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Title: Fertility and fontanel : women's knowledge of medicinal plants for reproductive health and childcare in western Africa

Issue Date: 2014-09-30

Chapter Six

Summary

Summary and Conclusions

The four chapters presented in this thesis describe the medicinal plant knowledge, plant harvest patterns, reproductive health perspectives, and infant treatment preferences of Beninese and Gabonese women, as well as the value, volume, and diversity of Gabon's medicinal plant trade. The major research questions from each chapter are outlined below, with a detailed explanation of the results, hypotheses, and conclusions. This summary concludes with methodological considerations, implications for public health and education programs, and suggestions for future research.

Research Questions

Which vegetation types are major sources of herbal medicine for women and children in Bénin and Gabon?

The results in **Chapter 2** support secondary vegetation as a crucial asset in both savanna-dominated and forest-dominated landscapes. More than 80% of the 335 species cited in Bénin and 272 species in Gabon came from disturbance vegetation and home gardens, supporting our first hypothesis that women harvest predominantly from secondary forest and disturbance vegetation. Beninese and Gabonese women from our study care for their children and their own well-being by growing domesticated species, transplanting forest species to their gardens, and managing the vegetation in their immediate surroundings. The women have overcome the vulnerability of having access to a limited space and few resources to meet their families' healthcare needs. Western African women's medicinal plant harvesting can be considered generally sustainable due to the heavy reliance on human-altered habitats, but additional research is needed on the ecology and regeneration of medicinal plant species in order to make specific conclusions on the sustainability of their harvest.

What are the differences in plant use patterns between herbal medicine vendors and urban and rural women who harvest for personal use?

Like women in urban and rural areas, the majority of species cited by market vendors in **Chapter 2** came from human-altered habitats. In Bénin, women who worked in large metropolitan markets, far removed from the primary forest, were the most likely to cite vulnerable species due to their access to primary forest products through trade. In a forested country like Gabon, primary forest products were still widely available, including for women who did not have access to trade networks, resulting in no relationship between vulnerable plant use and informant type. Thus, we reject our second hypothesis that rural women use more vulnerable and primary forest species than urban and market women.

Among all plants used for women's health, how many are used to treat the statistical causes of maternal morbidity and mortality?

As discussed in **Chapter 3**, women were knowledgeable on treating the major causes of maternal mortality, but the majority of plants species in both countries were used for pregnancy-related conditions, menstrual-related conditions, and vaginal cleanses. Thus, we rejected our hypothesis that local perspectives, knowledge, and practices closely parallel African maternal mortality statistics. Beninese informants cited 248 plant species in total for women's reproductive health, in which 39 species (16%) were used to treat high blood pressure and 28 species (11%) were used in remedies for postpartum hemorrhage. Out of the 46 informants in Bénin, 87% cited at least one herbal remedy for high blood pressure, and 73% cited a remedy for postpartum hemorrhage. In Gabon, women cited a total of 189 species, in which 35 species (18%) were used to treat high blood pressure, and 12 (6%) were used to treat postpartum hemorrhage. 63% of the 41 women in Gabon were knowledgeable on

an herbal remedy for high blood pressure, and 41% knew treatments for postpartum hemorrhage. One-half of the citations for postpartum hemorrhage, however, only involved the use of hot water and thus were not plant-based in nature. Sepsis was not mentioned specifically by women in either country, but the high number of plants reported to treat sexually transmitted infections and vaginal and uterine cleanses may be reflective of local responses to treating infections.

What percentage of plants is used to treat locally-determined reproductive health concerns not addressed by international health organizations?

Menstrual-related conditions and infertility were two of the most salient health concerns according to the free-listing exercises, citation counts, and cited species presented in **Chapter 3**. These ailments were not found to be prioritized in most international health programs. In Bénin, 83% of women knew at least one treatment for a menstrual-related condition, and in Gabon, 76% of women knew an herbal remedy. A total of 79 species (32%) were used for menstrual-related conditions in Bénin, with 28 species (15%) used in Gabon. 67% of the Beninese informants and 46% of Gabonese informants knew herbal treatments for infertility. A total of 58 species (23%) were cited by Beninese women for infertility, and 13 species (7%) were cited in Gabon.

How do local biomedical healthcare providers perceive the use of traditional plant-based medicines for women's health?

The biomedical staff interviewed in **Chapter 3** recognized the role of plant-based medicine in women's reproductive health in both countries where we worked. They reported positive outcomes, such as postpartum recovery through the use of a hot water massage and the successful delivery of difficult births in private clinics through consultations with traditional healers, as well as negative outcomes such as uterine rupture due to the use of herbal medicine to accelerate contractions. We did not find a strong opinion among biomedical healthcare providers about plant-based medicines, yet both sets of practitioners cited government policies did not authorize the use of traditional medicine in national hospitals. These restrictions limited the amount of information practitioners were able to share with their patients and discouraged patients to discuss plant use practices with their doctors.

Which children's illnesses do Beninese and Gabonese mothers treat with medicinal plants?

Chapter 4 showed that mothers were most knowledgeable on plants to treat respiratory illnesses, malaria, and intestinal ailments, highlighting the similarity of mothers' experiences of infant health and the statistical causes of infant mortality. To a lesser extent, the women were also knowledgeable on plants for folk illnesses. Our results conclude that plant-based medicine, and more specifically mothers' knowledge of plants, is a major factor in the management of common childhood health ailments.

What are the major children's folk illnesses in each country?

In Bénin, mothers frequently cited the skin rash illnesses *atita* (Fon) and *ka* (Fon). Gabonese mothers commonly reported folk illnesses *la rate* (French) and *les fesses rouges* (French). Mothers from both countries shared the cultural concepts of encouraging children to walk early, monitoring the closure of the fontanels, and applying herbal enemas. As discussed in **Chapter 4**, these folk illnesses give insight into local treatments and health perspectives and are of interest to biomedicine since they may reveal important neglected diseases, such as the correlating symptoms of *la rate* and sickle cell disease.

For which ailments do mothers seek treatment from biomedical doctors or traditional healers?

The mothers involved in the study described in **Chapter 4** largely saw the three African systems of healthcare as complementary. The women generally self-treated with plants first, sought biomedical care for advanced stages of malaria, anemia, or fever or as a second source of healthcare and consulted the spiritual realm to treat folk illnesses or those ailments with a superhuman cause. Biomedicine was perceived to have the advantage of advanced technology and materials, especially for treatments related to blood transfusions. Some mothers in Bénin reported a preference of using self-collected herbal medicine over biomedical care due to the expensive of modern treatment.

What are the species, volume, and value of medicinal plant products sold domestically on major markets in Gabon?

The market study described in **Chapter 5** resulted in 263 medicinal plant products corresponding with at least 217 species. We estimated that 27 tons of medicinal plant products with a value of US\$ 1.5 million are sold annually on the major Gabonese markets. We encountered 13 species on one-third of the surveyed stalls and found that 18 species made up almost 50% of the total volume of products available daily, including the fruits of *Tetrapleura tetraptera* and seeds of *Monodora myristica*.

What are the most frequently sold species and plant parts and the most salient health concerns treated by plants sold at the market?

Bark represented the majority of the Gabon market's floristic diversity (22%) as well as the highest percentage of daily stock (30%) in **Chapter 5**. The resin of IUCN red-listed rain forest tree species *Aucoumea klaineana* represented 20% of the daily volume of the entire market. The most salient uses of plants sold on the market were ritual purposes (32%), followed by women's health (13%), and childcare (10%). The strong presence of ritual plants on the marketplace highlights the role of spirituality and local belief systems in present-day Gabon, particularly in its urban centers.

How does Gabon's herbal medicine trade compare with markets in West Africa, Tanzania and South Africa?

Chapter 5 showed that the herbal market in Gabon was smaller in volume and value than markets in the Eastern Cape Province of South Africa, Ghana, and Bénin, and larger than the market in Sierra Leone. Gabon's floristic diversity on the market was higher than in Cameroon, Sierra Leone, South Africa, and Ghana, and slightly lower than in Bénin and Tanzania. These results support the first part of our hypothesis that Gabonese medicinal plant markets are smaller in volume than those in other African countries, but reject the second part, that Gabon's trade is smaller in floristic diversity. Herbal medicine in Gabon was more expensive than in Ghana or Bénin resulting in a fairly high value for a low volume of plant material for sale, and higher reported vendor salaries. In Gabon the most commonly traded plant parts were sold in the form of bark and resin, where Ghana was dominated by fruits and seeds, Bénin was mainly leaves and whole plants, and Sierra Leone was mainly barks and leaves. Bulbs, tubers and roots were most commonly traded in South Africa, with barks and roots most prevalent on Tanzania's market. Markets in Ghana, Gabon and Bénin all sold the seeds and fruits that doubled as food additives and medicine (*Xylopiya aethiopica*, *Monodora myristica*, *Aframomum melegueta*) with ritual and women's health as top salient health concerns. The rank of women's health plants among the top two most salient health domains addressed by markets in Bénin, Gabon, and Ghana illustrate that women's health is a major concern treated by herbal medicine markets in Western Africa. The presence of medicinal plants on markets throughout Gabon stresses the role of herbal medicine in relatively wealthy African countries with heavily urbanized populations.

Methodological Considerations

Our methodology of utilizing ethnobotanical questionnaires with the corresponding collection of cited plant species resulted in a large database of plant names and uses. Although we were able to match 98% of the Beninese database and 93% of the Gabonese database with scientific nomenclature, several plants that were cited in questionnaires were unable to be matched with scientific literature, purchased on the market, or collected in the field. While some of the plants simply were unavailable due to season, location, or particular day on the market, many of the errors could be avoided in future studies. One explanation to this shortcoming can be attributed to the challenge of working with an international team of researchers with a variety of linguistic backgrounds (English, Spanish, Flemish, French, Dutch, Fon, Yoruba, Fang). Some of the unmatched names may be a result of the multiple phonetic interpretations of African plant names. Including special consideration for linguistics, including training in phonetic spelling of African languages, in future ethnobotanical studies may help to avoid similar database errors. Our data-collection methods could have been improved by follow-up focus group sessions with women who participated in the questionnaires. These sessions could serve to reiterate the data gathered in the questionnaires and confirm plant names with associated botanical collections. Future studies by ethnobotanists should continue the methodology of combining questionnaires with plant collection with these shortcomings in mind.

The largest critique of the methodology utilized in our study would be to spend more time in the individual communities where we worked. Although the six months spent in each country was a reasonable time frame for conducting doctoral fieldwork of this nature, field visits typically lasted from a few hours to several days. Spending more time with each woman and her broader community could result not only in more thorough understandings of local treatments from an anthropological perspective, more complete collection of medicinal plant vouchers from a botanical perspective, but also benefit sharing from an ethical perspective. In only one community from our study, a village in Bénin, were we able to contribute to a community-driven project directly from the results of our research. We sent the database of all herbal remedies cited by the community to the school director, complete with scientific identifications. The director plans to work with the school children to create and distribute booklets on medicinal plants for childcare directly from the knowledge generated in our study. Theoretically, our work can be applied to stimulate health care and conservation decisions from a policy viewpoint, but future research should seek to work closer with local people, health clinics, and conservation organizations to strengthen the direct outcome of ethnobotanical research for African communities.

In addition to creating stronger links with the communities where we worked, spending additional time with students at the universities and with research institutes could improve future research cooperation. Local African students are incredibly well-versed in the local languages and cultures but often have not had the same training as their peers outside of Africa. Foreign researchers have the possibility to expand the skillset of local students through offering opportunities to work on research studies and to build their anthropological, botanical, and logistical research skills.

Implications for public health and education programs

The local doctors, midwives, and gynecologists are uniquely positioned at the intersection of the two medical systems, situated between cultural practices and the biomedical science promoted in government hospitals and clinics. Although research on the effects of medicinal plants is sorely needed, in the meantime, educators and healthcare providers should familiarize themselves with common practices and herbal treatments in order to facilitate fruitful discussions with their patients and avoid

the negative effects of combined healthcare systems. Biomedical research is still inconclusive on the role of vaginal cleanses in either preventing or increasing vaginal infections (Myer et al. 2005; Low et al. 2011), yet anthropological research has shown that these practices are deeply embedded in a woman's agency over her own fertility and relationships (Martin Hilber et al. 2012). Dismissing local treatments or discouraging their use will further distance women from the treatment options available through biomedicine. Educational efforts can also focus on the link between sexually transmitted infections (STIs) and infertility, as infertility is a frequent concern of the women involved in our study, and STIs are considered one of its major causes (Collet et al. 1988).

Future research

In order to further the discussion on the sustainability of harvesting in secondary vegetation from **Chapter 2** and the commercialized species highlighted in **Chapter 5**, future studies should carry out population assessments, impact studies and natural regeneration measurements of species indicated as having conservation concerns such as *Baillonella toxisperma*, *Garcinia kola* and *Pterocarpus soyauxii* in Gabon and *Xylopia aethiopica*, *Khaya senegalensis*, *Monodora myristica*, and *Caesalpinia bonduc* in Bénin. Additionally, future research on male knowledge domains (e.g. ritual plants and aphrodisiacs) and associated plant harvesting patterns can help illustrate the gendered differences of medicinal plant use and its variable impacts on surrounding vegetation.

Echoing the biomedical healthcare providers interviewed in **Chapter 3**, additional information is needed on the role of plants in women's gynecological healthcare, including the specific benefits and risks of plant-based medicines in the long and short-term. Research should go beyond the goal of substantiating efficacy, instead focusing on improving biomedical healthcare providers' abilities to provide relevant information and practical advice to their patients.

Unlike the biomedical providers interviewed on women's health, the mothers in **Chapter 4** largely saw the three African healthcare systems as complementary. This dissonance creates fertile ground for politically-focused research on African governments' provision of biomedical care services, policies on herbal medicine, and local women's practices of managing reproductive and pediatric health.

Finally, in **Chapter 4**, we concluded that mothers' knowledge of herbal medicine is a major factor in the provision of infant healthcare. However, we did not take into account differences in ethnicity or age. In our study, we defined "mother" as any woman who had at least one child, which resulted in the participation of mothers and grandmothers. Future ethnobotanical research in Africa can assess the human behavior theory surrounding "grandmothering" (Hawkes et al. 1997; Bezner Kerr et al. 2008), focusing on the medicinal plant knowledge of women of the third age. This highly debated theory suggests that the presence of women in the post-fertile period of life is an evolutionary advantage, contributing to the wellbeing and survival of subsequent generations (O'Connell et al. 1999).

It is my hope that this study serves to give a voice to women from Bénin and Gabon on gynecological and pediatric health issues. May it contribute to an honest discussion between all stakeholders, followed with tangible action in improving the healthcare options and overall well-being of women and children in Beninese and Gabonese communities.