Hybridization between biomedicine and alternative medicine in COVID-19 care in a neo-rural population of Córdoba, Argentine

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ABSTRACT

We propose to investigate if the use and knowledge of medicinal plants and alternative medicine influence the adoption of biomedical strategies in dealing with COVID-19 - such as the use of masks, social isolation, and vaccination - in a context of a neo-rural population. The "neo-ruralism" phenomenon is a gradual displacement of urban middle classes to small rural locations. We collected data through online questionnaires, using the Google Forms platform in the "Paravachasca Valley", Córdoba, Argentine. Our sample size was 208 people. The questionnaires, anonymous, contained multiple choice questions about attitudes and opinions concerning prophylactic strategies against COVID-19. To test whether the use or knowledge of medicinal plants is associated with trust in the efficiency and adoption of biomedical strategies, we used a chi-square test of independence. We verified that the knowledge about medicinal plants is related to distrust and reluctance to the adoption of the use of masks, social isolation, and vaccination. Also, our results suggest that alternative medicine users are afraid of the vaccine effects. In this plural medical context of a neo-rural population, belief in alternative medicines for the treatment of COVID-19 can be an obstacle to immunization programs.

Keywords: Vaccine hesitancy; Social isolation; Use of masks; Medicinal plants; Urban Ethnobiology.

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RESUMEN

Nos propusimos investigar si el uso y conocimiento de las plantas medicinales y medicinas alternativas influyen en la adopción de estrategias biomédicas ante el COVID-19 - como el uso de mascarillas, el aislamiento social y la vacunación - en un contexto neorrural. El fenómeno del "neoruralismo" es un desplazamiento gradual de las clases medias urbanas hacia pequeñas localidades rurales. La recolección de datos se realizó a través de cuestionarios en línea, utilizando la plataforma Google Forms en el Valle de Paravachasca, Córdoba, Argentina. El tamaño muestral alcanzó 208 personas. Los cuestionarios, anónimos, contenían preguntas de opción múltiple sobre actitudes y opiniones sobre estrategias profilácticas contra el COVID-19. Para comprobar si el uso o conocimiento de las plantas medicinales está asociado con la confianza en la eficiencia y la adopción de estrategias biomédicas, utilizamos una prueba de independencia de chi-cuadrado. Verificamos que el conocimiento sobre plantas medicinales está relacionado con la desconfianza y la renuencia a la adopción del uso de mascarillas, el aislamiento social y la vacunación. Además, nuestros resultados sugieren que los usuarios de medicina alternativa temen los efectos de la vacuna. Proponemos que en este contexto médico plural de una población neorrural, la creencia en medicinas alternativas para el tratamiento del COVID-19 puede ser un obstáculo para los programas de inmunización.

Palabras claves: Reticencia a la vacunación: aislamiento social; uso de mascarillas; plantas medicinales; Etnobiología urbana.

SIGNIFICANCE STATEMENT

We aimed to analyze if the use and knowledge of medicinal plants and alternative medicine influence the adoption of biomedical strategies in dealing with COVID-19 in a context of a neo-rural population. The main contribution of the manuscript is the discussion that in a plural medical context of a neo-rural population, belief in alternative medicines for the treatment of COVID-19 can be an obstacle to immunization programs.

INTRODUCTION

The hybridization of biomedicine with traditional or alternative medicine has been widely discussed in ethnobiological literature (Ladio and Albuquerque 2014; Nascimento et al. 2018; Santos et al. 2023). Ethnobiologists aim to understand possible processes of competition or complementation, among several sub-processes that permeate the interaction of medical systems (Ladio and Albuquerque 2014). The tragic context of the COVID-19 pandemic has opened an interesting perspective of analysis on the use of different medical systems since people all over the world needed to seek treatments from different sources for a completely new disease. In this context of instability, the search for new information about prevention and treatment is favored (Soldati et al. 2015) and the hybridization process could gain space in human groups of different origins.

During the pandemic, the different medical systems had to adapt quickly. From a biomedical point of view, information was constantly updated by scientific committees and health authorities, but three strategies have been established as essential to deal with the SARS-CoV-2 virus: the use of masks, isolation, and vaccination. Cheng et al. (2021) showed that masks are particularly effective in preventing COVID-19 in combination with social distancing. Watson et al. (2022) estimated that vaccinations prevented 14.4 million deaths from COVID-19. Until the moment we wrote this manuscript, no biomedical drug has been shown to be effective in the treatment of COVID-19. Local and regional medical systems (according to Dunn's, 1976 denomination) also responded quickly to the threats of the SARS-CoV-2 virus. Regional medical systems, such as Chinese medicine and Ayurveda (also called alternative medicine) have adapted previously used strategies to prevent and treat other illnesses as a way to deal with COVID-19 (Mirzaie et al. 2020). The same happened with local medical systems, present in small rural and indigenous communities in different parts of the world (Gumbo et al.

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2021; Andrade et al. 2022).

Few studies have analyzed how people mix information and practices from different medical systems in the pandemic context, but there are some clues about how the hybridization process behaves for other diseases in general, in different populations. In rural communities, recent studies show that the hybridization between the local and cosmopolitan (biomedical) medical systems has led to the complementarity of both systems (Nascimento et al. 2018; Zank and Hanazaki 2017), even demonstrating that local botanical knowledge grows together with biomedical knowledge through time (Santoro and Albuquerque 2021). Such studies analyze the complementarity from the perspective of the concomitant knowledge of medicinal plants and industrial drugs. In the urban context, some studies also show a complementarity from this perspective and found similar results (Belliard and Ramírez-Johnson 2005; Waldstein 2006). However, in recent years, researchers have drawn attention to the increasing number of city dwellers who follow philosophies associated with the use of medicinal plants as opposed to allopathy (Ladio and Albuquerque 2014; Luján and Martínez 2017), and vaccination (Attwell et al. 2018; Hornsey et al. 2020).

In the duality between rural and urban, there are also the so-called "neo-rural"(Luján and Martínez 2017; Quirós 2019) environments, the result of the increasingly recurrent amenity migration - the urban-to-rural movement of people based on the draw of natural and cultural amenities (see, for example, Gosnell and Adams 2009). The comparison of rural or urban environments with neo-rural environments becomes complex, since the latter configures a middle ground, in which peculiarities of different environments are mixed. Latin American rural studies analyze neo-ruralism as part of the process of new ruralities and new urban-rural relations. (Quirós 2019). This movement of people from the city to the countryside is usually accompanied by a feeling of returning to nature and a denial of what comes from the city, including biomedicine (Mccool and Kruger 2003; Abreu et al. 2015). In the context of the COVID-19 pandemic, access to biomedical tools can be essential for individual and community survival, and the denial of this access represents a strong threat to public health.

In our study, we propose to evaluate the hybridization of medical systems in the pandemic context, mainly considering attitudes towards vaccination, isolation, and mask use (from biomedicine) and the use and knowledge of medicinal plants and other strategies from alternative medicine. We carried out our study in the Paravachasca Valley, in the province of Córdoba, Argentina. This region is already known for presenting the phenomenon of neo-rurality, with the intense use of medicinal plants (Arias Toledo et al.

2007a; Lujan and Martínez 2017). Considering the scenario, in which neo-rural environments can lead to a denial of what come from the city, we hypothesize that the hybridization of medical systems in the pandemic context of Paravachasca Valley leads to a situation of competition. Therefore, we predict that the use and/or knowledge about medicinal plants and alternative medicine negatively affects the perception of the effectiveness and adoption of preventive practices against COVID-19 arising from biomedicine, such as the use of masks, isolation, and vaccination. We also verified whether the use of medicinal plants is associated with distrust of vaccination.

MATERIAL AND METHODS

Paravachasca Valley

The Paravachasca Valley is a region that comprises several small valleys, mountainous areas, and a part of the Chaco-Pampean plain, in Córdoba, Argentina (Figure 1). The natural vegetation is a mixing xerophyte arboreal vegetation with species from the Chaqueña province and grasses from the 'pampas steppe' (Luti et al. 1979). It is characterized by a city, Alta Gracia, and several small rural communities, with a hierarchy of communes, among which stand out Anisacate, Villa La Bolsa, Valle de Anisacate, Villa Los Aromos, La Serranita and La Rancherita, all these settled on the banks of the Anisacate river (Alta Gracia Digital 2020) and/or at the side of Route 5. In each of the communes, there is a medical dispensary (Primary Health Attention Center) where vaccination was carried out during our study. The total population of these six communes is 6396 people (INDEC 2010).

The population composition is heterogeneous: Hispanic mestizo descendants and city dwellers coming from distinct parts of the country have settled in the region (Arias Toledo et al. 2007 a,b; Trillo et al. 2016). The valley has experienced sustained population growth for a few years as a result of internal migration, which has turned it into a dynamic and complex territorial space, with the increasingly frequent predominance of the population of urban origin (Robbiati et al. 2020). Due to the beauty of the landscape and the presence of historic sites of native Comechingon settlements and Jesuit buildings, tourism is one of the main economic activities of the region (Martínez et al. 2006), and many of the buildings are summer houses, inhabited only for one season of the year. However, there has been a significant wave of amenity migration since the beginning of the pandemic, as happened in many parts of the world (Nelson and Frost 2022) that has resulted in the occupation of

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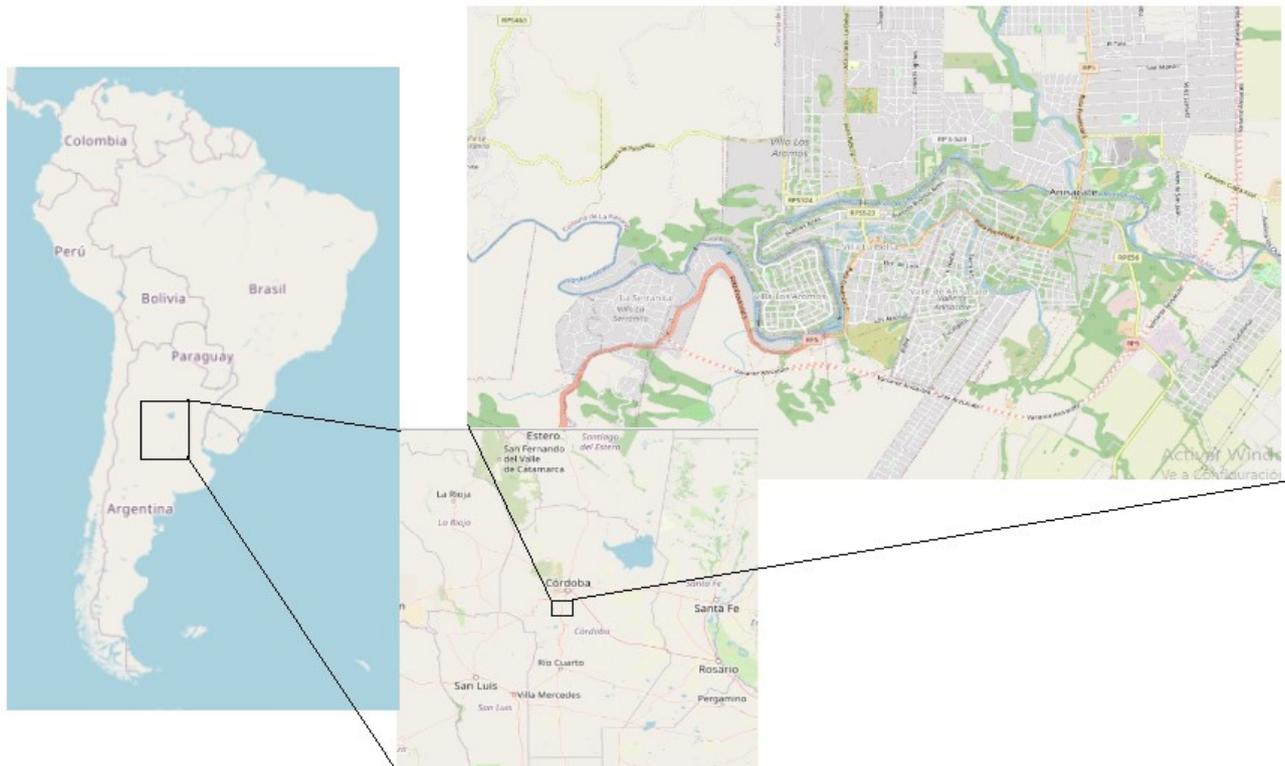
Figura 1. Map of Paravachasca Valley (made with QGIS, 2013)
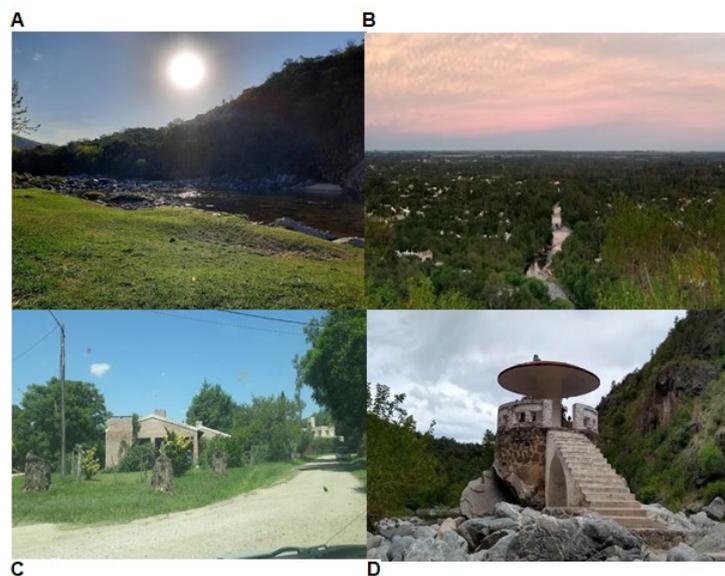
Figura 2. Landscapes of the Paravachasca valley: A) Anisacate River in the municipal resort of La Serranita; B) View of Villa La Bolsa, showing the Anisacate River in the middle; C) Construction and street in Villa Los Aromos; D) "El Hongo"(the mushroom), monument located in Villa La Paisanita.)

these houses. Figure 2 shows some of the landscapes of the Paravachasca Valley, in order to illustrate the context of our study.

Pandemic situation in Argentine during our research

We collected data between July and August 2021. At the beginning of August 2021, Argentina recorded

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more than 100,000 deaths from COVID-19, reaching a maximum of 4,357 deaths per day in May of the same year (Ministerio de Salud de la Nación 2022). The average case confirmation between July and August 2021 was 105000 cases per day (Ministerio de Salud de la Nación 2022).

The Argentine government established several mandatory preventive measures during the pandemic period. For example, through Decree 297/2020, the Argentine government established the measure of "Preventive and Obligatory Social Distance" (ASPO) from the 20th of March 2020 to the 31st of January 2021. Therefore, during our research, social isolation in recreational activities was recommended by national health authorities, but not prohibited. Throughout 2021, the use of masks was mandatory in any public space, subject to non-compliance fines, according to each province (Ministerio de Salud de la Nación 2022).

The vaccination against COVID-19 started in December 2020, but from May 2021, there was a great intensification of the vaccination campaign (Ministerio de Salud de la Nación 2022). In August 2021, there were six vaccines available in Argentine territory. In September, about 70% of the population had already received at least one dose (Ministerio de Salud de la Nación 2022).

Data collection

We collected data through online questionnaires, using the Google Forms platform (Additional File 1). The questionnaires were disseminated through local Facebook and WhatsApp local groups between July and August 2021. We shared our research in 20 WhatsApp groups in the region, including buying and selling groups, communal neighborhood groups, and groups about health dispensaries. We also publish on the Facebook pages of each commune and in Facebook buying and selling groups in the region. Before answering the questionnaire, participants were presented with a short text about the research (Additional File 1) and had to agree to participate before proceeding. The questionnaires were completely anonymous and participants had the option of not answering any of the questions if they did not feel comfortable.

The questionnaires contained multiple choice questions such as: Do you think that the use of a mask reduces the risk of contagion and spread of the virus? Do you use mask? Do you think social distancing decreases the risk of contamination? Do you do social distancing? Do you think vaccination is effective against the virus? Did you get vaccinated or do you plan to get vaccinated? The answers to these questions were graded between agreeing and disagreeing

(see Additional File 1). We also asked if people knew about medicinal plants or any strategies other than those mentioned in our questionnaire to treat and/or prevent Covid-19 (see Additional File 1). One of the questions in the questionnaire was the participant's place of residence. Considering that our focus was the neo-rural population, we excluded participants from the city of Alta Gracia and considered only people who lives in one of the six communes.

Data analysis

To test whether the use or knowledge of medicinal plants is associated with the prophylactic attitudes against COVID-19, the perception of the efficacy and risk of vaccines and willingness to be vaccinated we used a chi-square test of independence. For this, we used the number of records in each category organized in a contingency table. All analyses were performed in the R (CTR 2019), and p values ≤ 0.05 were considered significant.

RESULTS

Sampled population and attitudes toward Covid-19

Our survey had the participation of 208 people (18-81 years), including 152 women (73%), 51 men (24.5%), 2 identified with non-binary gender (0.9%) and 3 people did not answer about their gender. All participants currently live in one of the six communes in the valley. Most participants (166, 80%) lived in urban areas before living in the Paravachasca Valley, 22 (10.5%) previously lived in another rural area and only one person has lived in the Valley since birth. Few participants (20) did not respond about where they lived before moving to the Valley. The vast majority of participants (157, 75.5%) had formal higher education (college or similar), 33 (15.8%) people had secondary education (high school) and 2 people (0.9%) had primary education. Only 18 people did not answer about their educational level. Below we put the profile of people regarding their knowledge of medicinal plants and alternative medicine, the use of masks, social isolation, and vaccination.

Medicinal plants and Alternative medicine – A total of 65 (31%) people reported knowing medicinal plants or other strategies from alternative medicine to prevent and/or treat Covid-19, totaling 43 different strategies. The participants mentioned between 1 and 4 therapeutic strategies, totaling 29 medicinal plants and 15 other alternative medicines. In our questionnaire, we only asked about the plants that people knew and/or used to prevent or treat COVID-19, but we do not have data on how they were used, where

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they learned and how people understood that those plants were useful for this specific disease. The most cited medicinal plants were ginger (11 citations), echinacea (7 citations), garlic, eucalyptus, and lemon (4 citations each), all of exotic origin and easily found in local stores (fresh, dried, or in supplement form). Considering that plant citations were given by online forms, we were unable to collect and identify the cited botanical species. However, in order to have an overview of the botanical species used, the possible botanical species related to each common name are shown in Table 1 of the supplementary material 2. This inferred scientific name arises from understanding this data as a primary source of information, as described in Rosso and Scarpa (2012). Among other alternatives besides medicinal plants are the use of colloidal plata, chlorine dioxide, honey (3 citations each), vitamin C (2 citations), and healthy food (1 citation), among others (see supplementary material 2).

Use of masks – The majority of participants (172, 82%) believes that the use of masks prevents the spread of the virus in some way, 31 (15%) people believe that it does not and 5 people did not want to comment on their effectiveness. Regarding the use of the mask, 11 (5%) people say they never use it because for them the mask represents a health risk, 22 (10.5%) people say they prefer not to use it, but use it only when it is mandatory (such as to enter some establishments), 83 (40%) people say they use it them only indoors and 93 (44%) people use them every time they leave home. It is important to emphasize that among people who know medicinal plants to prevent or treat COVID-19, only 26,1% use masks whenever they leave home while this number rises to 53.1% among people who do not know.

Social distance – Most participants (161, 77.4%) believe that social distancing prevents the spread of the virus, 33 (16%) people believe that it does not affect anything, and 12 (5.8%) people said they cannot or do not want to give an opinion on social distancing. Regarding practicing distancing, 107 (51%) people say they avoid contact with people who are not part of their daily lives, 59 (28%) people say they would like to be more isolated but find it difficult to comply with isolation, 25 (12%) people would not do social isolation, but end up doing it as a consequence of government measures and 14 (6.7%) people say they do not practice isolation. Among people who know medicinal plants to prevent or treat COVID-19, only 36% practice social distancing while this number rises to 58.4% among people who do not know.

Vaccination – Most participants (140, 67%) believe that vaccination is effective against the Covid-19 virus, 46 (22%) believe it is not, and 19 (9%) people doubt its effectiveness. Although some are in doubt, 155 (74.5%) participants had already been vaccinated (138 - 66%) or were waiting for their turn to get vaccinated (17). The minor (29,14%) said they would not get vaccinated, 23 (11%) were still in doubt about whether they would get vaccinated or not.

Tested Hypothesis

We verified that the knowledge of medicinal plants or other alternative medicine strategies for the treatment or prevention of COVID-19 is related to the perception of effectiveness of protective measures such as use of masks (x-squared = 217.37, p-value = 2.2 e-16), social distancing (x-squared = 217.93, p-value = 2.2 e-16), and the COVID-19 vaccine (x-squared = 15.029, p-value = 0.004642). The knowledge about medicinal plants other alternative medicine strategies to deal with COVID-19 is also related to the adoption of those prophylactic measures, namely the use of protective masks (x-squared = 18,299, p-value = 0.0003815), social distancing (x-squared = 11,986, p-value = 0.00743) and vaccination (x-squared = 13,899, p-value = 0.0009591).

We can see this contrast when we compare for example the difference in the percentage of people who believe that the use of mask, isolation and vaccination are effective against the COVID-19 virus among the group of people who know and/or use alternative medicine and the group of people who don't: 73%, 64% and 50% respectively in the first group, against 88.8%, 83.2% and 72% in the last group. The same contrast is observed among people who effectively wear the mask whenever they leave home - 27% in the first group against 53,14% in the last group; practice social isolation thoroughly - 37% in the first group against 58% in the last group; and have already vaccinated - 58,46% in the first group against 81,3% in the last group.

Additionally, the knowledge or use of medicinal plants for the treatment or prevention of COVID-19 is also related to the perception of the risk of taking the COVID-19 vaccine (x-squared = 22.128, p-value = 0.000189). Illustrating this difference, 43% of people who know and/or use alternative medicine to deal with Covid-19 believe that Covid-19 vaccines can cause any health damage, against only 14% of people who do not know and/or use medicine alternative in the pandemic context.

DISCUSSION

The study population corresponds to the majority of urban origin of recent residence in the Paravachasca Valley, confirming what previous studies speculated about the occupation of the region in recent years (Robbiati et al. 2020), as a result of amenity migration. This configures a scenario of great cultural di-

versity. Considering the origin of most of the research participants we can characterize the environment of our research with characteristics very similar to those described by Ladio and Albuquerque (2014) about urban environments: systems where different symbolic, economic, and cultural contexts coexist with a strong mass media presence. Also, the vast majority of people also have higher formal education.

Despite being a population that shares the feeling of returning to nature, currently living in a rural area with a great diversity of botanical resources, - in contrast with populations from urban environments - few people reported knowing medicinal plants to treat or prevent COVID-19, when compared to studies in other urban or rural localities (Andrade et al. 2022, Khadka et al. 2021, Villena-Tejada et al. 2021). This low proportion can be explained by multiple factors, such as the short period of experimentation, given that COVID-19 is a very recent disease, in addition to the absence of a consolidated knowledge transmission network that allows knowledge about medicine to be shared. We noticed this possible absence in the low consensus among the few plants cited. Considering that the majority of the population has recently migrated to the Valley, this transmission network is also very new, and many people probably still retain their transmission networks of knowledge based on urban logic, through the mass media and internet groups.

In spite of the low consensus, the most cited plants in our study converge with the most cited plants to deal with COVID-19 in other rural and urban localities (Andrade et al. 2022, Khadka et al. 2021, Villena-Tejada et al. 2021, Wannes and Tounsi 2020) such as ginger, garlic and eucalyptus, plants generally used for other respiratory conditions. Perhaps because it is a new disease, exotic plants predominate in the medicinal collection of several populations (Medeiros 2013), including rural ones (Andrade et al. 2022). Even though the plant origin was not surveyed through the questionnaire, we are aware that the vast majority of plants cited in our study can be purchased in health food stores or pharmacies, in the form of capsules (as is the case with Maca, Echinacea, Ginkgo and Green tea), unlike what occurs in rural populations. The extensive mention of this type of plant, in addition to other strategies bought in the same places by the same forms (such as colloidal plata, melatonin, spirulin and vitamin C), reaffirms the characteristic behavior of inhabitants of urban centers. Indeed, the set of therapeutic strategies mentioned comes from multiple types of alternative medicine, featuring the heterogeneity of people's origins and showing that, currently, this set of knowledge does not yet belong to a consolidated local medical system.

Regarding the use and reliance on biomedical strategies, we saw that more than half of the participants agree that the three main preventive measures (use of masks, isolation and vaccination) contribute to reducing the spread of the virus and practice it. However, there is a significant proportion of the population that is very doubtful or rejects the COVID-19 vaccine (between 11% and 22%), the use of masks (between 5% and 15%), and the isolation strategy (between 6.7% and 16%). This, although small, is still worrying if we consider, for example, that the refusal rate of more than 10% can be sufficient to undermine the population benefits of vaccination against COVID-19 (DeRoo et al. 2020). According to the WHO (2019) vaccine hesitancy is one of the greatest threats to public health at a global level. Our study showed that, among the three strategies mentioned, vaccination is in fact the one with the highest rejection rate.

Several studies address the anti-vaccine movement during the pandemic and relate this behavior mainly to the lack of information, miss-information, and distrust in vaccines (Allington et al. 2021, Fieselmann et al. 2022, Muhajarine et al. 2021). Few studies, however, analyzed the use and beliefs of the three strategies against COVID-19 together. Among these few studies, Taylor and Asmundson (2021) aimed to analyze specifically the anti-masks attitudes and found that it is linked to disregard for social distancing and anti-vaccination attitudes, but mainly with psychological reactance - a motivational response to rules, regulations, or attempts at persuasion that are perceived as threatening one's sense of control, autonomy, or freedom of choice (Brehm and Brehm 1981). They found a proportion of anti-masks similar to that found in our study and point out that people who object to wearing masks are a small but highly vocal minority of individuals fueled by social media.

The role of social media is crucial in people's behavior during the pandemic (Rochel de Camargo 2020; Suarez-Lledo and Alvarez-Galvez 2021). Numerous studies found associations between the use of social media as an information source about COVID-19 and vaccine hesitancy (Allington et al. 2020; 2021; Bertin et al. 2020; Freeman et al. 2020; Jennings et al. 2021; Romer and Jamieson 2020). We have no information on how the transmission networks of knowledge about COVID-19 occur in the Paravachasca Valley, but we can assume that social media have a great influence on the participants' attitudes, considering that the same questionnaires were disseminated by such media and the type of information cited as alternative medicine are quite popular on the internet.

Overall, our results point to a proportion of anti-biomedical behavior during the pandemic similar to other populations in different parts of the world, but we draw attention to the relationship of this type of behavior with the use of and beliefs in alternative medicine. Regarding our hypothesis, all of our predic-

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tions were confirmed. Thus, people who know medicinal plants and alternative strategies to prevent o treat COVID-19 are less likely to trust and adopt the preventive measures suggested by biomedicine. Therefore, we can infer that there is a situation of competition between the use of the biomedical system and the use of other alternative medical systems in the context of COVID-19.

New studies in rural populations show that the hybridization between biomedicine and the local medical system happens in a cooperative way, where strategies from both systems coexist and complement each other (Nascimento et al. 2018; Santoro and Albuquerque 2020; Zank and Hanazaki 2017). In urban environments, a behavior of denial of biomedicine has been noticed in people who mainly use alternative medicine (Ladio and Albuquerque 2014; Pochettino et al. 2012). However, these studies deal with the concomitant use of allopathy and the use of medicinal plants, none of them deals with vaccination strategies, the use of masks and isolation.

Indeed, respecting vaccination, our results are consistent with several studies in non-pandemic contexts, which show that users of alternative medicines were more vaccine-hesitant (e.g., Cassell et al. 2006; Fong and Fong 2002; Gellin et al. 2000; Wilson et al. 2005; Zuzak et al. 2008). According to Hornsey et al (2020), one possible conclusion that can be drawn from this is that trusting in alternative medicines results in people becoming more vaccine-hesitant. An alternative possibility is that vaccine hesitancy and the use of alternative medicine are both downstream consequences of a third factor: distrust in conventional treatments. Our results point to the second possibility: alternative medicine users are not only vaccination hesitant but also reluctant to any health official strategy about COVID-19 (using face masks, social distancing, etc.). In addition, they are also more likely to believe in the possible harm that the vaccine can cause.

Here we find a common point also mentioned in other works on preventive measures against COVID-19: distrust in what comes from the hegemonic culture, as is the case of biomedicine (Allington et al. 2020, Taylor and Asmundson 2021). Based on our results and comparing them with other studies (Allington et al. 2021, Fieselmann et al. 2022, Muhajarine et al. 2021, Taylor and Asmundson 2021), we can say that a neo-rural population, the result of recent migration in search of greater contact with nature, does not differ from urban populations in terms of the proportion of people who deny biomedical strategies to prevent COVID-19. However, within this type of population, we can see that the use of alternative medicine is indicative of this denial.

LIMITATIONS

The main limitations of our study refer to how we were able to sample the population of the Paravachasca Valley. Because the study was conducted during the pandemic, our sample is limited to people who use the social media we targeted. However, we believe that the part of the valley's population that does not use such media does not correspond to the neo-rural population that we seek to access, but rather to people who have been in the region for longer. Furthermore, due to this same limitation, in which our only form of data collection was the online questionnaire, we were unable to identify the plants mentioned and, therefore, we did not delve into the specific characteristics of the plants.

CONCLUSION

There are several alternative medical systems being used by the study population, without much convergence in order to sustain a single consolidated local medical system. In this medical context, our results show that belief in alternative medicines for the treatment of COVID-19 can be an obstacle to immunization programs. People in this neo-rural environment who use medicinal plants and other therapeutic strategies from different medical systems, other than the biomedical one, probably do so because they distrust any information of biomedical origin.

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To the people of Paravachasca Valley.

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceived of the presented idea: FRS, BAT. Carried out the data collection: FRS, BAT.
Carried out the data analysis: LSC.
Wrote the first draft of the manuscript: FRS, BAT, LSC.
Review and final write of the manuscript: FRS, BAT.

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REFERENCES

Abreu DBO, Santoro FR, Albuquerque UP, Ladio AH, Medeiros PM (2015) **Medicinal plant knowledge in a context of cultural pluralism: A case study in Northeastern Brazil**. *Journal of Ethnopharmacology* 175: 124-130.

Allington D, McAndrew S, Moxham-Hall V, Duffy B (2021) **Coronavirus conspiracy suspicions, general vaccine attitudes, trust and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic.** *Psychological Medicine* 1–12. doi: 10.1017/S0033291721001434.

Alta Gracia Digital (2020) https://altagraciadigital.com/2018/12/13/descubriendo-el-valle-de-paravachasca Acessed 3 April 2020.

Andrade MTVS, Monteiro SM, Costa VM, Assis DMS, Tavares-Martins, ACC (2022) **Evolutionary ethnobiology and knowledge about medicinal resources used to treat COVID-19 symptoms in Salvaterra, Marajó, Pará, Brazil**. *Research Square*; 2022. doi: 10.21203/rs.3.rs-2167604/v1.

Arias Toledo B, Galetto L, Colantonio S (2007a) **Uso de plantas medicinales y consumo de alimentos silvestres según características socio-culturales en la Comuna de Los Aromos (Córdoba)**. *Kurtziana* 33 (1): 79-88.

Arias Toledo B, Colantonio S, Galetto L (2007b) **Knowledge and use of food and medicinal plants in two populations from the Chaco, Córdoba province, Argentine.** *Journal of Ethnobiology,* 27(2), 218-232.

Attwell K, Ward PR, Meyer SB, Rokkas PJ, Leask J (2018) **"Do-it-yourself": Vaccine rejection and complementary and alternative medicine (CAM).** *Social Science and Medicine*, 196, 106-114.

Belliard JC, Ramírez-Johnson J (2005). **Medical pluralism in the life of a Mexican immigrant woman.** *Hispanic Journal of Behavioral Sciences*, 27(3), 267-285.

Brehm SS, Brehm JW (1981) **Psychological reactance**: A theory of freedom and control. Academic, New York.

Cassell JA, Leach M, Poltorak MS, Mercer CH, Iversen A, Fairhead JR (2006) **Is the cultural context of MMR rejection a key to an effective public health discourse?** *Public Health,* 120, 783–794.

Cheng Y, Ma N, Witt C, Rapp S, Wild PS, Andreae MO, Pöschl U, Su H (2021) **Face masks effectively limit the probability of SARS-CoV-2 transmission**. *Science*, 372(6549), 1439-1443.

CTR (2019) **R: A language and environment for statistical computing,** https://www.r-project.org.

Dunn F. (1976) **Traditional Asian medicine and cosmopolitan medicine as adaptive systems**. In: C. Leslie (Ed.). *Asian medical systems*: a comparative study (1st ed., pp. 133-158). University California Press, California.

Fieselmann J, Annac K, Erdsiek F, Yilmaz-Aslan Y, Brzoska P (2022**) What are the reasons for refusing a COVID-19 vaccine? A qualitative analysis of social media in Germany**. *BMC Public Health* 22: 846. doi: 10.1186/s12889-022-13265-y.

Fong LK, Fong DP (2002) **Usage of complementary medicine among children.** *Australian Family Physician* 31, 388–391.

Gellin BG, Maibach EW, Marcuse EK (2000) **Do parents understand immunizations? A national telephone survey.** *Pediatrics* 106, 1097–1102.

Gosnell H, Abrams J (2011) **Amenity migration: diverse conceptualizations of drivers, socioeconomic dimensions, and emerging challenges**. *GeoJournal*, 76(4), 303-322.

Gumbo MT, Gaotlhobogwe M. (2021) **African Indigenous Knowledge and Practices to Combat COVID-19 Pandemic.** *Journal of Management, Spirituality and Religion*, 18(5), 462-481.

Hornsey MJ, Lobera J, Díaz-Catalán C (2020) **Vaccine hesitancy is strongly associated with distrust of conventional medicine, and only weakly associated with trust in alternative medicine.** *Social Science and Medicine*, 255, 113019.

INDEC, **Instituto Nacional de Estadísticas y Censos** (2010) Accessed 7 March , 2023 [www.indec.gob.ar].

Khadka D, Dhamala MK, Li F, Aryal PC, Magar PR, Bhatta S, Thakur MS, Basnet A, Cui D, Shi S (2021) **The use of medicinal plants to prevent COVID-19 in Nepal.** *Journal of Ethnobiology and Ethnomedicine* 17: 26 (2021). doi: 10.1186/s13002-021-00449-w.

Ladio AH, Albuquerque UP (2014) **The concept of hybridization and its contribution to urban ethnobiology.** *Ethnobiology and Conservation*, 3:6.

Luján MC, Martínez GJ (2017) **Dinámica del conocimiento etnobotánico en poblaciones urbanas y rurales de Córdoba (Argentina)**. *Boletín La-*

Santoro *et al.* 2023. Hybridization between biomedicine and alternative medicine in COVID-19 care in a neo-rural population of Córdoba, Argentine

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tinoamericano y del Caribe de Plantas Medicinales y Aromáticas, 16(3), 278-302.

Luti R, Bertrán de Solís MA, Galera MF, Muller De Ferreira, N, Berzal M, Nores M, Herrera MA, and Barrera YJC (1979) **Vegetación**. In J. V., Vázquez, R. A. Miatello and M. E. Roque (Eds). Geografía Física de la Provincia de Córdoba (1st ed., pp 297-368). Boldt, Córdoba.

Martínez GJ, Planchuelo AM, Fuentes E, Ojeda, M (2005) **A Numeric Index to Establish Conservation Priorities for Medicinal Plants in the Paravachasca Valley, Córdoba, Argentina.** *Biodiversity and Conservation* 15(8): 2457–2475. doi: 10.1007/s10531-004-7179-y.

Mccool SF, Kruger LE (2003) **Human migration and natural resources: Implications for land managers and challenges for researchers**. *USDA Forest Service - General Technical Report (PNW)*, 580, 1-19.

Ministerio de Salud de la Nacion (2022) - **Sala de Situación Coronavirus online.** Accessed 22 November, 2022 https://www.argentina.gob.ar/salud/coronavirus-COVID-19/sala-situacion.

Mirzaie A, Halaji M, Dehkordi FS, Ranjbar R, Noorbazargan H (2020) **A narrative literature review on traditional medicine options for treatment of corona virus disease 2019 (COVID-19)**. *Complementary therapies in clinical practice*, 40, 101214.

Muhajarine N, Adeyinka DA, McCutcheon J, Green KL, Fahlman M, Kallio N (2021) **COVID-19 vaccine hesitancy and refusal and associated factors in an adult population in Saskatchewan, Canada: Evidence from predictive modelling.** *PLoS One* 16(11): e0259513. doi: 10.1371/journal.pone.0259513.

Nascimento ALB, Medeiros PM, Albuquerque UP (2018) **Factors in hybridization of local medical systems: Simultaneous use of medicinal plants and modern medicine in Northeast Brazil.** *PLoS One*, 13(11), e0206190.

Nelson PB, Frost W (2022) **Migration Responses to the COVID-19 Pandemic: A Case Study of New England Showing Movements down the Urban Hierarchy and Ensuing Impacts on Real Estate Markets**. *The Professional Geographer*, doi: 10.1080/00330124.2022.2114092.

Pochettino ML, Arenas P, Sánchez D, Correa R (2008) **Conocimiento botánico tradicional, circulación comercial y consumo de plantas medicinales en un área urbana de Argentina.** *Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aro-*

máticas, 7(3), 141-148.

QGIS Development Team (2013) **QGIS Geographic Information System**. Open Source Geospatial Foundation Project. http://qgis.osgeo.org.

Quirós J (2019) **Nacidos, criados, llegados: relaciones de clase y geometrías socioespaciales en la migración neorrural de la Argentina contemporánea**. *Cuadernos de Geografía: Revista Colombiana de Geografía* 28 (2): 271-287. doi: 10.15446/rcdg.v28n2.73512.

Robbiati FO, Minervini MG, Triquell X, Machado M, Nores MJ (2020) **El bosque serrano en Paravachasca: conocimientos científicos y saberes tradicionales. Universidad Nacional de Córdoba. Secretaría de Extensión Universitaria.** *RevistaExt* 11: 1-23.

Rochel de Camargo Jr. K (2020) **Here we go again: The reemergence of antivaccine activism on the internet.** *Cadernos de Saúde Pública*, 36, e00037620.

Rosso C, Scarpa G (2012) **Identificaciones botánicas de las plantas empleadas entre los mocovíes en la reducción San Javier durante el siglo XVIII a partir de la obra de Florián Paucke, S.J**. In: P., Arenas (Ed.) *Etnobotánica en zonas áridas y semiáridas del Cono Sur de Sudamérica*. (1st ed, pp. 45–70). Sigma, Buenos Aires.

Santoro FR, Albuquerque UP(2021) **What factors guide healthcare strategies over time? A diachronic study focused on the role of biomedicine and the perception of diseases in the dynamics of a local medical system**. *Acta Botanica Brasilica*, 34: 720-729.

Santos SS, Santoro FR, Ferreira Júnior, WS (2023) **New evidence regarding the role of previous disease experiences on people's knowledge and learning of medicinal plants and biomedical drugs**. *Ethnobotany Research and Applications*, 25: 1–23.

Soldati GT, Hanazaki N, Crivos M, Albuquerque UP (2015) **Does environmental instability favor the production and horizontal transmission of knowledge regarding medicinal plants? A study in Southeast Brazil.** *PLoS One*, 10(5), e0126389.

Taylor S, Asmundson GJ (2021) **Negative attitudes about facemasks during the COVID-19 pandemic: The dual importance of perceived ineffectiveness and psychological reactance.** *PLoS One*, 16(2), e0246317. doi: 10.1371/journal.pone.0246317.

Trillo C, Arias Toledo B, Colantonio S (2016) **Dife-**

Santoro *et al.* 2023. Hybridization between biomedicine and alternative medicine in COVID-19 care in a neo-rural population of Córdoba, Argentine

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rencias en el uso y la percepción del bosque por pobladores de diferente tradición cultural de la laguna de Mar Chiquita, Córdoba, Argentina. *Ecología Austral,* 26, 7-16.

Villena-Tejada M, Vera-Ferchau I, Cardona-Rivero A, Zamalloa-Cornejo R, Quispe-Florez M, Frisancho-Triveño Z, Abarca-Meléndez RC, Alvarez-Sucari SG, Mejia CR, Yañez JA. (2021) **Use of medicinal plants for COVID-19 prevention and respiratory symptom treatment during the pandemic in Cusco, Peru: A cross-sectional survey.** *PLoS One*, 16(9), e0257165. doi: 10.1371/journal.pone.0257165.

Waldstein A. (2006) **Mexican migrant ethnopharmacology: pharmacopoeia, classification of medicines and explanations of efficacy.** *Journal of Ethnopharmacology*, 108(2), 299-310.

Wannes WA, Tounsi MS (2020) **Can medicinal plants contribute to the cure of Tunisian COVID-19 patients.** *Journal of Medicinal Plants Studies*, 8, 218-226.

Watson OJ, Barnsley G, Toor J, Hogan AB, Winskill P, Ghani AC (2022) **Global impact of the first year of COVID-19 vaccination: a mathematical modelling study**. *The Lancet Infectious Diseases*, 22(9), 1293-1302. doi: 10.1016/S1473-3099(22)00320-6.

Wilson K, Busse JW, Gilchrist A, Vohra S, Boon H, Mills, E (2005) **Characteristics of pediatric and adolescent patients attending a naturopathic college clinic in Canada**. *Pediatrics* 115, e338–343.

Zank S, Hanazaki N (2017) **The coexistence of traditional medicine and biomedicine: A study with local health experts in two Brazilian regions**. *PLoS One*, 12(4), e0174731.

Zuzak TJ, Zuzak-Siegrist, I, Rist L, Staubli G, Simoes-Wust AP (2008) **Attitudes towards vaccination: users of complementary and alternative medicine versus nonusers.** *Swiss Medical Weekly*, 138, 713–718.

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Additional Files

Add File 1

La pandemia en el Valle de Paravachasca

Estimadas/os vecinos y vecinas de Paravachasca:
Estamos realizando un estudio sobre las percepciones y estratégias de las y los residentes del Valle de Paravachasca sobre la pandemia que estamos atravesando. Buscamos entender cómo cada uno de nosotras/os percibimos y lidiamos con restricciones impuestas por el virus y/o por las medidas gubernamentales en respuesta a la pandemia. Tu participación es muy importante y absolutamente anónima. Es decir, queremos que te sientas cómoda/o para expresar tu opinión y asegurar que tu identidad nunca será revelada. Tu participación es voluntaria y puede finalizar cuando lo desees. La encuesta se encuadra en estudios de profesionales pertenecientes a CONICET y a la Cátedra de Antropología, de la Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba y toma en media 6 minutos en ser respondida. Si tenés cualquier tipo de duda, podés enviar un mail a pandemiaenelvalle@gmail.com.

* Indica uma pergunta obrigatória

1. Para seguir con la encuesta es necesario marcar esa opción, de carácter   *
   obligatorio. Será la única obligatoria de todo el cuestionario y la hacemos para
   tener seguridad de estar cumpliendo con los lineamientos generales de ética en
   investigación humana

   Marcar apenas uma oval.

   ◯ Soy mayor de edad, acepto que mis respuestas pueden ser analizadas y
   publicadas (en forma completamente anónima, de ahora y para siempre) y respondo
   voluntariamente la siguiente encuesta.

2. ¿Cuánto crees en la existencia del virus SARS-CoV-2, el virus causador del COVID-19?

Marcar apenas uma oval.

◯ Estoy seguro(a) que existe

◯ Me parece que existe, pero no estoy seguro(a)

◯ No estoy seguro(a) de que existe o no

◯ Me parece que no existe, pero no estoy seguro(a)

◯ Estoy seguro(a) que no existe

◯ Prefiero no opinar sobre eso

3. Si pensás que de alguna manera existe, ¿Cuánto riesgo crees que significa para tu salud personal?

Marcar apenas uma oval.

◯ Gran riesgo

◯ Riesgo moderado

◯ Poco riesgo

◯ Ningún riesgo

◯ No creo que exista el vírus

4. Si pensás que de alguna manera existe, ¿Cuánto riesgo crees que representa para la salud comunitaria?

Marcar apenas uma oval.

◯ Gran riesgo

◯ Riesgo moderado

◯ Poco riesgo

◯ Cero riesgo

◯ No creo que exista el vírus

5. ¿Estás de acuerdo con el uso de barbijo?

Marcar apenas uma oval.

◯ Sí, lo uso siempre que salgo de casa, no importa si en ambientes abiertos o cerrados

◯ Sí, lo uso sólo cuando estoy en ambientes cerrados (fuera de casa)

◯ Sí, pero se me hace difícil usarlo

◯ No, pero lo uso porque es obligatorio en algunos lugares

◯ No, nunca lo uso.

◯ No, nunca lo uso y creo que su uso implica un riesgo para la salud

◯ Outro: _____

6. ¿Crees que el uso de barbijo disminuye el riesgo de contagio y diseminación del virus?

Marcar apenas uma oval.

◯ Sí

◯ No

◯ No puedo/quiero opinar sobre eso

◯ Outro: _____

7. ¿Estás de acuerdo con el distanciamiento social?

Marcar apenas uma oval.

◯ Sí, evito siempre estar cerca de las personas con quienes no convivo

◯ Sí, pero no lo respeto totalmente porque se me hace difícil

◯ No, pero de alguna manera lo hago porque son las medidas impuestas

◯ No, y no lo practico

◯ Outro: _____

8. ¿Crees que el distanciamiento social disminuye el riesgo de contaminación?

Marcar apenas uma oval.

◯ Sí

◯ No

◯ No puedo/quiero opinar sobre eso

◯ Outro: _____

9. ¿Estás de acuerdo con la prohibición de actividades festivas y ferias al aire libre?

Marcar apenas uma oval.

◯ Sí, esa medida es fundamental para evitar la propagación del virus

◯ Hay que relativizar, algunas de esas actividades deben seguir, con distanciamiento social y uso de barbijo

◯ No, todo tipo de festival y ferias libres deberían ser permitidos

◯ Outro: _____

10. ¿Crees que prohibir actividades festivas y ferias al aire libre son buenas estrategias de control de la diseminación del virus?

Marcar apenas uma oval.

◯ Sí

◯ No

◯ No puedo/quiero opinar sobre eso

◯ Outro: _____

11. ¿Qué estrategias pensás que son efectivas contra la diseminación del virus?

_____

_____

_____

_____

_____

12. ¿Crees que la vacunación es efectiva contra el virus?

Marcar apenas uma oval.

◯ Sí

◯ No

◯ Outro: _____

13. ¿Crees que las vacunas, de manera general, te pueden causar algún daño?

Marcar apenas uma oval.

◯ Sí

◯ No

◯ Outro: _____

14. Describí el posible daño, si así lo marcaste:

_____

_____

_____

_____

_____

15. ¿Pensás vacunarte?

Marcar apenas uma oval.

◯ Sí, cuando sea mi turno me vacunaré

◯ Sí, ya me vacuné

◯ No sé aún

◯ No, no me vacuné/vacunaré

16. ¿Tenés preferencia de alguna vacuna?

Marcar apenas uma oval.

◯ No, me voy a vacunar/me vacuné con la que me toca/ tocó

◯ Sí, la Sputnik V

◯ Sí, la AstraZeneca

◯ Sí, la Sinopharm

◯ Sí, la Covishield

◯ Sí, la de Pfizer

◯ Sí, otra

◯ No me voy a vacunar

17. ¿Te negarías a vacunarte si no te toca la vacuna que preferís?

Marcar apenas uma oval.

◯ No

◯ Sí

◯ Tal vez

◯ No me voy a vacunar, independiente de cual sea la vacuna

18. ¿Qué pensás sobre las vacunas, de manera general?

_____

_____

_____

_____

19. ¿Utilizas plantas medicinales para prevenir el Covid-19?

Marcar apenas uma oval.

( ) Sí, uso plantas que me ayudan a prevenir el Covid-19

( ) No, pero conozco plantas que ayudan a prevenir el Covid-19

( ) No

20. Si marcaste que sí, ¿Cuál(es) planta(s) utilizas/conoces para prevenir el Covid-19?

_____

_____

_____

_____

_____

21. ¿Utilizas plantas medicinales para tratar la enfermedad del Covid-19?

Marcar apenas uma oval.

( ) Sí, uso/usé plantas que me ayudan a tratar la enfermedad del Covid-19

( ) No, pero conozco plantas que ayudan a tratar la enfermedad del Covid-19

( ) No

22. Si marcaste que sí, ¿Cuál(es) planta(s) utilizas/conocés para tratar el Covid-19?

_____

_____

_____

_____

_____

23. ¿Hay algo más que nos quieras contar sobre tu percepción sobre la pandemia?

_____

_____

_____

_____

_____

Pular para a pergunta 24

Para finalizar nos gustaría conocer algunos datos personales. Al igual que con cualquiera de las respuestas anteriores, si no te sentís cómodo, no hace falta que respondas. Estos datos nos permitirán analizar los datos obtenidos pero nunca, de ninguna forma, significarán que pierdas el anonimato en tus respuestas:

24. Edad

_____

25. Género

Marcar apenas uma oval.

◯ Mujer

◯ Hombre

◯ No binarie

◯ Outro: _____

26.   Nivel educativo máximo alcanzado

Marcar apenas uma oval.

○ Sin estudios formales

○ Primario incompleto

○ Primario completo

○ Secundario incompleto

○ Secundario completo

○ Universitario incompleto

○ Universitario completo o superior

○ Outro: _____

27.   Ocupación

_____

28.   Lugar en que vivís en el Valle:

Marcar apenas uma oval.

○ Anisacate

○ Valle de Anisacate

○ Villa La Bolsa

○ Los Aromos

○ La Rancherita

○ La Paisanita

○ La Serranita

○ Outro: _____

29. Posición política

   Marcar apenas uma oval.

   ◯ Me encuadro en la izquierda

   ◯ Tengo una tendencia para la izquierda

   ◯ Ni izquierda ni derecha

   ◯ Tengo una tendencia para la derecha

   ◯ Me encuadro en la derecha

   ◯ No me identifico con ninguna posición política

   ◯ Outro: _____

30. Antes de vivir en el Valle, vivías

   Marcar apenas uma oval.

   ◯ En un ambiente urbano

   ◯ En un ambiente rural

   ◯ Outro: _____

Google Formulários

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Add File 2. Plants cited, their possible botanical nomenclature, biogeographical origin and number of citations

Popular name	Possible plants species	Biogeographic Origin	Citations
Cannabis	*Cannabis sativa L.*	Exotic	3
Cat's claw	*Uncaria tomentosa (Willd. ex Schult.) D.C.*	Exotic	1
"Chañar"	*Geoffroea decorticans (Hook. & Arn.) Burkart*	Native	3
Cinnamon	*Cinnamomum cassia (L.) J.Presl*	Exotic	1
Dandelion	*Taraxacum officinale (L.) Weber ex F.H.Wigg.*	Exotic	1
Echinacea	*Echinacea purpurea (L.)*	Exotic	7
Garlic	*Allium sativum L.*	Exotic	4
Ginger	*Zingiber officinale Roscoe*	Exotic	11
Ginkgo	*Ginkgo biloba L.*	Exotic	1
"Good herb"	*Mentha sp.*	Exotic	1
Green tea	*Camellia sinensis (L.) Kuntze*	Exotic	1
"Lapacho"	*Handroanthus impetiginosus (Mart. ex DC.) Mattos*	Native	1
Lavender	*Lavandula angustifolia Mill.*	Exotic	1
Lemon	*Citrus limon (L.) Osbeck*	Exotic	6
"Llanten"	*Plantago major L.*	Native	2
"Maca"	*Lepidium meyenii Walp.*	Exotic	2
Mint	*Mentha sp.*	Exotic	1
"Moringa"	*Moringa oleifera Lam.*	Exotic	1
Nettle	*Urtica dioica L.*	Exotic	2
Onion	*Allium cepa L.*	Exotic	1
Orange	*Citrus sinensis (L.) Osbeck*	Exotic	2
Rosemary	*Rosmarinus officinalis L.*	Exotic	1
Thyme	*Thymus vulgaris L.*	Exotic	2
Turmeric	*Curcuma longa L.*	Exotic	1
"Several plants"	-	-	7

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Add File 3. other resources of alternative medicine cited by participants and the number of citations.

Alternative strategie	Citations
Essential Oils	1
"Healthy Food"	1
Chlorine Dioxide	3
Phytotherapy	1
Homeopathy	1
Kefir	1
Yeast	1
Melatonin	1
Honey	3
Colloidal plata	3
Propolis	2
Spirulin	1
Natural And Organic Supplements	1
Vitamin C	2
Zeolit	1