to a lesser extent, to the city of Puebla. Furthermore, in terms of its infrastructure, the roads and public services were mostly equivalent to those of Atlixco, which illustrates public investments and growth as a consequence of its location in the ladders of the Puebla - Mexico City highway. It was also notable, in terms of access to water, that many houses had access to their own water well, providing families with an alternative to the use of public water, or private bottle consumption.

Figure 1.5: Santa Ana counts with more paved roads which facilitates private and public transportation. Picture was taken from Google Maps.

In terms of safety, Santa Ana Coatepec exhibits resemblances to urban areas, with moderate levels of gang violence, high levels of abuse of alcohol and drugs, and a generally unsafe environment after 4 or 5pm in the afternoon. Operationally, this implied that the survey collection needed to be adjusted for earlier hours of the day, but beyond that no major inconveniences occurred as a consequence of this difference.

Santa Ana has a BUAP location, led by the School of Nursing, which provides some basic healthcare services, especially for newborn babies and infants. It is also the only community of the four studied which has a rehabilitation center for people with drug or alcohol addictions. However, after an informal visit and conversation with the administration and its patients, it was possible to determine that its engagement with the community is modest, with most of its patients originating from other communities, and even other states in Mexico.

Santa Ana Coatepec was also the community with lower levels of participation in the community events, and with the highest number of families unwilling to complete the survey. As a larger constituency than both of the rural communities, it also became clear that the ability of the team to reach the entire location was limited. These limitations led to a prominence of respondents who had previous work with FCP, or with a higher inclination for community participation. Additionally, the owners of small grocery stores had a much higher acceptance rate and given the elevated numbers of those locales in the community, they also represented a large amount of the responses in that community. In total, 60 surveys were conducted in this community, 2 focus groups, one intensive case study, and two key informant interviews, over a span of 10 days

Colonia Flores Magón

Colonia Ricardo Flores Magón is a typical *colonia popular* located within the town of Atlixco in the Municipality of Atlixco. Like so many cities and towns in Mexico that were rapidly experiencing urban growth and widening economic activities land capture and self-built at the periphery of the city became the primary form of housing production in Mexico – in some cases

comprising 30-50% of the population and build to area. Flores Magón is one such, forming around a small *ejidal* outlier in the 1940s, as land was sold off informally to would be homeowners and builders – usually on lots measuring 15x20m (modal lot size = 300m2). It now forms part of an inner urban ring beyond the traditional city center, and, as the city has expanded outwards, newer *colonias* have formed such as Lomas de Tejaluca, as well as middle-income *fraccionamientos* (subdivisions). Indeed, the team based itself in one such neighborhood (Cristo Rey), built around the golf course and country club that was once part of a hacienda in the Southern part of the city. Since the early 2000s, as in many cities across the nation, supported by the central government, private mass social-interest housing developments have been promoted targeting working and low middle-class populations. Atlixco has three such developments to the North East and North located outside of the city in the peri-urban area. However, these are only available to certain income and formal workers, so informal settlements continue to grow at the periphery.

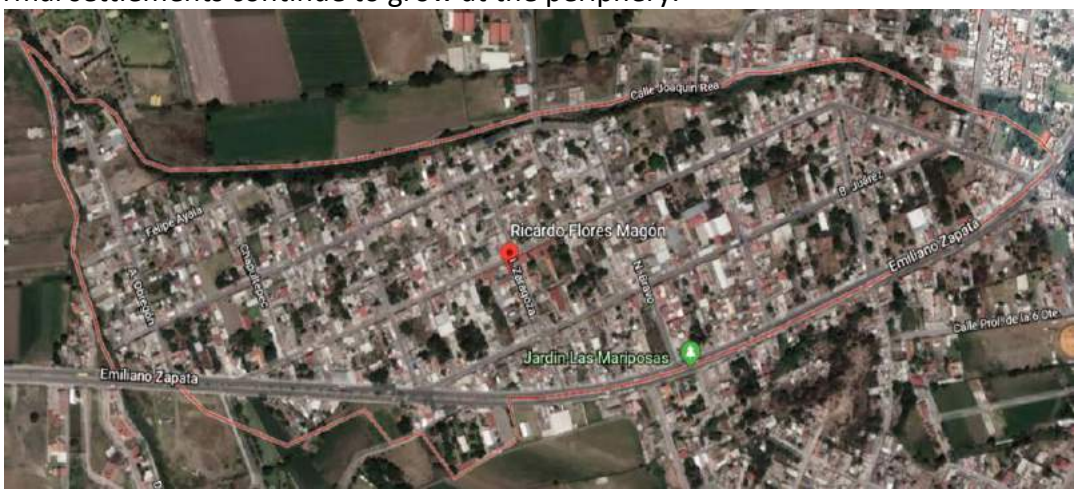

Figure 1.6: Aerial image of colonia popular Flores Magón from Google Maps.

Figure 1.7: Neighborhood map showing colonia popular Flores Magón in Atlixco, Puebla (from Google Maps).

Flores Magón is now completely urbanized with paved streets, piped water supply and mains drainage. Dwellings are largely self-built (often using hired labor), and while most of the *colonia* homes are single-story, there are also many two-story homes – such as that of the family that helped support our efforts in the community. As one can see in Figures 1.6 and 1.7, the *colonia* comprises around 20 blocks (or half blocks), with each full block containing around 80 individual lots (blocks being 10 by 8 lots).

Its two major boundaries are the main road Emiliano Zapata, and the small river and *barranca* that runs through the township, sometimes bordered by a small road (e.g. Barranca del Carmen). Flores Magón residents – especially those living close to the *barranca* -- complained about the smell and contamination from small industries and the abattoirs upstream, which generated health concerns from the local population. Most dwellings and activities turn their backs on the *barranca* and many lots along its margins are either undeveloped or less well consolidated. Residents look towards the town center and the main road of Emiliano Zapata (see Figure 1.7).

We chose to also work in a low-income *colonia* popular because we were interested in contrasting the medical and health profiles of rural pueblos with that of the urban population whom, we assumed, would have rather different activity patterns, health behaviors and better access to health care. Also, the more consolidated physical environment should reveal major differences in the microenvironment of health and housing conditions.

However, we did not have the same access to the community through the Fundacion Comunitaria Puebla as we did in the rural communities. Indeed, several members of the FCP board had major concerns about the safety of our working in a low-income *colonia* and were hesitant to work in an area that we knew little about. Therefore, we consulted with Mr. Sergio Hidalgo (the father-in-law-to-be of Eder, one of our BUAP medical faculty interns), who was well known in Atlixco and who had good contacts with the *Ayuntamiento*. With his help we were put in touch with María de Jesúus Rosales a local *sindico* (Trustee member of the council) who kindly secured the support of local elected political leaders from different parties. Moreover, the Public Security Secretary of the city council offered to provide police monitoring and escorts (which we tactfully declined), and he and other council members came to our launch meeting in the community. Once in the field and conducting surveys, a police vehicle periodically passed through the *colonia* to check that all was well.

Which it was, until halfway through the survey when two large black Suburbans without license plates began asking local residents who we were, and what we were doing. Likely members of a local drug gang, we immediately pulled the team out, leaving us with only half the surveys completed. But everyone felt that it was the right decision.

Figure 1.8: Typical paved roads in the urban colonia. Image retrieved from Google Maps.

Being an urban community, we made changes to survey accordingly, and dropped sections relating to agricultural activities, storage of chemicals, etc. In retrospect this was a mistake, since a number of respondent families were engaged in agriculture.

Given that the *colonia* had been settled thirty to forty years ago and is today located quite close to the city center (within 15 minutes walking distance), some of the lots and dwellings closest to the center house renters and small commercial establishments. These are clearly visible having two or more electricity meters for each lot or dwelling. Because we were interested in owner households, we excluded the blocks closest to the city center from our survey.

In this urban community, 46 surveys were conducted for the study (half of what was originally planned). This community exhibited the best physical infrastructure (roads, dwellings) and access to health-related services. Apart from the level of infrastructure, the most significant distinctions between Col. Flores Magón and the three rural pueblos were the use of natural gas as a cooking fuel, the purchase and consumption of bottled water, and concerns over safety and substance consumption.

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