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Original article

Sampling problems in Brazilian research: a critical evaluation of studies on medicinal plants

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ABSTRACT

This work compiled Brazilian articles regarding medicinal plant use by local communities in order to analyze the most common sampling problems and if research characteristics can influence the presence of sampling irregularities. We focused on studies about medicinal plants that present a species-indications list and had a quantitative nature. The proportion of works with and without sampling problems was evaluated considering the journal impact factor, period of publication, community status (urban x rural), sample type, presence of testing hypothesis and presence of research questions. We found that an alarming proportion of papers had some kind of sampling problems (48.39% serious and 19.35% moderate). The most common problems were related to: lack of information regarding the sample size or the universe, small sample sizes and selection of specialists based on obscure criteria. We could not find a significant influence between our tested variables and the occurrence of sampling problems, except for the community status (urban x rural). Results indicate that a significant amount of intracultural diversity is not properly captured, taking into consideration both the population as a whole and a group of interest in the community (= healers).

Introduction

The use of sampling techniques based on the Hypothetico-deductive method is common in scientific investigations, mainly due to the difficulty or cost of dealing with the whole universe (U). The proper use of these techniques allows the researchers to make conclusions about a population based on just a part of it. Furthermore, sampling can be applied to situations whose research objectives are not to draw a general profile for the entire universe, but rather to deal with specific components of this universe.

However, sampling misuse and negligence on the principles behind its application are common in scientific research (Bartlett et al., 2001; Albuquerque and Hanazaki, 2009). In fields

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that deal with interviews or information about humans, the scenario is not different, as evidenced by some studies that evaluate and discuss sampling and its problems (Marks, 1951; Kitson et al., 1982; Malhotra et al., 1996; Woodberry, 1998; Bartlett et al., 2001; Lee, 2010).

Accordingly, this research contributes to the discussion of sampling issues regarding the context of medicinal plants research, in order to evaluate the Brazilian studies with a quantitative approach. We sought to identify recurring sampling problems in these studies. We also intend to verify if research characteristics influence the occurrence of sample problems. The appearance of sampling problems can have important consequences concerning bioprospecting studies based on an ethnodirected approach.

Questions, hypothesis and their explanations

The following questions and hypotheses were formulated:

a) *Are more recent publications more concerned about sampling quality than older publications?* Hypothesis: More recent publications present less sampling problems than older ones. This is expected since literature has increased, the number of manuals that offer methodological support for ethnobotanical and ethnopharmacological research (Oliveira et al., 2009). In fact there was an increase in the number of Brazilian and international publications that deal with sampling issues in this scientific fields or correlated fields (Bernard, 2006; Albuquerque et al., 2014).

b) *Does the journal's impact factor influence the presence of sampling problems?* Hypothesis: studies published in journals with higher impact factors apply a higher sampling quality. This might be true since high-impact journals are considered to publish studies with meticulously performed sampling design.

c) *Do studies developed in urban areas have proportionally more sampling problems than studies developed in rural areas?* Hypothesis: Studies from urban areas have proportionally more sampling problems. We drew this hypothesis since urban areas are often more populated, they need a larger use of sample strategies, given that it is not always possible to interview the entire population

d) *Do the different types of informant's selection (purposive, random or mixed) present differences to what concerns sampling quality?* Hypothesis: sampling quality is higher for purposive (intentional) samples. We believe in this assumption because random samples often mean interviewing more people, which is more difficult to reach.

e) *Do studies that test hypothesis present less sampling problems than studies that do not test them?* Hypothesis: studies that explicitly test hypothesis are more concerned with sample quality and present less sampling problems.

f) *Do studies that present a clear research question have less sampling problems than studies that do not present it?* Hypothesis: studies that present a clear research question are more concerned with sample quality and present less sampling problems.

Sampling in qualitative and quantitative research

In most cases, the use of sampling techniques in quantitative research is associated with hypothesis testing, search for behavior patterns and comparisons within a study or with other studies. In these cases, the sample size is determined by the number required to allow valid inferences about the population or group of interest (Marshall, 1996). Therefore, a good sampling design is an essential step to reach objectives linked to the search for patterns and trends. The misuse of sampling can constitute a source of bias regarding acceptance of hypotheses that should be rejected and vice versa, in addition to hiding behavior patterns and inappropriately capturing the internal diversity of a given universe (Freiman et al., 1978; Bartlett et al., 2001).

Sample size is not the only requirement to ensure representativeness. It is necessary to follow the principles of randomness, so that the sample is not biased by a particular group. These assumptions are usually considered in quantitative research aimed at generalizing findings to the universe.

The qualitative investigations, in turn, have some particular features such as frequent use of theoretical samples, and other types of intentional samples (Marshall, 1996). Qualitative studies often assume that some cases (or respondents) provide "richer" information than others, and so the election of them would increase the researcher's ability to understand a given scenario (Marshall, 1996). In many cases, small samples are used in qualitative studies in order to allow more detailed information, so that this approach does not intend to generalize findings (Marshall, 1996; Curtis et al., 2000). Despite the peculiarities of qualitative research, many authors argue that this approach is not free from evaluations of sample quality. The sample choice must be consistent and explicit about the research objectives (Curtis et al., 2000; Dixon-Woods et al., 2004). However, as sampling in qualitative studies cannot be evaluated in quantitative terms, we decided to focus this work only on quantitative investigations, which clearly follow a positivist orientation.

Statistical assumptions in quantitative ethnobotany

According to the statistical assumptions, a sample is considered to be representative when it is randomly chosen and the probability of misrepresenting the universe is 5% or less (Bernard, 2006). Problematic sampling designs can lead the internal diversity not to be properly captured and it can be a source of bias to conclusions on, for example, the distribution of botanical knowledge within a community.

In ethnobotanical sampling, it is common to consider the community members (total or > 18 years) as the sample unit for generalization, as well as the heads of family (men and/