Traditional Medicinal Plants: Preserving Knowledge in Cuenca, Ecuador

Alex Hill, Susanna Oppong, Hannah Smith

An Interactive Qualifying Project Proposal
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
In partial fulfillment of the requirements for
the Degree of Bachelor of Science

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Abstract

Knowledge about traditional medicinal plants is passed on through word of mouth from ancestor to ancestor in Cuenca, Ecuador. This project addresses ways to preserve knowledge and provide access to traditional medicinal plants. Through surveys, interviews, and observations our team collected data on medicinal plants to best provide a platform for youths to access this knowledge. It was found that education on traditional medicinal plants is necessary, proper instruction and tips are needed to care for the plants, and an accessible platform is needed for the youth. The results revealed that the most preferred mode of accessibility for plant information was a mobile app. An app prototype was recommended and developed for Museo Pumapungo to engage the youth and most importantly, help keep the knowledge of traditional medicinal plants alive.

Acknowledgements

The success of this project stemmed from the contributions of several individuals during this research investigation. We would like to thank those who significantly demonstrated their efforts to make this project come to life.

First, we would like to thank our project liaisons, Gabriella Arias and Ximena Moscoso of Museo Pumapungo. Their knowledge and guidance throughout our time spent in Cuenca made for an effective app prototype to be produced. Throughout the research investigation, they provided us with contacts of people to conduct our methodologies along with the information required to guide our project to a successful end. They took time out of their busy schedules to guide us in this project through weekly meetings and consistently made themselves available for our questions and concerns. We would like to thank everyone who spoke with our team for providing us with information, testimonials, and their personal time.

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Executive Summary

Overview

Traditional medicine is used by 80% of the population in developing countries as their primary resource for healthcare (Chivian et al, 2008). This practice has held popularity for many years and continues to grow. Traditional medicine can be categorized into subsections including spiritual healers, medicinal plants, healing through animals, and cultural rituals (WHO, 2019). It is defined as the knowledge, skill, and practice used in the maintenance and prevention of health based upon the theories, beliefs, and experiences of different cultures" (WHO, 2019). In Cuenca, traditional medicinal plants have lost their popularity due to the lack of knowledge amongst the youths in Cuenca. Museo Pumapungo, home to a traditional medicinal plant garden strives to make information of medicinal plants more widely known to the public and would like to expand this knowledge to the youths in Cuenca.

Problem Statement

Currently, the knowledge of traditional medicinal plants at Museo Pumapungo can only be accessed by going to the museum garden. We found that there is a distinct lack of knowledge of traditional medicine in Cuenca and to increase its use, we must create an alternative solution in replacement of passing its information from ancestor to ancestor. From our research we found that 93.3% of Cuencano youth use the internet as their main form of accessing information on traditional plants, a platform that would easily educate youth of traditional medicinal plants. Our team will identify strategies on how to make the knowledge of using and tending to medicinal plants accessible in Cuenca.

Proposed Solution

Because of the increased use of the internet in Cuencano youth, it is likely that they would access and retrieve information about traditional medical plants through the internet. We considered ways in which knowledge about these plants can be preserved and made more accessible to youth. We considered the needs of Museo Pumapungo as we developed our research objectives. Our proposed solution was an app prototype to give to the museum to be used to educate the youth on how to use, grow, and buy traditional medicinal plants.

Objectives and Methods

Our first objective was to learn how the youth in Cuenca access information on traditional medicinal plants through surveys.

The second objective was to identify the most used traditional medicinal plants in Cuenca. We surveyed and interviewed the public to determine the common plants used. This provided us with accurate list of the top ten plants used in Cuenca.

Our last objective was to collect information about plant care and consider ways to document current traditional medicinal practices in Cuenca. We conducted observations of the fieldworkers at Museo Pumapungo and we were able to document how to tend to medicinal plants.

Findings

Through analyzing the data, we collected the following findings regarding the knowledge of traditional medicinal plants, plant care, and accessibility to plant information are:

- **Education is Necessary for the Preservation of Plant Knowledge:** A recurring theme during the interviews and observations held was that the knowledge on traditional medicinal plants is being lost overtime. To publicize information on Andean traditional medicine, the top ten most used plants were revealed through interviews and surveys. Information from further research was then compiled for each of these plants to serve as an outlet for the youth to learn from, rather than having the information passed on from ancestor to ancestor.

- **Instruction and Guidance are Needed to Care for Plants:** For further information to successfully use medicinal plants, information on how to grow and cultivate these plants hold an equal importance to how to use them. Through observing the fieldworkers of Museo Pumapungo, we were able to document helpful tips on how to have these plants in one's own home or garden. Documenting instructional care for these plants will promote the use of traditional Andean medicine.

- **Accessibility to Plants in Cuenca Needs to Appeal to the Youth:** To publicize the information gathered during this research investigation our accessibility survey revealed that 93.3% of people use the internet to access information about traditional medicine. We further found that 89.9% of participants would like to see this information published in a mobile app. This finding led our team to prototype an app for Museo Pumapungo containing information on how to use the top ten medicinal plants discovered and how to grow these plants.

Recommendations for Future Researchers

- **Traditional Medicinal Plant Program:** It was found that there are limited resources available in Cuenca to engage the youth in learning about traditional medicinal plants. Development of a program based for elementary and middle school children introduced at Museo Pumapungo would allow for these students to learn about the cultural and scientific importance of these plants through the Museum's garden and exhibits.

- **Addition of Full Medicinal Plant Catalog to app prototype:** It is important to continue publishing all medicinal plants found at Museo Pumapungo to the app prototype. Further observations and additional interviews with store owners, *mamas,* and *taitas* can provide one with the necessary information to complete a full plant catalog for the app.

- **Interactive Demonstrations for Medicinal Plant Cultivation:** It was found that many people do not know how to tend or cultivate these medicinal plants on their own, which through research was found to only consist of a few steps. Within the app prototype, the inclusion of demonstrations on how to care for these plants will allow people to grow these plants themselves.

Conclusion

This project addressed ways in which information about traditional medicinal plants can be preserved and made more accessible to youth. There was a distinct lack of knowledge found surrounding traditional medicine within Cuenca. To increase its use and begin to improve this lack of knowledge, Museo Pumapungo has taken the initiative to increase education surrounding this field. With the development of a mobile app, future IQP teams can travel to Cuenca and use this project as a baseline to further extend the knowledge of traditional medical plants to the people within the city.

Authorship Table

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Acknowledgements	Alex	Hannah
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Chapter 1: Introduction to Traditional Medicinal Plants

Traditional medicinal plants have held their popularity for years in countries across the world, including Ecuador (Pedersen *et al*, 1983). Traditional medicine is used by 80% of the population in developing countries as their primary resource for healthcare (Chivian *et al*, 2008). Over hundreds of medicinal plant options are in markets and stores throughout Ecuador (Tinitana, 2015). While these plants have been proven to be well-received, there is a lack of current knowledge and scientific research surrounding their use, especially amongst the youth of Cuenca (Wassie *et al*, 2015). This is because traditional medicines and herbal products are not regulated for use and their knowledge is primarily passed down through ancestors (Molina, 2007). It is necessary to create an outlet for this information that is easily accessible to the public. With problems surrounding the costs, quality, and access of these drugs, only 50% of the public takes proper medication when faced with illness (Molina, 2007). As traditional medicine is more affordable and accessible to the public in Cuenca, it is essential for information surrounding the use and benefits of traditional medicine to be known and better incorporated within the healthcare system.

Traditional Medicine is defined as "the knowledge, skill, and practice used in the maintenance and prevention of health-based upon the theories, beliefs, and experiences of different cultures" (WHO, 2021). It has been around as one of the world's most popular forms of medicine in many countries, with roughly 65-80% of the world's healthcare using this practice (WHO, 2019). Although this practice is taught through literature, it is typically passed down from one generation to the next (Miranda, 2021). The practice contains herbal remedies, spiritual healers, cultural rituals, and the use of animals for healing (WHO, 2021). Countries rely on these traditions to pass on cultural beliefs and continue practices for many generations. Without knowledge of this practice, many traditional practices cannot be continued and passed on (Che, 2017). It is important to understand the significance of traditional medicine in history, how it is passed on, and its continued use throughout the world.

Museo Pumapungo in Cuenca is home to a garden containing over thirty different types of traditional medicine plants with information regarding their uses. The medicinal plants grown at the museum stem from Andean history. This plant collection is designed for educational purposes and the rescue of ecosystems typical to the cultures of Ecuador. The only way to access the garden is by visiting the museum in person to tour the gardens, which makes learning about the plants difficult, especially during a pandemic.

Chapter 2: Background

The use of traditional medicinal plants is widely respected across the globe (Wassie *et al*, 2015) however, there are concerns about the loss of knowledge on how to use these plants effectively amongst the younger generations (United Nations, 2009). Museo Pumapungo is home to an abundance of these traditional medicinal plants. Traditional medicine plays a heavy role in the health care systems of developing countries (Zhang, 1996). Museo Pumapungo and researchers across the world are concerned that the lack of knowledge surrounding traditional medicinal plants is continuing to rise amongst the youth (Thomas, 2020 and Silva *et al*, 2011). This chapter begins with preliminary background information needed to work towards addressing the issue of the lack of knowledge surrounding traditional medicine. It is important to further investigate the current scientific knowledge of traditional medicinal plants, how traditional medicine has been historically used worldwide, common perceptions of these plants, and how Museo Pumapungo plays an active role in educating the public about the plants.

2.1: Traditional Medicine

"Traditional medicine" is a term that refers to the knowledge, skill, and practice used in the maintenance and prevention of health-based upon the theories, beliefs, and experiences of different cultures (WHO, 2021). Today, many cultures still rely on these concepts of traditional medicine as their primary form of healthcare (Che, 2017). An abundance of these cultures is found within the regions of China, India, Japan, Africa, and South America. Some of these forms of medicine are backed by literature and records, while others are simply taught from information passed down from generation to generation (Miranda, 2021). Usually, traditional medicine is referred to as herbal remedies, but the term also includes the use of animals, fungi, minerals, and other substances found within nature. In many countries, traditional medicine is used alongside complementary or alternative medicine (CAM). This type of medicine refers to the broad use of health practices that do not belong to a country's own traditions or conventional medicine (WHO, 2019).

Many traditional medicine practices that are Indigenous to specific regions and cultures around the world are under investigated and reported (Li, 2018). Over the years there has been substantial efforts in scientifically evaluating the efficiency and safety of traditional medicine. Due to the nature of these medicines and the differing conditions in which they are used, there is a consensus that there is a lack of scientific evidence for their physical benefits. Within the years of 2005 to 2018, the World Health Organization (WHO) documented that 88% of countries confirmed the biggest challenge to traditional medicinal plants was a need for technical guidance on the research and evaluation of traditional medicines (Lin, 2021). WHO established that in many developing countries, traditional medicine plays a key role in meeting the primary health

care needs of the population (Morales, 2016). It is necessary that an improvement be made concerning the research and documentation of traditional medicinal plants.

2.1.1: Historical Documentation of Medicinal Plants

The documentation of medicinal plants and Indigenous knowledge of these plants are important for the preservation and continued passing on of information from generation to generation. The oldest written evidence of medicinal plants' usage for preparation of drugs has been found documented by the Sumerians approximately 5000 years ago (Boadu, 2017). The lack of documentation and scientific evidence surrounding these plants today causes challenges. Studies have indicated that Indigenous knowledge about traditional medicinal plants is continuously being lost through factors such as acculturation and biodiversity losses (Petrovska, 2012). Other reasons include rapid land degradation such as accelerated destruction of forests, people's access to modern medicine, and exposure to modern culture (Weldegerima, 2009). The continual documentation of these types of plants is essential for the survival of cultural information and research. Documenting medicinal plant species will help to preserve Indigenous people's cultural heritage for future generations (Savina, 2021). These cultures are spread across the world, and each have different relationships with these medicinal plants.

2.2: Traditional Medicine Worldwide

According to the WHO report on the global use of traditional medicine, 65-80% of the world's healthcare uses traditional medicine in their practices (WHO, 2019). Traditional medicine has been around for years and has contributed to the progression of humanity. With its long history, the benefits of traditional medicine have been displayed well in many countries. These countries include, but are not limited to China, Middle Eastern countries, India, Ghana, and Ecuador.

Table 1: Breakdown of countries using traditional medicine

Country	**Traditional Practices**
China	• Use psychological, physical, and herbal approaches (Tai Chi, acupuncture, herbal remedies) (U.S Department of Health and Human services, 2016)
Middle East	• Introduced the world's first pharmacies full of traditional herbs • Credited with the early medicinal use of wine, castor oil, marijuana, opium, mints and beer made from barley and wheat," for medicinal use (Azaizeh, 2006)
India	• Traditional medicine very popular in Indian households (Srinivasan *et al*, 2016) • Humans that are well are connected physically, mentally, and spiritually with nature (Shi *et al*, 2020)
Ghana	• Uses an inclusive system of traditional medicine to defend and legalize its use (Vasconi *et al*, 2011) • Uses spiritual leaders to perform traditional medicine (Vasconi *et al*, 2011)

2.2.1: Traditional Medicine in Ecuador

Traditional medicine has been present in the Andean region of Ecuador before Spanish colonization in the form of spiritual rituals, plants, minerals, and animals. Since traditional medicine has been around for many years, it is common to find traditional practices in markets all around Ecuador. Additionally in previous years and now, the Andean region of Ecuador has been known for local traditional plant trading contributing to the value of traditional medicine in Ecuadorian culture. For years traditional medicine has been used in rural and urban settings which "span all socioeconomic levels of rural and urban people." (Tinitana *et al*, 2015). Spanish influence has greatly impacted the presence of traditional medicine in Ecuador. Many cultures and belief systems contribute to the use of traditional medicine. This practice has also been used due to its affordability. According to another study by Jaramillo, traditional medicine is far cheaper than modern medicinal practices, therefore many people in Ecuador use this as their primary form of medicine. In addition, Jaramillo explains that traditional medicine is also common in Ecuador due to the vast diversity of plants found in the region (Jaramillo, 2017). As one of the most diverse regions in the world regarding nature, traditional medicine is a very common practice in Ecuador.

Additionally, a lot of medicinal plants are used in traditional ceremonies called "*limpias"* or "cleansings" where someone is cleansed with a mixture of traditional plants. It is important to note the presence of traditional medicine in Cuenca already as the city has "*Las Mujeres Que Limpian*" or "the women that clean" in the markets across the main part of the city (Drexler, 2017). They use ancestral medicine to "cleanse" and "heal" those who participate in the cleansing ceremony.

2.3: Perceptions of Medicinal Plants

For centuries plants have been used as an alternative option for medical treatments across the world (Bispo *et al*, 2021). For many, these plants are considered the only option to use for medical treatments. Medicinal plants have historically been considered safe for use; however, concerns lie around the lack of knowledge on their side effects (Lanini, 201). Most of the information about medicinal plants stems from oral recitations and ancestral knowledge, which leads many to be skeptical when using these plants (Thomas *et al*, 2020). While distrust lies within the realm of medicinal plants, if used correctly they serve as the only viable option for people across the world.

Tradition medicine has an impact on the three hundred million Indigenous people live in disadvantaged rural locations (Bodeker *et al*, 2020). This practice holds an important role for those living in poverty with limited resources to keep them alive and healthy (Mwangi, 2019). A report published by the WHO in 2013 states the increasing use and demand for traditional

medicinal plants around the world has brought challenges to public health regarding the safety, access, quality, and efficiency of these substances. The report stated that for most rural communities and Indigenous peoples, traditional medicinal plants represent the only option for disease control and prevention. This is because of the poverty found within these areas, a lack of health care services, and access to Western Medicine. Aside from Indigenous populations, interest in medicinal plants has been on the rise globally. A 2008 report states that medicinal plants have gained popularity in the last decade as 20% of the American adult population now uses them (Bent, 2008). With the rising interest it is important to better educate the public on the scientific background of these plants to lower the concern surrounding their usage.

Museo Pumapungo is aiming to involve themselves with this initiative to educate the youth on the importance of traditional medicinal plants. The museum's resources, their Andean Garden, and overall knowledge can help move Cuenca in the right direction to educate the public on the use of traditional medicinal plants.

2.4: Museo Pumapungo

Museo Pumapungo is an ethnographic and art museum in Cuenca (Figure 1). The museum holds rich cultural heritage pieces of Ecuador with onsite ruins, a ranch, a vast museum collection, and an outdoor garden. It is home to thousands of ancient artifacts and traditional medicinal plants that date back to the Incan Empire (Museo Pumapungo in Cuenca, 2019). Here tours are given to the public where they can learn about the traditional medicinal plants grown in the museum's garden. In the museum's garden over twenty plants are grown with respective plaques containing general information about them. While these plaques are unique to the museum and offer valuable information, they are not easily accessible to the public, especially during the COVID-19 pandemic. Therefore, this lack of access is contributing to the loss of knowledge surrounding traditional medicinal plants in Ecuador (Bussman *et al*, 2006).

Figure 1. Museo Pumapungo's Garden

2.4.1: Medicinal Plants at Museo Pumapungo

In Cuenca, Andean traditional medicine can be found throughout the country and in the garden of Museo Pumapungo (Orellana-Paucar *et al*, 2021). Andean traditional medicine entails that people live healthily and in harmony with their surrounding environment (Mathez-Stiefel *et al*., 2007). The plants in the garden can be found listed in Appendix A. The growth of these plants

stems back to 1978 when the museum was discovered (Pumapungo Museum, 2015). Prior to the museum, these plants were discovered by Aztec, Incan, and Maya cultures (Zola, 1980). In Ecuadorian traditional health systems, individuals such as M*amas, Taitas* and market owners have perfected the use of this type of medicine (Zambonino, 2020).

In the next chapter, we discuss the methods involved in determining the presence of traditional medicine in Cuenca, and how the knowledge of these plants can be distributed amongst the youth. It is important to note that many methods in the following chapter include strategies to first understand the presence of these plants and the following strategies include discovering how these plants are used. Altogether, the methods in the following chapter contribute to the goal of the project.

Chapter 3: Methodology

Our team worked towards identifying strategies on how to make the knowledge of using and tending medicinal plants accessible in Cuenca. To accomplish this, we wanted to understand how traditional medicinal plants are already used in Cuenca. We sought to learn about the plants, understand how they are used, and determine how common these plants are. Through this, we wanted to find a way to implement the use of traditional medicine and make it more accessible to people in Cuenca. We developed three project objectives:

1. To determine how Cuencanos access information on traditional medicinal plants
2. To identify the most used traditional medicinal plants in Cuenca
3. To document traditional medicinal practices in Cuenca

3.1: Objective 1: Determine how Cuencanos access information on traditional medicinal plants

There are many methods used by Cuencanos to access information regarding traditional medicine ranging from traditional methods through ancestral means to modern access through the internet. As of 2017, around 57.27% of Ecuador's population can access the internet from their home (Statista, 2019). While this number steadily grows every year, almost all the population that has immediate internet access lives within the cities of Ecuador. Many of the people that possess and provide ancestral knowledge are known as *Mamas* and *Taitas*. They are generally found and visited in the more rural areas of Ecuador known as *El Campo*. Understanding these methods of information retrieval through the internet, stores, friends, or old documents has helped us to identify the appropriate platform that Cuencanos prefer to access.

3.1.1: Survey

To determine a platform for use, we have administered surveys to the public of Cuenca asking questions about information retrieval regarding traditional medicine information. These surveys can be found in Appendix B. We first used a survey to get information on how different ages of Cuencanos prefer to access information on traditional medicine. This enables us to group demographics to see what platform is most preferred. Finding the data from respondents of differing ages, we then created a survey based on the results of preferred access. A second survey was administered to public respondents focusing on the preferred type of internet platform, whether it be in the form of a mobile app or online web page. From these surveys, we aimed to find information that would allow an ideal platform for the public to access information on traditional plant medicine.

3.2: Objective 2: Identify the Most Commonly Used Traditional Medicinal Plants in Cuenca

To understand traditional medicinal plant usage, we employed a survey and conducted semi-structured interviews. Surveys were administered to Cuencanos asking them questions on what medicinal plants they have used in their lifetime and what medicinal plants they use frequently. Then, semi-structured interviews were held with store owners who sell medicinal plants in Cuenca asking them their most popular items sold in stores.

3.2.1: Survey

A detailed list of questions can be found in Appendix C. This survey is designed to be brief and will also collect the participants' demographics. The survey was modeled after a survey conducted in 2004 asking the public about their preference for traditional medicinal tea (Morton, 2004). The answers gathered from this survey allowed our research to progress in narrowing down the most common traditional medicinal plants in Cuenca.

3.2.2: Semi-Structured Interview

Semi-structured interviews were held with three stores in Cuenca (see Appendix D). These stores were selected through the advice of our sponsor, Ximena Moscoso, and advisor, Gary Pollice, who were both familiar with what is sold in each store. From the interviews, we obtained a better understanding of the most common medicinal plants used in Cuenca. The stores and people interviewed are listed below:

- Nectar – Tania Lucia
- Sisay Pacha - Tanya Peñaloza and *Mama* Griselda Duchitanga
- Lupuna - Chiva Sánchez

3.3: Objective 3: Document Traditional Medicinal Practices in Cuenca

To understand how medicinal plants are used and maintained, we spoke to and observed professionals, *Taitas, Mamas,* and fieldworkers at the museum to gain insight into how the public can use these methods on their own. Fieldworkers at Museo Pumapungo have a distinct role in caring for medicinal plants at the museum. They provide all the necessary care for maintaining and keeping these plants.

3.3.1: Observation

We met with fieldworkers of Museo Pumapungo to observe how plants are tended to, seasonal effects, the tools used, the weather condition, and the common tending routine. Through these observations we can understand how to teach people how to take care of these plants at home on their own. Appendix E contains detailed notes of the observation technique.

In the next chapter, we discuss our findings from our methodology. We organized our findings in three themes:

- A preferred preference for information accessibility
- The knowledge of traditional medicinal plants amongst the youth
- More plants are more commonly used compared to others in Cuenca

Chapter 4: Findings

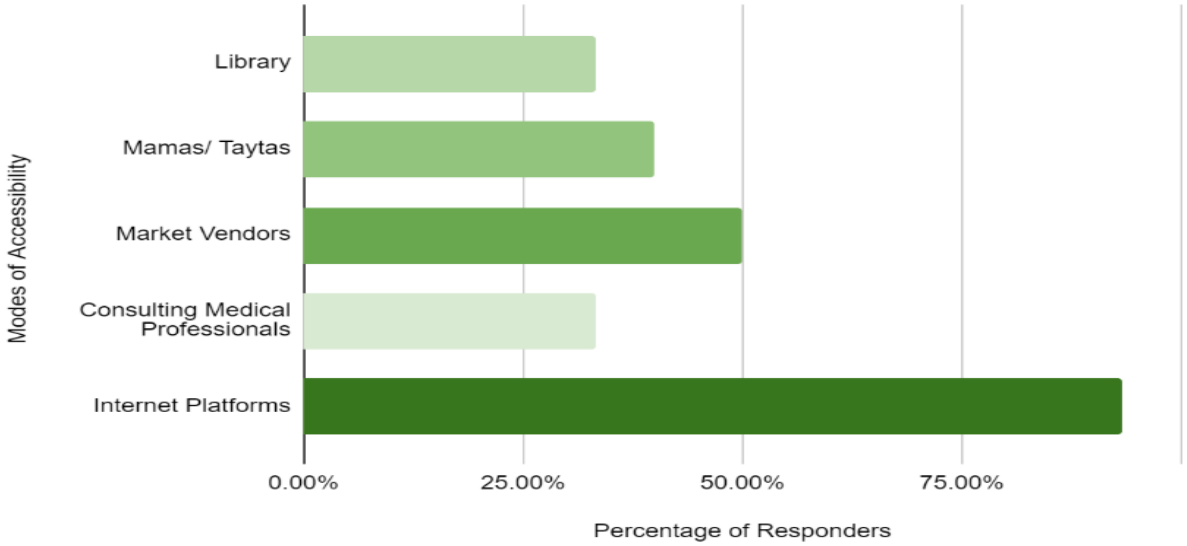
This chapter presents the data gathered from surveys, interviews, and observations. We organized our findings by project objectives. We describe the finding and discuss the implications to preserve the knowledge of traditional medicinal plants.

4.1: How the Public Access Information on Traditional Medicinal Plants

Through surveying Cuencanos, we found that our sample population prefers to access information through internet platforms. The surveys asked respondents questions surrounding what methods of information retrieval they use, along with where they tend to commonly access this specific information. The sample size of these surveys consisted of thirty respondents with an average age of 20-29 years old.

In Figure 2, we found that 93.3% of individuals reported that they prefer to use the internet when seeking information regarding traditional medicine. These individuals would not commonly seek the library, *mamas*, *taitas* or doctors for this information. With 62.1% of the respondents being within the age of 20-29, this allowed us to focus on reaching the younger populations with information on traditional medicine.

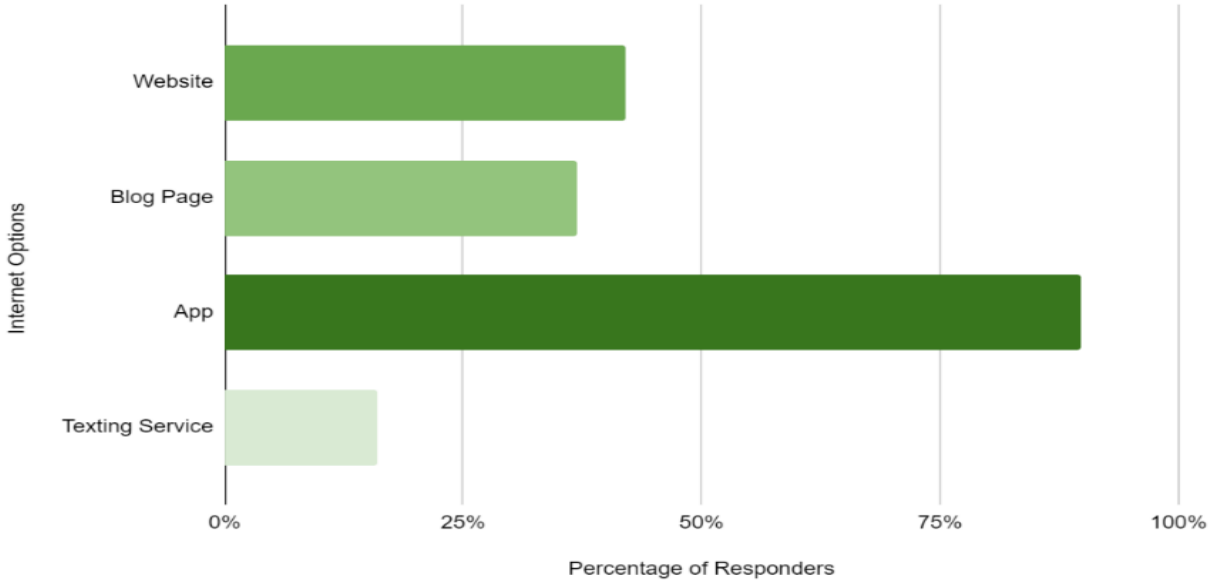
Figure 2. Survey Results on Accessibility Preference for Medicinal Plants



The second survey was created using results from the previous survey to ask what type of digital platform Cuencanos preferred to access this information. The results of this survey show that 89.9% of people with an average age of 20-29 would prefer to use an app (Figure 3). This statistic is much greater than the following options of a website or blog page leading us to infer

that people have an easier time accessing information directly from their smart phones. A digital app that can be accessible via Android or Apple smartphones is best suited to house traditional medicine information for the public.

Figure 3. Internet Accessibility Preference Survey



4.1.1: Discussion

After interpreting the survey data, we found that the internet was heavily favored when searching for information rather than any other outlet. The second digital media preference survey confirmed that an internet, app-based platform is best suited to spread this knowledge among the youth population.

4.2: Common Traditional Medicinal Plants Used in Cuenca

The survey results showed that there are certain-medicinal plants that are used more often than others in Cuenca. The survey was taken by fifty members of Cuenca with an average age of 20-29. The survey asked if they have used a specific plant in their life and if they use that plant frequently. This was conducted in person in Spanish throughout the city of Cuenca. These plants are listed in Table 2:

Table 2. Plant Names

Plant Name	English Name	Scientific Name
Cedrón	Lemon Verbena	*Silybum Marianum L.*
Mático o Hierba del Soldado	Spiked Pepper	*Piper aduncum L.*
Escancel	Bloodleaf	*Iresine sp.*
Cola de Caballo	Horsetail	*Equisetum arvense*
Borraja	Borage	*Borago officinalis L*
Sábila	Aloe vera	*Aloe vera L.*
Manzanilla	Chamomile	*Anthemis Novilis L.*
Pata con Panga	Pata con Panga	*Peperomia sp.*
Violeta Azul Comun	Violet Common	*Viola Odorata L.*
Sen	Senna	*Senna*

The results from survey are as followed in Figure 4 and Figure 5:

Figure 4. Most Common Medicinal Plants Used in One's Life

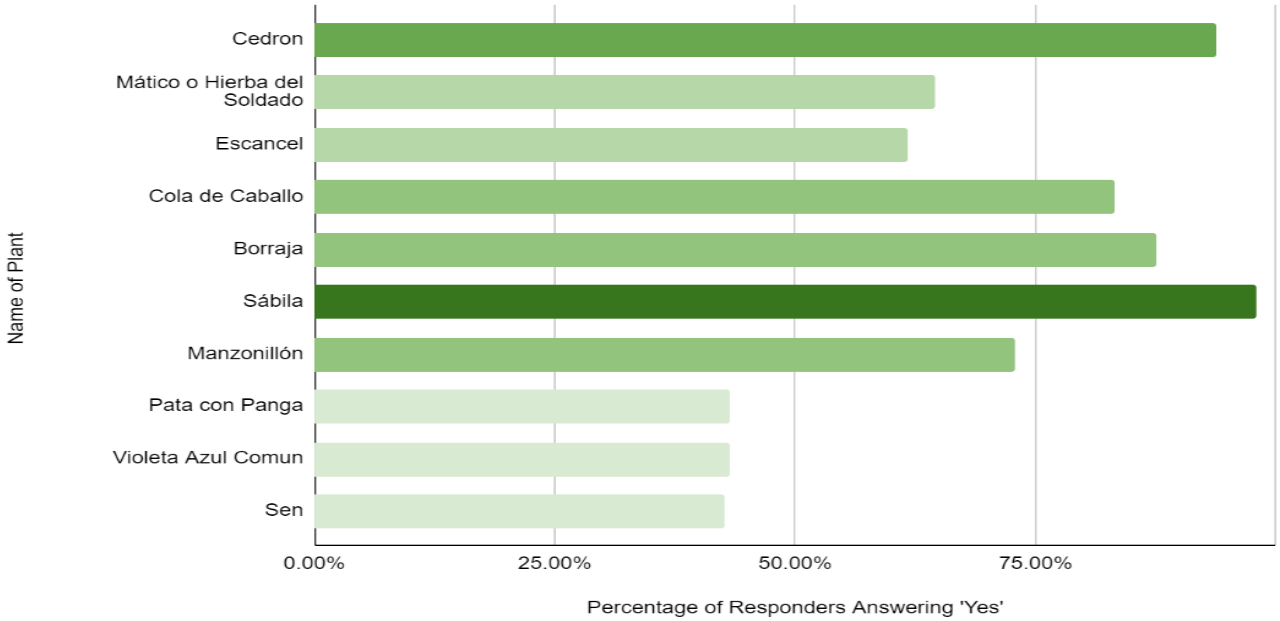
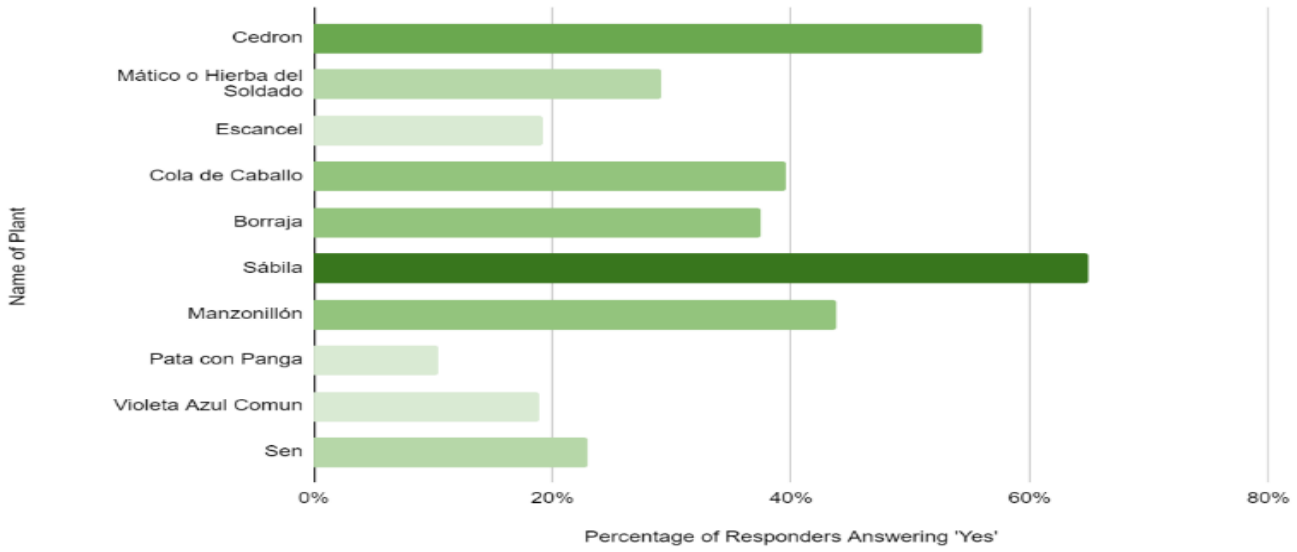


Figure 5. Most Common Medicinal Plants Used Frequently Throughout One's Life



Through these interviews, we obtained a breakdown of the ten most common traditional plants to Cuenca. A chart in Appendix F shows a detailed breakdown of the top ten plants discovered.

Through semi-structured interviews conducted with local medicinal plant market owners and store owners who understand the rich history of traditional medicinal plants in Cuenca, we were able to obtain information on the most sold and frequently purchased items. The interviews lasted for about thirty minutes in which we asked each owner five open-ended questions. These interviews confirmed our findings from the survey results.

In our first interview, we spoke with Tanya Peñaloza in the store Sisay Pacha. Here, we were provided with information on this store's top-selling medicinal plant. Tanya said that "Sen is the most popular product sold in our store; people buy it every day". Our next interview was with the store Nectar owned by Tania Lucia located in Cuenca. In this interview we learned that Cedron is most sold to be used in tea. During this interview we were also informed that traditional Andean medicine is not commonly sold. Instead, imported medications from the coast of Ecuador and the United States are more frequently purchased, especially amongst the youth (personal communication, January 26, 2022). This is due to the lack of knowledge revolving Andean medicine, as many do not know how to use traditional plants (personal communication, January 26, 2022). At the store, Lupuna owned by Chiva Sánchez, we further confirmed the results from the survey by learning the most common plants used in her products. The most common plants sold at Lupuna include *cola de caballo, mático,* and *sábila*.

In the following interviews, we interviewed *Taita* Alfonso, owner of Kushi Waira, and asked about the important plants in his practice. *Taita* Alfonso confirmed the ten plants we found

prevalent in our survey and provided more insight into information regarding how these plants are used.

4.2.1: Discussion

The top ten most used medicinal plants found from this data analysis will be used in a future app prototype for Museo Pumapungo. Through our interviews, we confirmed our survey results indicating that these plants have high popularity in Cuenca (personal communication, January 27, 2022). These popular plants such as *Pata con Panga, Escancel* and *Borraja* all have scientific evidence indicating that they can help individuals with illnesses (Kujawska, 2012). These findings will be used in a future app to educate the youth on medicinal plants.

4.3: Maintaining Traditional Medicinal Plants

By observing fieldworkers, we were able to learn about the most common traditional plants and the process by which they are cared for. The fieldworkers demonstrated their process of caring for the plants as well as providing information on their important qualities.

During observation of the fieldworkers, our team was taken through the garden of Museo Pumapungo and taught the processes of how the medicinal plants are tended to daily. The observations explained the process needed to maintain plants. We observed that plants are tended to in the early afternoon in typical Cuenca weather conditions. The plants specifically all have the same routine, needing sunlight, water, and maintenance of soil. A natural compost called *abono* is used to feed the plants. More detailed notes of this observation can be found in Appendix E.

4.3.1: Discussion

The process for tending these plants is a simple one, requiring only water from a sprinkler system two hours a day and a fertilizer referred to as *abono,* which can be seen pictured below. This process suggests that anyone can care for medicinal plants in their home. A*bono* is an organic compost that is created using material from the plants found in the park. It was an important point made by the field workers that no outside chemicals are used in the cultivation of these plants.

In the next chapter, we present our recommendations and conclusions based on our findings. We describe our design for an app which may promote the preservation of traditional medicinal plant knowledge.

Chapter 5: Recommendations and Conclusions

This chapter contains a summary of key findings and aims to provide recommendations to promote the education of traditional medicinal plants through Museo Pumapungo. We make recommendations to increase the public's access to traditional plants and suggestions to educate young people about these traditions. We believe these recommendations will begin to promote the use of traditional medicine among young people, encourage the growth of these practices in homes, and expand the use of traditional medicine.

5.1: Recommendations for Museo Pumapungo

An app prototype was created for Museo Pumapungo. This working prototype was developed to provide the necessary elements that are important to educate the youth on traditional medicinal plants. This app aims to modernize the cultural history of traditional medicine.

Figure 6a, 6b, 6c. Home Page, Table of Contents Page, Catalog Sample Page

The plant app first begins with an interactive homepage (Figure 6a) where the user can select *Empezar* to be brought to Figure 6b. Then a table of contents page (Figure 6b) was created to serve directly for each of the seven features of the app. After selecting the button, *Aprender Más,* a catalog of the ten plants found most popular during this research project are listed out with a picture of each plant taken at Museo Pumapungo. Here in Figure 6c a sample catalog is shown with six plants.

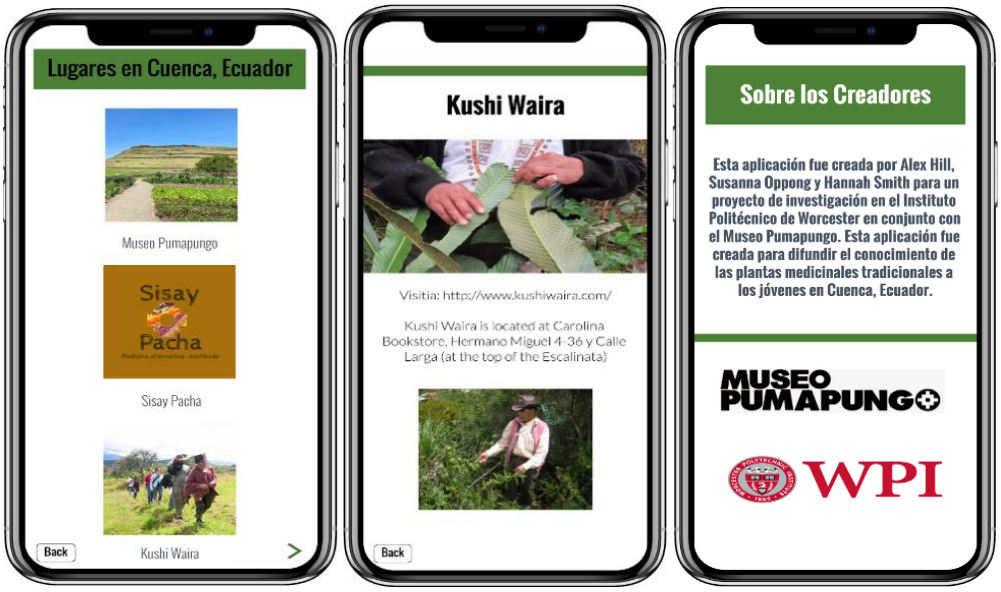
Figure 7a, 7b, 7c. Plant Home Page, Plant Information Page, Plant Benefits Page

Next after selecting a desired plant a page with the scientific name, Spanish name, English name, and a photo of the plant is provided (Figure 7a). The user can then either select an English informational page or Spanish informational page. The Spanish sample page can be seen in Figure 7b. Here, general information about the plant is provided from research done during this project. A button is also on this page to direct the user to a new page called *Beneficios/Cómo Usar*. A sample page of how to use the plant can be seen in Figure 7c. This page was created to provide scientific information about each respective plant in a concise manner to engage the youth of Cuenca. This page also provides a link to a home recipe on how to eat the plant along with a scientific journal article on research conducted on this plant.

Figure 8a, 8b, 8c. Problem Diagnoses Page, Stories of Success, About Medicinal Plants Page

Next, is a page called *Cuál es el Problema* (Figure 8a) which was coded to be an interactive aspect of the app to engage the youth. This page allows the user to tap which part of their body needs treatment and they will then be directed to the correct plant for that part of their body. The *Historias de Éxito* page was created to provide the youth with traditional stories from members of the Cuenca community. This page (Figure 8b) has four stories of success for the users to watch and learn from. The page *Sobre Plantas Medicinales* (Figure 8c) was created to provide the user with information about medicinal plants and Museo Pumapungo history. This information was gathered through our interviews, observations, and research during this investigation.

Figure 9a, 9b, 9c. Places Near Me, Store Sample Page, About the Creators Page

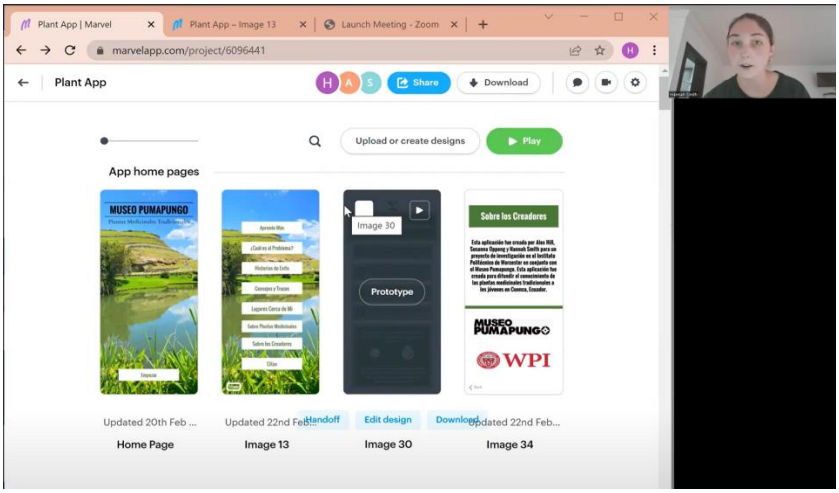


The last page includes stores and organizations in Cuenca with their location and store name (Figure 9a). These were all stores we conducted interviews with. The reason for including this page in the app is so the youth can visit places near them to purchase medicinal plants and learn about their history. Here in Figure 9b a sample page from the store Kushi Waira is shown. The included information was the website link and a general description of the location. The last page from the table of contents is about the creator's page (Figure 9c). Here is a description about the research project itself and the creators of the app.

Figure 10a, 10b. Tending to Plants and Citations Page

A page of how to tend to the plants was included in the app. This information stemmed from observations of the Museo Pumapungo fieldworkers to help those at home grow their own traditional medicinal plants (Figure 10a). A page of citations was included to indicate sources used in the app itself and other scientific articles used throughout the duration of this research project (Figure 10b).

Figure 11. App Demonstration Video Screenshot



A video was additionally made to how to make edits within the app protype software, Marvel. This was made in Spanish to aid Museo Pumapungo in making future edits and additions in the app so it can then be published for public use.

Video Demonstration on How to Edit App

Figure 12. Video Demonstration Screenshot

A video demonstration of how to navigate through the app can be seen below. This was created to give an accurate representation on how the app prototype would look if published for Android or Apple devices.

App Demonstration Video

At the completion of our project, we offer recommendations to increase the use of traditional medicine in Cuenca. Our recommendations are for promoting the use of traditional medicinal plants in Cuencano young adults.

We recommend that a program can be introduced at Museo Pumapungo. We found that there are limited resources available in Cuenca to engage the youth in learning about traditional medicinal plants. To overcome this obstacle an interactive and informative program could be introduced to Museo Pumapungo for children in elementary and middle school. This would allow for students to visit the museum's garden and learn lessons about the importance of these plants, therefore leading to a continuation of historical knowledge.

We recommend that a full catalog of plants and their respective information are added to the app prototype. Through the surveys and interviews conducted in this research it is important to continue publishing information from all the plants in Museo Pumpapungo's garden in addition to the ten used in this report. Further observations on how to tend to the plants and interviews with store owners, *mamas,* and *taitas* a complete catalog of information for each plant can be created and implemented into an app for Museo Pumapungo.

We recommend that interactive demonstrations of how to use the plants are added to the app prototype. Using the information gathered on how people prefer to find information regarding traditional medicine plants, we concluded that an app prototype is best suited for holding this information. As previously outlined, many people do not know how to tend and cultivate these plants which requires a few steps. Within an app prototype, the inclusion of

demonstrations and steps on how to care for these plants and use them can help expand the knowledge.

5.2: Conclusions

We found three areas to improve public education of traditional medicine: knowledge of plants, accessibility to plant information, and ability to care for plants. These issues can be addressed by our recommendations in Museo Pumapungo's app prototype.

Knowledge of Plants: Education is Necessary for the Preservation of Plant Knowledge
We found that there is a lack of education among Cuencano youth about traditional medicinal plants and it is necessary for the knowledge of these plants to be passed on for them to be used. In personal communication with our sponsors and interviewees, we learned that store owners have a desire to educate people about these traditional plants so the public would be more inclined to use them. The largest obstacle store owners mentioned is this lack of education. People do not buy plants because they do not know what they do or how to use them. Store Owner Tanya Peñaloza of Sisay Pacha stated, "Education about traditional medicines is a problem here, young people don't know it" (personal communication, January 27, 2022). Many other store owners confirmed this, Chiva of Lupuna stating "many young people do not use traditional medicine because they believe they are already healthy and do not need it" (personal communication February 2, 2022). This demonstrates the lack of education as traditional medicine can be used for much more than just physical ailments. Thus, education is necessary to promote the use of traditional plants.

Ability to care for plants: Instruction and Guidance Needed
Guidance to care for plants is necessary to promote the use of these plants. We concluded after observing field workers at Museo Pumapungo, that the ability to care for these plants is possible and feasible (observation February 3, 2022). There are not a lot of steps required. We learned that in the whole garden of Museo Pumapungo (which is a couple of acres large) there are only five workers maintaining all the plants in the garden. We concluded that in order to promote the use of traditional plants, there must be a way for plant owners to learn how to tend to their plants. Currently, the only way of passing this instruction on is by word of mouth. Although this has been effective on a small scale, to increase the use of traditional medicinal plants overall, there must be a resource apart from this. By including instructions to care for traditional plants, people in Cuenca will be able to use these plants and have access to them at home.

Accessibility to Plants in Cuenca Needs to Appeal to the Youth
Accessibility to plant knowledge is an obstacle many Cuencano people face regarding traditional medicine. Although there are traditional medicine stores in the city (Nectar, Sisay Pacha, etc.) there are an abundance of pharmacies with modern medicine for Cuencanos to use. Many young

people here are more inclined to using modern medicine because they do not readily have access to information on traditional medicine (personal communication, February 3, 2022). We found through our survey that 93.3% of people use the internet to access information about traditional medicine, with 62.1% of our responders being of the age 20-29. We further found that 89.9% of participants would like to see this information published in an app. The drawbacks here lie within how easy it is for young people to get information. Our survey showed that they are not talking to experts in traditional medicine but are firmly relying on the internet when they need to know more about traditional medicines.

Museo Pumapungo, although another good resource to learn about traditional medicine, is not widely used by the public. During our time there, we asked questions about plants that all the workers had answers to and concluded the effectiveness of this resource to the public in learning about plants. Since the start of the pandemic, the museum has had a sharp decline in visitors, and no longer have many people visited the park and learned about traditional plants (personal communication, February 3, 2022). Although this method of educating the public is effective for those who visit the museum, there are some drawbacks in terms of outreach.

Project Impact

Traditional medicine has played its role in Andean history since the origin of the country. To continue to develop the rich history of traditional medicine, there must be a way for the public and youth of Cuenca to easily access this information and learn from it. We believe the app prototype will have an impact on preserving the knowledge of traditional medicine. As Cuenca is developing and modernizing, its traditions must be kept, and we believe the creation of this app will jumpstart that initiative and encourage other Cuencano traditions to be documented in this way.

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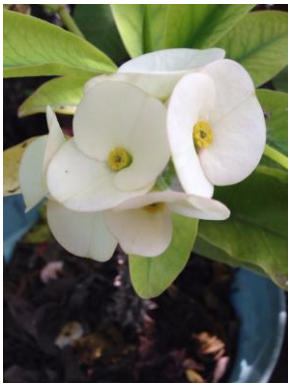
Appendix A: Plants found in Pumapungo

Plant Name	Picture	Benefits/Usage
Cedron		● Improves digestion ● Helps treat diarrhea ● Helps control nerves and anxiety ● It helps you lose weight ● Helps control allergic reactions ● Reduces inflammation and abdominal swelling ● Promotes the elimination of toxins from the body ● Helps to treat irritable bowel syndrome ● Helps control pain and stomach spasms ● Helps prevent wounds from becoming infected ● It is effective to treat insomnia ● Helps to treat migraines and headaches ● Helps control rheumatic pain
Abejón		● Used as a laxative, antimicrobial and fungicide
Pata con Panga		● Relieving the flu, it is a cardiac stimulant and provides relief for migraines, it is useful for earaches

Mático o Hierba del Soldado		• Healing. • Antihemorrhagic. • Digestive. • Gastroprotective. • Astringent. • Depurative. • Diuretic. • Analgesic. • Pain relieving. • Antitussive. • Bactericidal or antibacterial. • Anti-inflammatory. • antioxidants.
Escancel		• Lungs • Colds • catarrh • Angina • Chest discomfort, and pneumonia
Huda Arruda o Armaga		• elimination of intestinal worms • treat cysts
Violeta Azul Común		• Used against vomiting • Improves gastritis • Is a laxative • Lowers fever
Borraja		• Fever • Cough • Depression

Flor de Cristo Blanco		• Latex to remove warts.
Canaro		• analgesic properties against headaches • Anticatarrhal • stomach and antidiarrheal activity • Anti-inflammatory • Antispasmodic activity • digestive hyperacidity • gastric hypersecretion
Pajuro		• Used against cough and lung ailments. • It is astringent and hemostatic and is used to stop external hemorrhages and diarrhea.
Sabila		• Stimulates hair growth • Remove dandruff • Prevent hair loss • Cleanses the deep layers of the skin • Soothes skin irritations
Aranto o Espinazo del Diablo		• Antibacterial • For allergy • For muscles • For blood • For the nervous system • For fluid retention • For the skin

Bromelia		• treatment of respiratory diseases • Diabetes • inflammation • gastrointestinal disorders
Quishuar		• Antirheumatic • antibacterial and antifungal, • stimulate the proliferation of the endometrium • regenerate the skin
Guasimo		• Helps abdominal pain, cramping • Prevents hair loss
Joyapa		• laxative herb. • increase water loss
Pintor Laurel		• prevents flu, colds • helps improve the immune system in general • prevents nerve problems in fetuses • improves hormone production • regulates the function of organs • nerves and muscles • controls blood sugar levels.
Chilca o Chilca Blanca		• treat wounds • bruises • injuries

Campanilla Azul		• improves memory, since it raises the levels of the neurotransmitter acetylcholine • reduce anxiety and stress
Manzonillon		• Helps calm the nerves and works as a relaxant, as it increases the levels of serotonin and melatonin that help reduce anxiety and stress. • It is also used to combat problems such as insomnia, as it contains apigenin, an antioxidant that is needed to promote drowsiness by calming the nervous system. • This plant also contains antispasmodic and anti-inflammatory properties that help calm the ailments caused by menstruation such as swelling, cramps, anxiety, sweating and sudden mood swings that occur during that time of the month.
Congona		• Otitis, • Conjunctivitis • Antibacterial • Antifungal • Carminative • Digestive • Cardiotonic • Antimigrainal • Pectoral • Healing

		• Menstrual • Renal and hepatic disorders
Floripondio		• induce hallucinations/euphoria. • treat asthma.
Cola de Caballo		• fluid retention • urinary tract infections (UTIs) • Osteoporosis • loss of bladder control

Appendix B: Survey on Accessibility

In order to determine how people in Cuenca access information we have created a survey that will be distributed to the people of Pumapungo Museum. The survey is designed to last 5 minutes and appears as the following:

This survey will ask you several questions about how you most commonly access information about traditional medicines. Please answer yes or no to the following questions. By completing this survey, you are providing consent for us to use your data to formulate materials and recommendations for how to access traditional plant information in the city of Cuenca. If any of these questions make you uncomfortable, you can skip the questions as all are optional and can withdraw from the process at any time.

For more information about this research or about your rights as a research participant, please contact any of the involved below:

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All of your responses will be anonymous and your identity will remain confidential throughout the entirety of our study. Please answer the questions by saying yes or no. Questions:

Part 1:

Access to Traditional Medicine Information Survey	
Questions	Responses
What age group are you in?	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+

I have web access at anytime through the day	Yes No
I have trouble with internet access from my home	Yes No
I have a smart phone with internet access	Yes No
I go to a library in order to find information on traditional medicine	Yes No
I go to the doctor for traditional medicine recommendations	Yes No
I go to taitas or mamas for information on traditional medicine	Yes No
I prefer physical documents with traditional plant information	Yes No
I prefer to use the internet when looking for information regarding traditional plants	Yes No
I would prefer a physical document over a online document for information about traditional medicine	Yes No

Part 2:

Access to Traditional Medicine Information Survey	
Questions	Responses
What age group are you in?	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+

I would prefer to use a website to access information about traditional medicinal plants	Yes No
I would prefer to use a blog post site to access information about traditional medicinal plants	Yes No
I would prefer to use an app to access information about traditional medicinal plants	Yes No
I would prefer to use a texting service to access information about traditional medicinal plants	Yes No

Con el fin de determinar cómo las personas en Cuenca acceden a la información, hemos creado una encuesta que se distribuirá a la gente del Museo Pumapungo. La encuesta está diseñada para durar 5 minutos y aparece de la siguiente manera:

Esta encuesta le hará varias preguntas sobre cómo accede con mayor frecuencia a la información sobre las medicinas tradicionales. Por favor, responda sí o no a las siguientes preguntas. Al completar esta encuesta, usted está dando su consentimiento para que usemos sus datos para formular materiales y recomendaciones sobre cómo acceder a la información tradicional de la planta en la ciudad de Cuenca. Si alguna de estas preguntas lo hace sentir incómodo, puede omitir las preguntas, ya que todas son opcionales y puede retirarse del proceso en cualquier momento.

Para obtener más información sobre esta investigación o sobre sus derechos como participante de la investigación, comuníquese con cualquiera de los involucrados a continuación:

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Todas sus respuestas serán anónimas y su identidad permanecerá confidencial durante todo nuestro estudio. Por favor, responda a las preguntas diciendo sí o no. Preguntas:

Parte 1:

Acceso a la Encuesta de Información sobre Medicina Tradicional	
Preguntas	Opciones de Respuestas

¿En qué grupo de edad te encuentras?	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+
Tengo acceso a la web en cualquier momento del día	Sí No
Tengo problemas con el acceso a Internet desde mi casa	Sí No
Tengo un teléfono inteligente con acceso a Internet	Sí No
Voy a una biblioteca para encontrar información sobre medicina tradicional	Sí No
Voy al médico para obtener recomendaciones de medicina tradicional	Sí No
Voy a taitas o mamás para obtener información sobre medicina tradicional	Sí No
Prefiero documentos físicos con información tradicional de la planta	Sí No
Prefiero usar internet cuando busco información sobre plantas tradicionales	Sí No

Preferiría un documento físico a un documento en línea para obtener información sobre la medicina tradicional	Sí No

Parte 2:

Acceso a la Encuesta de Información sobre Medicina Tradicional	
Preguntas	Opciones de Respuestas
¿En qué grupo de edad te encuentras?	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+
Preferiría usar un sitio web para acceder a información sobre plantas medicinales tradicionales	Sí No
I would prefer to use a blog post site to access information about traditional medicinal plants	Sí No
Preferiría usar una aplicación para acceder a información sobre plantas medicinales tradicionales	Sí No
Preferiría utilizar un servicio de mensajes de texto para acceder a información sobre plantas medicinales tradicionales.	Sí No

Appendix C: Survey of Medicinal Plants

In order to gauge the most common medicinal plants used by the people of Cuenca a survey was distributed to visitors of Museo Pumapungo. The survey is designed to last approximately 10 minutes and will appear as the following:

This survey will ask you several questions asking what traditional medicinal plants you most commonly use. Please answer the questions by selecting yes or no. By completing this survey you are providing consent for us to use your data to formulate materials and recommendations for traditional medicinal plant knowledge in Cuenca. If any of these questions make you uncomfortable, you can skip the question as all are optional and can withdraw from the process at any time.

For more information about this research or about your rights as a research participant, please contact any of the involved below:

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All of your responses will be anonymous and your identity will remain confidential throughout the entirety of our study. Please answer the questions by saying yes, no or I have never heard of this. Questions:

Medicinal Plant Preference Survey	
Questions	Response Options
What age group are you in?	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+

I have used *Cedron* in my life	Yes No I have never heard of this
I use *Cedron* frequently	Yes No I have never heard of this
I have used *Abejón* in my life	Yes No I have never heard of this
I use *Abejón* frequently	Yes No I have never heard of this
I have used *Pata con Panga* in my life	Yes No I have never heard of this
I use *Pata con Panga* frequently	Yes No I have never heard of this
I have used *Mático o Hierba del Soldado* in my life	Yes No I have never heard of this
I use *Mático o Hierba del Soldado* frequently.	Yes No I have never heard of this
I have used *Escancel* in my life	Yes No I have never heard of this
I use *Escancel* frequently	Yes No I have never heard of this
I have used *Huda Arruda o Armaga* in my life	Yes No I have never heard of this

I use *Huda Arruda o Armaga* frequently	Yes No I have never heard of this
I have used *Violeta Azul Común* in my life.	Yes No I have never heard of this
I use *Violeta Azul Común* frequently.	Yes No I have never heard of this
I have used *Borraja* in my life	Yes No I have never heard of this
I use *Borraja* frequently	Yes No I have never heard of this
I have used *Flor de Cristo Blanco* in my life	Yes No I have never heard of this
I use *Flor de Cristo Blanco* frequently.	Yes No I have never heard of this
I have used *Canaro* in my life	Yes No I have never heard of this
I use *Canaro* frequently	Yes No I have never heard of this
I have used *Pajuro* in my life	Yes No I have never heard of this
I use *Pajuro* frequently	Yes No I have never heard of this

I have used *Cactus o Tuna* in my life	Yes No I have never heard of this
I frequently use *Cactus o Tuna*	Yes No I have never heard of this
I have used *Sabila* in my life	Yes No I have never heard of this
I use *Sabila* frequently	Yes No I have never heard of this
I have used *Aranto o Espinazo del Diablo* in my life	Yes No I have never heard of this
I use *Aranto o Espinazo del Diablo* frequently	Yes No I have never heard of this
I have used *Bromelia* in my life	Yes No I have never heard of this
I use *Bromelia* frequently	Yes No I have never heard of this
I have used *Quishuar* in my life	Yes No I have never heard of this
I use *Quishuar* frequently	Yes No I have never heard of this
I have used *Guasimo* in my life	Yes No I have never heard of this

I use *Guasimo* frequently.	Yes No I have never heard of this
I have used *Joyapa* in my life	Yes No I have never heard of this
I use *Joyapa* frequently	Yes No I have never heard of this
I have used *Pintor Laurel* in my life	Yes No I have never heard of this
I use *Pintor Laurel* frequently	Yes No I have never heard of this
I have used *Chilca o Chilca Blanca* in my life	Yes No I have never heard of this
I use *Chilca o Chilca Blanca* frequently	Yes No I have never heard of this
I have used *Campanilla Azul* in my life	Yes No I have never heard of this
I use *Campanilla Azul* frequently	Yes No I have never heard of this
I have used *Manzonillon* in my life	Yes No I have never heard of this
I frequently use *Manzonillon*	Yes No I have never heard of this

I have used *Congona* in my life	Yes No I have never heard of this
I frequently use *Congona*	Yes No I have never heard of this
I have used *Floripondio* in my life	Yes No I have never heard of this
I frequently use *Floripondio*	Yes No I have never heard of this
I have used *Cola de Caballo* in my life	Yes No I have never heard of this
I frequently use *Cola de Caballo*	Yes No I have never heard of this

Con el fin de evaluar las plantas medicinales más comunes utilizadas por la gente de Cuenca, se distribuirá una encuesta a los visitantes del Museo Pumapungo. La encuesta está diseñada para durar aproximadamente 10 minutos y aparecerá de la siguiente manera:

Esta encuesta le hará varias preguntas sobre qué plantas medicinales tradicionales usa con más frecuencia. Responda las preguntas seleccionando sí o no. Al completar esta encuesta, usted está dando su consentimiento para que usemos sus datos para formular materiales y recomendaciones para el conocimiento de las plantas medicinales tradicionales en Cuenca. Si alguna de estas preguntas lo hace sentir incómodo, puede omitir la pregunta ya que todas son opcionales y puede retirarse del proceso en cualquier momento.

Para obtener más información sobre esta investigación o sobre sus derechos como participante de la investigación, comuníquese con cualquiera de los involucrados a continuación:

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Todas sus respuestas serán anónimas y su identidad permanecerá confidencial durante la totalidad de nuestro estudio. Por favor conteste las preguntas diciendo sí, no o Nunca he oído hablar de esto. Preguntas:

Encuesta de Preferencia de Plantas Medicinales	
Preguntas	Opciones de Respuesta
En que grupo de edad estas	<10 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80+
He usado Cedron en mi vida	Sí No Nunca he oído hablar de esto
Uso Cedron con frecuencia	Sí No Nunca he oído hablar de esto
He usado Abejón en mi vida	Sí No Nunca he oído hablar de esto
Uso Abejón con frecuencia	Sí No Nunca he oído hablar de esto
He usado Pata con Panga en mi vida	Sí No

	Nunca he oído hablar de esto
Yo uso Pata con Panga con frecuencia	Sí No Nunca he oído hablar de esto
He usado Mático o Hierba del Soldado en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Mático o Hierba del Soldado con frecuencia	Sí No Nunca he oído hablar de esto
He usado Escancel en mi vida	Sí No Nunca he oído hablar de esto
Uso Escancel con frecuencia	Sí No Nunca he oído hablar de esto
He usado Huda Arruda o Armaga en mi vida	Sí No Nunca he oído hablar de esto
Uso Huda Arruda o Armaga con frecuencia	Sí No Nunca he oído hablar de esto
He usado Cola de Caballo en mi vida	Sí No Nunca he oído hablar de esto
Uso Cola de Caballo con frecuencia	Sí No Nunca he oído hablar de esto
He usado Violeta Azul Comun en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Violeta Azul Comun con frecuencia	Sí

	No Nunca he oído hablar de esto
He usado Borraja en mi vida	Sí No Nunca he oído hablar de esto
Uso Borraja con frecuencia	Sí No Nunca he oído hablar de esto
He usado Flor de Cristo Blanco en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Flor de Cristo Blanco con frecuencia	Sí No Nunca he oído hablar de esto
He usado Cactus o Tuna en mi vida	Sí No Nunca he oído hablar de esto
Uso Cactus o Tuna con frecuencia	Sí No Nunca he oído hablar de esto
He usado Sábila en mi vida	Sí No Nunca he oído hablar de esto
Uso Sábila con frecuencia	Sí No Nunca he oído hablar de esto
He usado Aranto o Espinazo del Diablo en mi vida	Sí No Nunca he oído hablar de esto
Uso frecuentemente Aranto o Espinazo del Diablo	Sí No Nunca he oído hablar de esto

He usado Cactus largo en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Cactus largo con frecuencia	Sí No Nunca he oído hablar de esto
He usado Quishuar en mi vida	Sí No Nunca he oído hablar de esto
Uso Quishuar con frecuencia	Sí No Nunca he oído hablar de esto
He usado Guasimo en mi vida	Sí No Nunca he oído hablar de esto
Uso guasimo con frecuencia	Sí No Nunca he oído hablar de esto
He usado Joyapa en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Joyapa con frecuencia	Sí No Nunca he oído hablar de esto
He usado Pintor Laurel o Ce en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Pintador Laurel o Ce con frecuencia	Sí No Nunca he oído hablar de esto
He usado Chilca o Chilca Blanca en mi vida	Sí No Nunca he oído hablar de esto

Yo uso Chilca o Chilca Blanca frecuentemente	Sí No Nunca he oído hablar de esto
He usado Campanilla Azul en mi vida	Sí No Nunca he oído hablar de esto
Uso Campanilla Azul con frecuencia	Sí No Nunca he oído hablar de esto
He usado Manzonillon en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Manzanillon con frecuencia	Sí No Nunca he oído hablar de esto
He usado Congona en mi vida	Sí No Nunca he oído hablar de esto
Yo uso Congona con frecuencia	Sí No Nunca he oído hablar de esto
He usado Floripondio, Wantuk o Guanto en mi vida	Sí No Nunca he oído hablar de esto
Uso frecuentemente Floripondio, Wantuk o Guanto	Sí No Nunca he oído hablar de esto

Appendix D: Semi-Structured Interview with Local Stores

Semi-structured interviews will be used to understand the most common medicinal plants in Cuenca. Traditional medicinal plant store owners will be asked five specific questions to lead into an open-ended conversation. The goal of these interviews is to understand the store owners' top selling products and information regarding those products. The interviews will be conducted with Nectar, Sisay Pacha, and Lupuna.

This semi-structured interview will last approximately 30 minutes. The first half of the interview will be based on structured questions while the last half will be used for a free discussion. The data you provide us with will assist us in understanding of traditional medicinal plants and help us determine the best strategies to better educate the public on the use of this practice. If any of these questions make you uncomfortable, you can skip the question as all are optional and can withdraw from the process at any time.

For more information about this research or about your rights as a research participant, please contact any of the involved below:

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All of your responses will be anonymous, and your identity will remain confidential throughout the entirety of our study. Questions:

1. What are the top three most sold traditional medicinal plants in your store?
2. What age group do you most commonly see buying these top products?
3. How frequently do people come in to buy these specific products?
4. How frequently do you restock these top selling products?
5. Anything else you would like to tell us about your top selling product

Esta entrevista semiestructurada tendrá una duración aproximada de 30 minutos. La primera mitad de la entrevista se basará en preguntas estructuradas, mientras que la última mitad se utilizará para una discusión libre. Los datos que nos proporcione nos ayudarán a comprender las plantas medicinales tradicionales y nos ayudarán a determinar las mejores estrategias para educar mejor al público sobre el uso de esta práctica. Si alguna de estas preguntas lo hace sentir incómodo, puede omitir la pregunta ya que todas son opcionales y puede retirarse del proceso en cualquier momento.

Para obtener más información sobre esta investigación o sobre sus derechos como participante de la investigación, comuníquese con cualquiera de los involucrados a continuación:

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Todas sus respuestas serán anónimas y su identidad permanecerá confidencial durante la totalidad de nuestro estudio. Preguntas:

1. ¿Cuáles son las tres plantas medicinales tradicionales más vendidas en su tienda?
2. ¿Qué grupo de edad ve con mayor frecuencia comprando estos productos principales?
3. ¿Con qué frecuencia viene la gente a comprar estos productos específicos?
4. ¿Con qué frecuencia repone estos productos más vendidos?
5. ¿Cualquier otra cosa que le gustaría decirnos sobre su producto más vendido?

Appendix E: Observing Plant Fieldworkers

The observation method will be used to obtain information on plant tending and keeping through fieldworkers at Museo Pumapungo. The following demonstrates an example for note keeping when observing the fieldworkers:

Topics:	**Notes:**
Plant being tended to:	Fieldworkers discussed various plants, all with the same routine.
Hour of the Day:	Early Afternoon
Tools Used:	Rake, sprinkler
Weather Conditions:	Extremely sunny, temperate weather
Tending Routine:	Allow sprinklers to water plants for two hours a day, five days a week. Rake surrounding and add fertilizer (*Abono*) weekly.

For more information about this research or about your rights as a research participant, please contact any of the involved below:

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El método de observación se utilizará para obtener información sobre el cuidado y mantenimiento de las plantas a través de los trabajadores de campo en el Museo Pumapungo. A continuación, se muestra un ejemplo para tomar notas cuando se observa a los trabajadores de campo:

Temas:	**Notas:**
Planta que se está cuidando:	Los trabajadores de campo discutieron varias plantas, todas con la misma rutina.
Hora del día:	Temprano en la tarde
Instrumentos utilizados:	Rastrillo, aspersor
Las condiciones climáticas:	Extremadamente soleado, clima templado
Rutina de atención:	Permita que los aspersores rieguen las plantas durante dos horas al día, cinco días a la semana. Rastrille los alrededores y agregue fertilizante (Abono) semanalmente.

Para obtener más información sobre esta investigación o sobre sus derechos como participante de la investigación, comuníquese con cualquiera de los involucrados a continuación:

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Appendix F: Top Ten Plant Table

Plant Name	English Name	Scientific Name	Photo
Cedrón	Lemon Verbena	*Silybum Marianum L.*	
Mático o Hierba del Soldado	Spiked Pepper	*Piper aduncum*	
Escancel	Bloodleaf	*Iresine sp.*	
Cola de Caballo	Horsetail	*Equisetum arvense*	
Borraja	Borage	*Borago officinalis L*	

Sábila	Aloe vera	*Aloe vera L.*	
Manzanilla	Chamomile	*Matricaria chamomilla*	
Pata con Panga	Pata con Panga	*Pelargonium Graveolens.*	
Violeta Azul Comun	Common Violet	*Viola Odorata L.*	
Cactus o Tuna	Cactus o Tuna	*Opuntia Tuna*	
Sen	Senna	*Senna*	

Appendix G: Recommendations for Future Researchers

From the field work completed with Museo Pumapungo, market owners, store owners, and the public we determined that there are further areas of growth for this social science research project.

1. **Using an experienced translator when speaking with Ecuadorian store owners.**

It is important to be prepared for situations when you are conducting interviews with a language barrier. For example, an obstacle faced during this research project was when interviews were held with people who spoke *kichwa* (a Quechuan language used in Ecuador, Columbia, and parts of Peru). Preparing with prior communication through online platforms to determine what the language barriers are will make for an easier interview.

2. **Having strong background research on the historical elements used in the country your fieldwork is conducted in.**

It is important to understand the culture of the country you are conducting your fieldwork in prior to beginning the methodologies' objectives. For example, traditional Ecuadorian *limpias* have specific courtesies and traditions you need to be familiar with before receiving the cleanse. To overcome this obstacle, communication with locals, blog posts, and online videos of people from the country can help prepare you with the knowledge needed to successfully interact with the stakeholder in the respective situation.