

## Medicinal plant use in primary health care: an integrative review

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**Abstract** Medicinal plant (MP) use supports comprehensiveness of care in Primary Health Care (PHC), enabling appreciation of popular knowledge and self-care. This integrative literature review aims to analyze researches that approach the insertion of using MP in PHC. PICO strategy was used as a guideline in search of evidence, reuniting 18 articles published between January 2015 and August 2020, in the Virtual Health Library and PubMed databases. The variables of analysis were knowledge of PHC healthcare professionals about MP and associated policies, MP use by its users, highlighting their profile, the reasons that lead to the use and lack of security in MP use. The results show insufficient knowledge of healthcare professionals about Integrative and Complementary Practices policies and the medicinal uses of plants. The main users are women, elderly, with low income and education, either in Brazil or other countries. Regarding safety in MP use, frequently there is no correct identification of species, its origin, its preparation and the appropriate dose for each case. Finally, failure to approach these contents during training of healthcare professionals generates less knowledge, less research and more prejudice due to lack of information, impairing incentive and dissemination to the community.

**Key words** Medicinal plants, Medicinal herbs, Primary health care

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## Introduction

The use of different plants in favor of human objectives is historical, from their application as poisons to their use in curative activities<sup>1</sup>, being, in the latter case, called Medicinal Plant (MP). This use was inspired by the empirical observation of practices of other animals, since several species had habits of consuming plants due to injuries<sup>2</sup>.

Through such analysis, human beings began to systematize MP use, reconciling characteristic philosophical and cultural aspects, developing the basis of strands of medicine<sup>3</sup>. Thus, MP is considered to be capable of alleviating or curing illnesses and has a tradition of being used as a remedy by people in the community<sup>4</sup>.

Over the centuries, healthcare has undergone transformations and, today, academic scientific knowledge and the biomedical model centered on the disease are valued, to the detriment of other types of knowledge generation<sup>5</sup>. Thus, the medicalization of life arises, which is a phenomenon of appropriation by medicine, which interferes with the construction and interpretation of concepts, customs and social behaviors.<sup>6</sup> In this context, there is a devaluation of self-care and the connection with nature, with increasing appreciation of modern conventional medicine as the only effective and safe resource<sup>5,6</sup>.

On the other hand, social movements and public policies have emerged in recent decades that seek to rescue traditional knowledge and value the promotion and integrality in healthcare, stimulating the human-nature interaction<sup>7</sup>.

In 1978, with the Alma-Ata declaration, the World Health Organization (WHO) started to recognize MP use and herbal medicines as effective health strategies, validating their curative, prophylactic and palliative properties<sup>8</sup>. In Brazil, the theme was addressed at the 8<sup>th</sup> National Conference<sup>9</sup>, in 1986, defining that alternative healthcare practices should be part of the Unified Health System (SUS – *Sistema Único de Saúde*), still under construction, allowing users to choose the desired therapy.

After 20 years, with the regulation of the Brazilian National Policy on Integrative and Complementary Practices (PNPIC - *Política Nacional de Práticas Integrativas e Complementares*)<sup>10</sup> and the Brazilian National Policy on Medicinal Plants and Herbal Medicines (PNPMF – *Política Nacional de Plantas Mediciniais e Fitoterápicos*)<sup>11</sup>, the adoption of MP use and phytotherapy in SUS was determined, with a focus on Primary Health

Care (PHC) as another form of treatment for diseases, also valuing popular knowledge<sup>12</sup>.

Through policies and movements that strengthen Integrative and Complementary Practices (ICP), the objective is to rescue popular knowledge, favoring forms of holistic care that promote sustainability, valuing self-care and active participation of patients throughout the process. With MP use, it is possible to achieve these goals, promoting environmental education, in order to promote health and the recovery of self-care<sup>13</sup>.

Thus, the aim of this study was to analyze research that addressed forms of MP use in PHC, characterizing the profile of these users, factors that promote the use, what is the knowledge of healthcare professionals on the subject and on associated policies, as well as the issue of lack of safety and adequate assistance regarding MP use in PHC.

## Method

This is an integrative literature review, an instrument for obtaining, identifying, analyzing and synthesizing publications on a specific topic. The steps were followed: problem identification (defining the theme of the review in the form of a question, called PICO or guiding question); sample selection, definition of research characteristics (categorization of studies and data collection); analysis of studies included in the review, identifying similarities and conflicts; discussion and interpretation of results; presenting knowledge review/synthesis<sup>14,15</sup>.

To develop this integrative review, the question was: what is the scientific evidence related to the ways of using MP in PHC?

To search the selected databases (Virtual Health Library – VHL – and US National Library of Medicine – PubMed), the following keywords were used for the search strategy: medicinal plants; medicinal herbs and national list of medicinal plants; primary health care; basic service; primary care; basic care; primary service; primary care; first level of assistance; first level of service; first level of care; first level of health care.

The search for articles was performed by four researchers, using the same criteria, two being responsible for the search in the VHL database and two in the PubMed database. Duplicates were performed blindly, validating the methodology. Two researchers were responsible for selecting the articles. In case of divergence, it was decided

to keep the articles in the selection until the full reading stage, checking if they covered the theme of this review.

The selection of the initial sample adopted as inclusion criteria articles that brought in their titles or abstracts elements on MP use in PHC, found in national and international literature, published from January 2015 to August 2020, in Portuguese, Spanish and English. Dissertation theses and reviews were excluded and articles with different methodological designs were accepted, as the guiding question requires coverage of the investigated theme.

Thus, the sample consisted of 1,038 articles, 533 of which were found in the VHL and 505 articles in PubMed, with the application of language and date filters. Nine hundred eighty-one were excluded for the following reasons: titles or abstracts did not fit the theme question or because they were reviews or dissertation theses, leaving 57 articles (Figure 1).

At this stage, all 57 articles were available for reading: 14 articles with public access and four private, accessed through the University supporting this research.

Eleven duplicate articles were discarded, blindly, leaving 46. All of these were read in full and 28 were excluded because they addressed MP use in PHC in a non-exploratory way, not

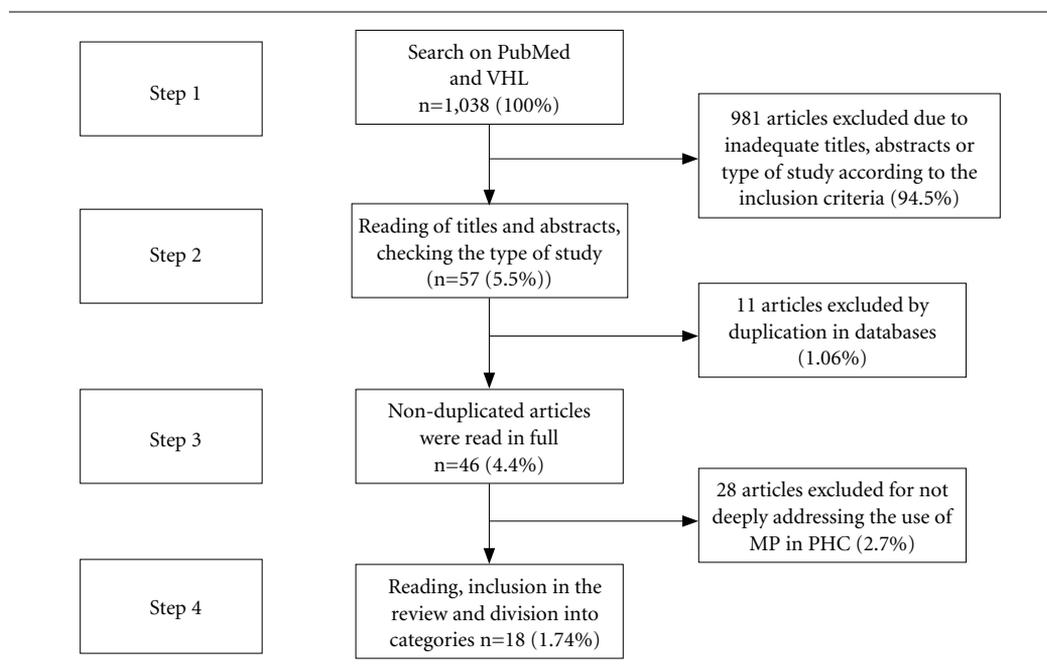
answering the question. Through an analysis of two researchers, 18 articles were established as corpus of analysis, ten from VHL and eight from PubMed (Figure 1).

To study the articles, the thematic analysis technique<sup>16</sup> was used, which consists of the following steps: text skimming, coding, categorization and articulation with the following theoretical frameworks: PNPIC<sup>10</sup> and PNPMPF<sup>11</sup>.

The following categories were then created: “Knowledge of PHC healthcare professionals about MP and associated policies”; “MP users in PHC: profile and factors that lead to use”; “The lack of security in MP use”. Careful reading of each article was adopted, observing these categories, and the same article may be present in more than one section.

## Results and discussion

Of the 18 articles selected for analysis, seven were prepared in other countries, namely: Peru, Paraguay, Spain, Mexico, Jamaica, Pakistan and Serbia. Eight studies were published exclusively in Portuguese, four in English, three in Spanish, and three in both Portuguese and English. *Revista Ciência e Saúde Coletiva* (n = 3) and *Journal of Ethnopharmacology* (n = 4) stand out with the



**Figure 1.** Fluxograma referente aos resultados de busca.

largest number of articles published on the subject of this review.

The articles were described in Chart 1 as to their authors, year of publication, place of research, published journal, type of study and the main evidence found in the study.

From the results, the importance of discussing different variables that influence MP use in PHC was evidenced, showing the complexity of issues that permeate healthcare. Thus, we highlighted themes that served as the basis for analysis, enabling the relationship between the data and the deepening of the literature to understand the level of knowledge of professionals regarding MP, the characterization of users and MP use

with greater safety, in order to answer the PICO question.

### Knowledge of PHC healthcare professionals about MP and associated policies

Studies point out the insufficiency of knowledge of healthcare professionals regarding the policies of ICP and the general aspects of MP use. In a survey conducted in forty-five units of Family Health Strategy in the city of Blumenau/SC, 65.6% of healthcare professionals reported knowing the PNPIC, however, they were unable to cite all the practices, thus demonstrating a superficial knowledge of it<sup>17</sup>.

**Chart 1.** Distribution of selected articles according to authors, year of publication, research site, published journal, type of study and the main evidence found in the study.

Author/ year	Journal/location/type of study	Main Study Evidence
Dantas et al., 2019	Revista de Saúde Coletiva, (PE - Brazil); Qualitative study	Health practices were related to popular care through MP use and prevention actions. Community socioeconomic, cultural and educational factors negatively impacted the health condition. There was a discrepancy between technical and popular healthcare
Soares et al., 2019	Revista de Enfermagem do Centro-Oeste Mineiro, (MG - Brazil); Descriptive study with a qualitative approach	Nurses' lack of knowledge about the PNPIC due to gaps in the process of training, training and continuing education of professionals. Despite this, the professionals pointed out as being an important source of care MP use and herbal medicines, but they do not know how to differentiate between them
Valenzuela-Ore et al., 2018	Revista Peruana de Medicina Experimental y Salud Pública, (Huancavelica - Peru); Cross-sectional study with a quantitative approach	Despite the analyzed communities make great use of the formal health system services, cultural and popular practices are still quite prevalent, highlighting MP use
Caccia-Bava et al., 2017	Revista Ciência e Saúde Coletiva, (SP - Brazil); Cross-sectional, multicenter study with a qualitative approach	The availability of herbal medicine is greater in more populous cities and with better socioeconomic indices. It was also found that the industrialized herbal medicine is more used and accepted than the herbal drug in natura or the manipulated herbal medicine
Szerwieski et al., 2017	Revista Eletrônica de Enfermagem, (PR - Brazil); Cross-sectional, correlational, analytical and descriptive study with a quantitative approach	MP use by older adults is widespread in the population analyzed, but it is necessary to guide them correctly as to the toxicity and benefits of some plants, given the widespread lack of knowledge. Nurses act as an important health promoter in this context
Souza et al., 2016	Revista Brasileira de MP, (RS - Brazil); Descriptive qualitative study	There was a lack of knowledge about the policy, although MP use in the workplace is well accepted. The policy is more effective when nurses organize groups, put into practice interdisciplinary dialogue and address users' cultural aspects
Palma et al., 2015	Revista de Pesquisa Cuidado é Fundamental Online, (RS - Brazil); Qualitative study	Healthcare professionals use MP as a self-care tool, and believe it is possible to incorporate MP use in PHC in situations of self-care and palliative care. Other than that, there is a preference for conventional allopathic resources, showing a reflection of professional training based on the biomedical model

it continues

**Chart 1.** Distribution of selected articles according to authors, year of publication, research site, published journal, type of study and the main evidence found in the study.

Author/ year	Journal/location/type of study	Main Study Evidence
Colet et al., 2015	Revista brasileira de medicina de família e comunidade, (RS - Brazil); Cross-sectional study with a quantitative approach	The need to train healthcare professionals for correct user guidance in MP use was explained, as well as for the promotion of research with MP to support the implementation of public policies on herbal medicine
Soria et al., 2015	Mem. Inst. Investig. Cienc. Salud, Paraguay; Observational, descriptive, cross-sectional and prospective study, with a qualitative aspect	The need to educate healthcare professionals and the population for a correct identification of the MP used by the Paraguayan population was evidenced, in order to know the toxicity potential of each plant
Mattos et al., 2018	Ciência e Saúde Coletiva, (SC - Brazil); Quantitative and cross-sectional study	Most healthcare professionals reported knowing the PNPIC, although most are unaware of the presence of herbal medicines in the Brazilian National List of Essential Medicines (RENAME - Relação Nacional de Medicamentos Essenciais). Professionals believe in the potential of MP, but do not prescribe them. However, they agree with the initiative to offer them in SUS after adequate training
Zeni et al., 2017	Ciência e saúde coletiva, (SC - Brazil); Observational epidemiological study, sectional type, with a quantitative aspect	MP are used as a therapeutic alternative, however, it is necessary that PHC services guarantee access to these products, as well as the adequate qualification of professionals.
Maciá et al., 2016	Revista de Fitoterapia, (Barcelona - Spain); Descriptive cross-sectional study with a quantitative approach	MP use is widely accepted and widespread in the community. Thus, there must be an adequate control of this practice in public health services in order to assess and avoid possible drug interactions and side effects
Alonso-Castro et al., 2017	Journal of Ethnopharmacology, Mexico; Quantitative study	MP are widely used by healthcare professionals in PHC in Mexico, with good acceptance by the local community
Picking et al., 2015	Journal of Ethnopharmacology, Jamaica; Bibliographic research, experimental studies, with a qualitative approach	MP use plays a key role in PHC in Jamaica in treatment and prevention of various diseases
Tribess et al., 2015	Journal of Ethnopharmacology, southern Brazil; quantitative study	Traditional medicine is an important PHC resource in rural communities in the Atlantic Forest region. In this region there is greater knowledge about MP use than in other locations. This form of traditional knowledge represents important strategies in environmental education, environmental preservation and validation of MP use in health policies that benefit the population
Yaseen et al., 2015	Journal of Ethnopharmacology, Thar Desert (Sindh, Pakistan); quantitative study	MP use represents, in the studied region, an important source of self-care in the practice of PHC within rural communities
Starosta et al., 2020	Ver Eletron Comum Infl nov Saúde, (PR - Brazil); Experience report with a qualitative approach	The documentary acts as a propagator of traditional knowledge gathered in the interviews, facilitating the dissemination of information to researchers, professionals and different communities, favoring dialogue and the exchange of knowledge
Živković et al., 2020	Frontiers in Pharmacology, (District of Pčinja - Serbia); quantitative study	MP is widely used as a modality of PHC in the studied region, mainly in the treatment of less complex diseases. However, MP have a wide spectrum of use, which should be further explored

Source: Authors.

On the other hand, studies carried out among nurses indicated that 88.7% of respondents in the southern region of the state of RS had a deficit of knowledge of national and public policies for valuing the use and dissemination of complementary therapies – including the PNPMP<sup>18,19</sup>.

Failure to deepen the knowledge of such policies may imply non-adherence to ICP, resulting in the devaluation of this form of care. Thus, it is necessary for professionals to acquire this knowledge for the policy consolidation.

Authors emphasize that, during training, healthcare professionals do not learn about traditional medicine and are often unaware of scientific evidence about MP<sup>20,21</sup>. A survey, carried out with nine professionals from a Family Health Unit (FHU) in the rural area of the city of Pelotas/RS, shows that, among the participating professionals, none had disciplines or discussions during their academic trajectory that addressed the theme of MP<sup>21</sup>.

Lack of knowledge about MP also leads to insecurity of healthcare professionals in prescribing them, as evidenced in data presented by Mattos *et al.* (2018), in which respondents were unaware of the plants or herbal medicines contained in RENAME.

On the other hand, 93% of professionals in the same study had knowledge about traditional medicine due to family influences and experiences, with 84.7% having already prescribed or suggested, in the case of non-medical professionals, the therapeutic use of MP<sup>17</sup>. On the other hand, others considered this form of origin of superficial knowledge, choosing not to prescribe without scientific deepening in the subject<sup>21</sup>.

Research shows that limited understanding occurs due to a structural failure of academic teaching plans and institutions in not offering training courses on the topic or encouraging professionals to seek this knowledge<sup>21</sup>. However, as demonstrated by Castro *et al.* (2017), 73% of the sample of professionals were interested in acquiring information<sup>20</sup>, via training courses, complementary materials or other sources that addressed MP use in PHC<sup>17,21</sup>.

Another important aspect addressed by the articles studied is the importance of knowing professionals' view regarding MP use, since personal opinion reflects on professional practice.

Castro *et al.* (2017) pointed out that 46% of healthcare professionals and 51% of physicians interviewed believed that patients should not use MP for reasons such as ineffectiveness, lack of scientific basis and lack of safety. However,

54% of these healthcare professionals and 49% of physicians have already made personal use of MP as an alternative therapy, claiming efficacy, due to family tradition and highlighting the reduction in the consumption of allopathic medicines<sup>20</sup>. That is, healthcare professionals are afraid to prescribe, but end up using it for their own treatment.

Of the professionals interviewed in RS, 81.4% acknowledged that the inclusion of policies aimed at including MP use in PHC would be of paramount importance<sup>18</sup>. However, some believe that MP use is effective only as a form of self-care in early-stage diseases and as an adjuvant in palliative diseases<sup>21</sup>.

As for self-care, it is important to emphasize that the potential for demedicalization presented by ICP does not depend on the way they are applied and used: the proposed experimentation and approach should encourage an expansion of patients' freedom to feel, reflect, experiment and know themselves to achieve a self-care model<sup>22</sup>. Therefore, Macià *et al.* (2016) add that one cannot forget the essentially popular character of this knowledge, showing an openness to learn and build with the population<sup>23</sup>.

In this sense, Souza *et al.* (2016) suggest that the insertion of MPs in PHC would become effective if healthcare professionals organized discussion groups with FHU users, exercising interdisciplinary dialogue, practicing health education and understanding the context in which they find yourself inserted<sup>18</sup>. Thus, professional action is established based on a relationship of respect for individuals' beliefs and values, empowered in their historical and popular knowledge, in the form of a dialogue in which both parties learn about citizenship and heterogeneity of care, fleeing of the logic of attending to only illness<sup>24,25</sup>.

### **MP users in PHC: profile and factors that lead to use**

Colet *et al.* (2012), through interviews applied to 446 users of Health Units in the city of Ijuí (RS), found that 81% of respondents use MP, aged 40 to 59 years (44.6% of respondents), 67.7% with an income of up to one and a half minimum wage and 71.5% claim to use them on the advice of relatives<sup>26</sup>.

Another study by Zeni *et al.* (2017), interviewed 701 individuals from Blumenau, SC, and observed that most of those who used MP were women (78.1%), white (81.6%), married

(56.4%) and belonging to class C (56.4%), with a mean age of 43.3 years<sup>27</sup>.

Szerwieski *et al.*, 2016, in Itaipulândia (PR), interviewed 252 older adults, also showing the most prevalent use in women (67.58%), with little (up to four years of education) or no education (90.11 % of those who use it), not being economically active (83.52%), receiving up to a monthly minimum wage (97.25%)<sup>28</sup>.

Data from Colet *et al.* (2012), Szerwieski *et al.* (2016) and Zeni *et al.* (2017) evidence the legacy of a patriarchal society. In this, women became responsible for the domestic maintenance and care of family members<sup>29</sup> as well as the cultivation of plants<sup>30</sup>. With this, women usually have more information about the MP and end up resorting to them, as they can be obtained in an affordable and accessible way in their own backyards<sup>31</sup>.

The study by Dantas *et al.* (2019) interviews healthcare professionals and Landless Workers' Movement (MST) representatives, using focus groups with families and a field diary, and emphasizes the role of encouraging MP use and strengthening popular knowledge in the two settlements surveyed through local centers<sup>32</sup>. This care converges with the experiences of the MST reported by state health sectors, which go towards the promotion of healthy habits, realization of the right to health and preparation of medicines based on MP<sup>33</sup>.

In another reality, the article by Macià *et al.* (2016), carried out in Barcelona – Spain, interviewed 161 individuals, finding that 85% used plants, 65.7% being women, and 45.2% were illiterate or had only completed elementary school. Although the sample average age was 62.9 years, the age group of 15-40 years (14% of the total) was the one that most reported using MP (97%), while in the group of 65 years or more this value was of 48.2%. Thus, the results in absolute numbers indicate that the profile of MP users is people over 65 years of age, illiterate or who only attended elementary school<sup>23</sup>.

In Peru, taking into account the country's cultural and ethnic diversity, Valenzuela-Oré *et al.* (2018)<sup>34</sup> address the social issue of MP use. Questionnaires were applied to 775 urban and rural villages, and 68.7% of respondents reported always using MP<sup>34</sup>. However, there is a decrease in the use of traditional medicine in the Peruvian population<sup>35</sup>.

In another study in Pakistan, Yaseen *et al.* (2015) showed that the local population interviewed used MP due to the lack of adequate health services for the treatment of various co-

morbidities, in addition to being an indigenous cultural and traditional heritage<sup>36-38</sup>.

Another article found, which differs from the previous ones, reports the construction of the documentary “*Cantos e saberes*”, based on the research “*Quintais Produtivos e sua relação com a segurança alimentar e nutricional*”<sup>38</sup>. To develop the documentary, the authors carried out a research in order to analyze the knowledge and traditional practices of MP use among women who attend the Horta Group, in Piraquara-PR.

The documentary is a modality that brings the possibility of dialogue between different spheres, with healthcare professionals, researchers and the community, and their realities<sup>40,41</sup>, pointing to the humanizing potential of ICP, such as MP, in healthcare, while highlighting the political and commercial repressions that they suffer<sup>42</sup>.

In turn, Tribess *et al.* (2015), in the Atlantic Forest region of the state of SC, carried out an ethnobotanical survey with local residents. It was noted that the practice of traditional medicine in rural communities acts as an important source of self-care, directly linked to PHC principles in the management of recurrent pathologies.

This study mentions that the Atlantic Forest has one of the greatest MP biodiversity per square meter and, therefore, favors access to various plants. This could serve as a strategy tool for health education practices and encourage forest preservation, providing a significant strengthening of national policies for MP use and directly benefiting the population that uses SUS<sup>43</sup>.

Finally, analysis by Caccia-Bava *et al.* (2017), carried out in 4,249 health units in the state of São Paulo, using data from the First Cycle of the Brazilian National Program for Improving Access and Quality of Primary Care (PMAQ – *Primeiro Ciclo do Programa Nacional de Melhoria do Acesso e da Qualidade da Atenção Básica*), showed MP use more prevalent in large cities and with higher socioeconomic indicators (63.9% of those classified in strata 4, 5 and 6 of the PMAQ), followed by smaller and marginalized cities (55.7% of those classified in the strata 1, 2 and 3 of the PMAQ)<sup>44</sup>.

Thus, the need to expand this knowledge in a more comprehensive way in the community and in the healthcare team is made explicit, in order to contemplate the population in a homogeneous way so that they can enjoy the natural and sustainable resources that their territories are able to provide them, always preserving and respecting the cultural aspects of the locality<sup>12</sup>.

### The lack of security in MP use

Some studies point to the difficulty and problems associated with users' lack of knowledge about the safety or risks of using MP.

In the work by Szerwieski *et al.* (2017), it was shown that users did not correctly know contraindications and possible side effects, and said that they used it indiscriminately, believing that, because it was more natural, it could not cause harm<sup>28</sup>. Also, Soria *et al.* (2015) report that in Paraguay, the correct identification of species is complicated because they are marketed by their popular name, which can lead to confusion<sup>45</sup>.

Soria *et al.* (2015) argue that including MP in PHC should be guided by its safe and effective use, with the correct identification of the species, its origin, its preparation and the appropriate dose for each case<sup>45</sup>. Therefore, it is essential to identify, through pharmacological and toxicological studies, the possible risks related to this practice, as well as to provide scientifically based information to healthcare professionals, establishing a pharmacovigilance program<sup>20</sup>.

Furthermore, the Caccia-Bava *et al.* (2017) revealed that in the state of São Paulo only 5.1% of the total of 467 health units that provide herbal medicines do so with the plant in natura<sup>44</sup>.

A possibility of institutionalized and safe expansion of MP use in PHC is the *Farmácia Viva* program, in the case of Brazil. *Farmácia Viva* is a pharmaceutical social assistance program that prepares herbal medicines, prescribes and dispenses them in the public health system. It also provides guidance on the use of plants, ensuring efficacy and safety from medicinal gardens with botanical certification<sup>21</sup>.

With the implementation of *Farmácias Viva* in PHC, it is possible to work with knowledge and popular uses of plants, associating them with scientific evidence, as well as to produce safe herbal remedies for use by the population, also considering side effects and contraindications of each one of them.

Regarding which MP are most used, the studies showed a very large variability depending on the geographic location, culture, historical and economic factors<sup>20,26,36,45-47</sup>.

As a limitation of this integrative review, the scarcity of studies describing the knowledge of the general population and professionals about efficacy, forms of administration, drug interactions and adverse effects of MP used in Brazil and worldwide was highlighted.

### Final considerations

Scientific evidence related to the ways of using MP in PHC characterize users and bring data about the knowledge of professionals and their safety. Thus, it is concluded that, in PHC, the MP user profile is made up of women, older adults, with low education and income, both in Brazil and in other countries, which highlights the role of women in production, use and transmission of traditional knowledge.

Also, it is evident that during the training of healthcare professionals, the topics of ICP are not addressed, generating less knowledge, more prejudice due to lack of information and leading to less research, resulting in less encouragement and dissemination to the population.

In this context, it is difficult to promote the safe, scientifically based and effective use of MP in PHC, since the lack of knowledge about how to correctly identify the plants, the proper form of use, the recommended dose and the possible drug interactions, adverse effects and toxicities are limiting factors.

However, with adequate professional training, PHC has the potential to develop medicinal gardens or implement the *Farmácia Viva*, ensuring better access to MP safely and effectively and working with popular knowledge to improve the population's well-being and self-care.

### Collaborations

KP Patrício and GC Barbosa participated in the project design, analysis of results, writing and review of the manuscript. ACS Minato, MA Lopes, AF Brólio and GR Barros contributed to all phases of the research, including data and literature survey, tabulation, results analysis, writing and review of the manuscript. VS Moraes worked on data and literature survey, formatting and final review of references.

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