Chapter 2

Use of Medicinal Plants by Dominican Immigrants in New York City for the Treatment of Common Health Conditions

A Comparative Analysis with Literature Data from the Dominican Republic

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Introduction

The growth of the Dominican population in the northeastern United States in the past two decades constitutes one of the major immigration waves during the second half of the twentieth century. This movement is equal in magnitude to the massive Puerto Rican migration in the 1950s and 60s (Rivera-Batiz 2002). If current trends continue, the Dominican immigrant population in New York City (NYC) will grow to be larger than that of Puerto Ricans in the next ten years. Fifty-three percent of all Dominicans in the United States live in New York City. Depending on the source, the number of Dominicans in New York City in 2000 was estimated to be 369,200 (NYC Department of City Planning 2004), 407,473 (US Bureau of Census), or 555,000 (Rivera-Batiz 2002). The actual number is likely to be higher given the presence of undocumented immigrants who are not included in the above estimates and whose population is difficult to

determine. Dominican immigrants live in all five New York City boroughs, but are primarily concentrated (more than 66 percent) in Manhattan and the Bronx (NYC Department of City Planning 2004).

Washington Heights, located near the northernmost tip of Manhattan, has long been the neighborhood with the largest Dominican community in New York City, together with Inwood (located north of Washington Heights), and Hamilton Heights (adjacent to the South). However, recently the Bronx is taking the lead (unpublished data from the Bureau of Epidemiology Services, NYC Department of Health and Mental Hygiene) in becoming the center of Dominican settlement.

The Dominican community shows a low level of socioeconomic attainment and poor indicators of well-being and health. In 2000, 70 percent of Dominicans living in New York City did not rate themselves as proficient in English, and less than 50 percent graduated from high school. Thirty-one percent were living in poverty, making Dominicans third in poverty measures among twenty NYC immigrant groups, after Mexicans and Bangladeshis (NYC Department of City Planning 2004). Dominicans, like other United States immigrants, disproportionately lack health insurance coverage and receive fewer health services than native-born citizens. Low-income noncitizens are more than twice as likely to be uninsured as compared with low-income citizens (Kaiser Commission on Medicaid and the Uninsured 2003). Dominicans in the United States rank fifth in lack of health insurance coverage (with 36 percent of people uninsured) among sixteen immigrant communities (Carrasquillo et al. 2000). In addition to lack of health insurance coverage, immigrants may encounter limited access to biomedical health care services because of language barriers, citizenship status, and/or the experience of lack of recognition of their cultural beliefs and practices by health care providers (Gomez-Beloz and Chavez 2001; Kaiser Commission on Medicaid and the Uninsured 2003). A health report from the predominantly Dominican neighborhood Washington Heights in Manhattan shows that 26 percent of people do not consider themselves to be in good health, while 17 percent needed care and did not receive it, and 34 percent have no personal doctor. New York City averages for these three health indicators were significantly better (19, 10 and 25 percent, respectively). In addition, the vulnerability of those living in Washington Heights is further demonstrated by the following comparisons (totals for New York City are given in parentheses): 44 (28) percent of adults did not graduate high school, 31 (21) percent live in poverty, and 53 (32) percent feel their neighborhoods are unsafe. These conditions are likely to negatively influence people's ability to increase healthy behaviors and maintain optimal health (Karpati et al. 2003). Hence, there exists an evident need for improved health care for the Dominican community in New York City.

In the United States, *botánicas* and *curanderos* (traditional healers) represent a unique, culturally based health care delivery system that is available outside of

community hospitals, clinics, physicians' offices, and pharmacies (Gomez-Beloz and Chavez 2001; Reiff et al. 2003). *Botánicas* are Latino and/or Afro-Caribbean shops and "sites of healing and community support" (Hernández and Jones 2004) that deal with physical, spiritual, and/or religious well-being and often function as herbal pharmacies by selling fresh, dried, and processed herbs grown in the United States, or imported from the Caribbean or elsewhere (Balick et al. 2000). By drawing on religious and healing traditions that recognize the multiple (physical, mental/emotional, spiritual, social, and environmental) dimensions of health and well-being in a holistic fashion, *botánicas* and the traditional healers associated with them are important resources for Latino immigrant health care. In academic publications, *botánicas* have been described in myriad ways: as "herb shops" and folk medical pharmacies (Fisch 1968), "small shops selling *artículos religiosos*" or religious supply stores (Borrello and Mathias 1977), "botanical shops" which function as "community-based establishments" and "outlets for important cultural traditions pertaining to healing and spirituality" (Delgado 1996; Delgado and Santiago 1998), "invisible hospitals" (Jones and Polk 2001), and "ethnic healing-religious stores" (Viladrich 2006). A large number of *botánicas* are situated in Manhattan and the Bronx, two boroughs of New York City with high populations of Latinos, including Dominicans. During a two-day systematic street survey through two ZIP-codes in the Bronx (representing 8 percent of all Bronx ZIP-codes), we mapped sixteen *botánicas* (unpubl. results). Therefore, we expect to map many more botánicas when we expand the survey. In addition, seventy-five *botánicas* were identified in the Bronx based on a review of local, Spanish-language telephone books, newspaper advertisements, and Internet searches (Yukes unpubl. results). Since most *botánicas* do not openly advertise themselves in print or online, the actual number of *botánicas* in this borough is probably considerably higher.

Botánicas offer culturally appropriate health care to their customers (Gomez-Beloz and Chavez 2001), and an herbalist, healer, or spiritual counselor (who may be called a *curandero/a*, *Espiritista*, *Santero/a*, or simply *Señor/Señora* or *Don/Doña*) can frequently be consulted on the spot. *Botánica* staff usually share the same cultural background (i.e., of Latino/a or Caribbean descent but not necessarily of the same nationality) as their clientele. Hence, explanations of the cause of illness and treatment regimes are generally understood by customers-patients, and herbal remedies may be familiar to those seeking them since they are also used in the immigrant's home country. Moreover, medicinal plants can be purchased in small quantities at relatively low cost, which allows for more flexibility in spending as compared to the one-time purchase of expensive whole packages of over-the-counter or prescribed pharmaceuticals. The particular modalities offered by *botánicas* and the reciprocal dialogue on health, illness, and treatment between customer (patient) and shopkeeper (alternative health care provider) may be convenient, culturally familiar, and cost-effective for many Dominicans.

Also, by providing a space for social interaction, cultural expression, and spiritual practices associated with Afro-Caribbean and Latin American religious traditions, *botánicas* are a valuable community resource.

Medicinal plants—or *plantas de la tierra*, *matas*, or *hojas*, as Dominicans call these herbal remedies—are an important aspect of Dominican culture (Robineau 1986; Brendbekken 1998). *Botánicas* exist in the Dominican Republic (DR) as well, and medicinal plants are also easily available at open air markets, local grocery stores, and even at supermarkets from international chains, some of which sell locally made bottles of medicinal roots (*botellas*) and packets of dried herbs for the promotion of health and well-being. Most Dominican homes in the Dominican Republic have patio gardens or agricultural land (*conucos*) that are another source for obtaining *matas*. It has been shown that after immigration to the United States, Latinos in general—and Dominicans in particular—continue to use medicinal plants for health care (Allen et al. 2000; Balick et al. 2000; Ososki et al. 2002; Mikhail et al. 2004).

In spite of the popularity of medicinal plant use, relatively few systematic ethnobotanical inventories have been compiled so far that focus specifically on Dominican (medicinal) plant use, either in the United States or in the Dominican Republic (Robineau 1986; Polanco et al. 1998; Balick et al. 2000; Peguero et al. 2001; Peguero 2002). An exception is the extensive ethnopharmacological survey conducted by TRAMIL (Traditional Medicine in the Islands) in twenty-three Caribbean countries including several communities in the Dominican Republic. However, although the survey records all the medicinal uses that are reported by participants for treating ten health conditions, the TRAMIL publications (Germosén-Robineau 1997; 2005) only include information on plant species and medicinal uses that were reported in at least 20 percent of the interviews at a given study site. This strategy was chosen as a function of the applied community health objectives of TRAMIL.

The ethnobotanical study on which we report in this chapter is part of an interdisciplinary project entitled "Dominican Herbal Medicine: Plants Used for Inflammation," conducted by researchers at the Institute of Economic Botany at the New York Botanical Garden, and funded by the National Institutes of Health, National Center for Complementary and Alternative Medicine (NIH-NCCAM). The study team consists of a consortium of seven institutes from the United States and Dominican Republic that bridges several disciplines, including botanical gardens (The New York Botanical Garden; Jardín Botánico Nacional Dr. Rafael Ma. Moscoso de Santo Domingo), Dominican community based organizations and networks (Alianza Dominicana; TRAMIL), research centers and universities (National Center for Natural Products research, University of Mississippi; Richard and Hinda Rosenthal Center for Complementary and Alternative Medicine, Columbia University), and clinics (Associates in Internal Medicine, New York Presbyterian Hospital). One of the main objectives of the project is to

create an inventory of medicinal plants known and used by Dominicans in New York City and to compare medicinal plant knowledge between New York City and the Dominican Republic.

Here, we report on the results of ethnobotanical fieldwork with 175 Dominican immigrants in New York City. We analyzed a subset of our ethnobotanical database by extracting information on those medicinal plants which participants report to (have) use(d) "only in New York City" (and hence excluding applications reported as "used only in the Dominican Republic" or "used in both New York City and the Dominican Republic"). Subsequently, the medicinal uses of the most frequently mentioned plants were compared with published information on their applications in the Dominican Republic.

Material and Methods

The research and study instruments (questionnaires, flyers, and oral consent forms) were approved by the Institutional Review Board of the City University of New York (IRB # 04-06-0599). Interviews were conducted with 175 Dominican participants, age eighteen or older, in Manhattan and the Bronx between April 2005 and February 2006. Before the start of the survey, a questionnaire consisting of eighty-four structured and semi-structured questions was designed, pilot tested with nine participants, and reviewed several times by different members of the project consortium. The questionnaire covered the following aspects of Dominican medicinal plant use and personal background information: (1) history of a participant's plant use in the Dominican Republic; (2) participant's present plant use in New York City; (3) general use-preference for medicinal plants or pharmaceuticals, and reason(s) for this preference; (4) sociodemographic profile, including age, education, geographical area of origin in the Dominican Republic, household size, income, and type of health insurance; (5) acculturation rating; (6) medicinal plant knowledge for thirty common health conditions; (7) knowledge of potentially harmful medicinal plants; (8) source of plant knowledge; (9) beliefs about illnesses that should be treated exclusively with pharmaceuticals or by a biomedical health care provider (9a), versus beliefs about illnesses that should be treated exclusively with medicinal plants or by a traditional healer (9b).

Participants were questioned about medicinal plant knowledge related to thirty common health conditions and notes were taken about: (1) the local and alternative name(s) for each medicinal plant they mentioned; (2) whether they ever experienced the illness for which a medicinal plant was mentioned; (3) whether they had treated the illness with: (3a) medicinal plants, (3b) pharmaceuticals, or (3c) both medicinal plants and pharmaceuticals; (4) in which country they had used this medicinal plant, with choice of the following options: (4a) in New York City only, (4b) in the Dominican Republic only, (4c) in both New York City and

the Dominican Republic. An overview of the list of health conditions included in the survey is provided in table 2.1.

Participants were recruited and interviewed through snowball sampling in New York City and at two specific locations in Washington Heights, New York City: (1) Alianza Dominicana, a Dominican community-based organization, and (2) the Associates in Internal Medicine Clinic (AIM), New York-Presbyterian Hospital. Participants contacted through referral were usually interviewed at home and on a few occasions at the Institute of Economic Botany of the New York Botanical Garden, while those recruited at Alianza Dominicana and the AIM clinic were interviewed on the premises in a private location. Prior informed oral consent was obtained from all participants, and permission was asked to tape record each interview. To ensure confidentiality, an ID-number was assigned to each participant to code their interview materials. On average, interviews lasted between one and two hours. At the end of the interview, participants received a compensation of $20 (US). In total, 175 Dominicans were interviewed, 111 women and 64 men. Data from the pilot interviews (5 women and 4 men) were excluded from data analysis since the questionnaire was substantially revised after pilot testing.

Interview data were entered in a Microsoft/Access database that includes three linked tables: (1) table with participant data (sociodemographic variables); (2) table with illness data (name of illness, use of medicinal plants or pharmaceuticals for treatment, use according to country, and mode of administration of the plant remedy); and (3) table with plant data (including local name, alternative name, whether used individually or in a mixture, and plant part used). For the purpose of data analysis, plant use data reported for "New York City only" were extracted, thus omitting plant use data for herbal remedies that were used "only in the Dominican Republic" and those that were used "in both New York City and the Dominican Republic".

The "NYC use only" data subset was used to calculate the citation frequency of plant species and an Index of Agreement on Remedies (IAR), based on the following formula: $IAR= (n_a-n_r)/(n_a-1)$, with n_a being the citation frequency of the ailment and n_r being the number of different plant remedies cited to treat that ailment (Phillips 1996). IAR-values fluctuate between "0" and "1," with "0" representing no consensus at all and "1" total consensus between participants. The limitation of this index is that it becomes less useful for health conditions that are mentioned infrequently; therefore, we limited calculation of IAR-values to health conditions mentioned at least ten times.

Three methods were used to cross reference local (Spanish) and scientific names of plants. The first method consisted of collecting voucher specimens together with Dominican participants in green spaces in New York City. This is the voucher collection of the first author (IV). The second sampling method involved collecting samples of dried plants or plant parts purchased from *botánicas,* defined here as the reference collection (Ref-IV); these samples were often sold as small

pieces or fragments of sterile parts (not flowering and/or fruiting), and typically sold in bags or in bulk. A third method consisted of using a plant portfolio displaying color photos of commonly used plants with numbered pictures for botanical identification purposes (Pic-Dom). The plant portfolio is particularly useful for verification of food plants. Since food plants are well known from a botanical perspective, no voucher collection was made from them. Photographs included in this portfolio were taken in New York City during visits to *botánicas* and Latino grocery stores (*bodegas*), and in the Dominican Republic in markets and in the field. Researchers were accompanied by knowledgeable Dominican participants who confirmed the local Spanish names of the plants. Plant images were provided by Irina Adam, Michael Balick, Flor Henderson, Andreana Ososki, and Ina Vandebroek.

Results and Discussion

Ninety-seven of 175 Dominican respondents mentioned medicinal plant remedies which they use(d) "only in New York City" (thereby excluding plants used "only in the Dominican Republic" or "in both New York City and Dominican Republic"). In total, there were 596 responses of herbal remedies to treat specific health conditions, and a total of 762 individual plant use reports, indicating that medicinal plants are often used in mixtures. Forty-one plants account for 74 percent of all the responses, and twenty-six plants are mentioned at least 10 times. Table 2.1 lists the citation frequency (of plant remedies) and IAR-values for the health conditions studied, as well as the number of different plants that were reported for treatment of a particular health condition. IAR-values fluctuate between "0" and "1," with "0" representing no consensus, "0.5" average consensus, and "1" total consensus.

Participants most frequently cited medicinal plants (fifty citations or more) for the following ailments (in descending order): flu and common cold, elevated levels of cholesterol, diabetes, asthma, bronchitis and cough. Consensus about plant remedies was high for flu and common cold, and for cholesterol (IAR-value of 0.73 and 0.76, respectively), indicating that participants know very well how to treat these conditions with medicinal plants and frequently cite the same plant remedies. The same holds true for asthma (IAR=0.62). On the other hand, consensus is borderline for bronchitis and cough (IAR=0.51), and low for diabetes (IAR=0.46). This shows that, in general, participants use a high diversity of plant remedies in New York City to treat diabetes, and that particularly popular and hence widely known plant remedies may not exist for this health condition among the study group.

The total number of 762 individual plant use reports corresponded with 125 different medicinal plants. Hence, the same plants are cited repeatedly for similar or different ailments, and some plants are cited more frequently than others. Sixty-one percent of these were food plants that are used as medicine, meaning

Table 2.1. Index of Agreement on Remedies (IAR) Values for Common Health Conditions

Health condition/Ailment ***(Spanish name)***	**Response frequency in interviews (n=97)***	**Number of plant remedies cited**	**IAR-value****
flu and common cold (*gripe y resfriado/catarro*)	107	30	0.73
high cholesterol (*colesterol alto*)	79	20	0.76
diabetes (*diabetes, azúcar*)	62	34	0.46
asthma/chest congestion (*asma/pecho apretado*)	59	23	0.62
bronchitis and cough (*bronquitis y tos*)	52	26	0.51
hypertension (*presión alta*)	48	23	0.53
sinusitis (*sinusitis*)	29	16	0.46
kidney problems and stones (*riñones y cálculos/botar piedras*)	28	14	0.52
rheumatism (*artritis/reumatismo*)	28	17	0.41
diarrhea (*diarrea*)	25	13	0.50
menstrual pain (*dolor menstrual*)	15	8	0.50
fungal skin infections (*hongos de la piel, mazamorra, paños, manchas blancas en la piel*)	15	11	0.29
burns (*quemaduras*)	14	6	0.62
labor pain and puerperium (*dolor del parto, posparto, entuerto*)	13	7	0.50

vaginal discharge (*flujo vaginal, flujo blanco*)	11	9	0.20
hypotension (*presión baja*)	8	4	—
infertility (*infertilidad, cuando alguien no puede tener bebes y quiere tenerlos*)	6	6	—
wounds (*heridas*)	5	3	—
back pain (*dolor de espalda*)	4	3	—
impotence (*impotencia*)	4	4	—
furuncles (*nacíos*)	3	3	—
sprains (*torcedura de huesos, huesos torcidos, esguince, zafadura de mano, pie, tobillo, dedos*)	3	2	—
trauma (*traumatismo de golpe, chichón, moratón, para debaratar golpes*	3	2	—
herpes zoster (*culebrilla*)	2	2	—
birth control (*contracepción, para no tener más niños*)	2	2	—

*The response frequency refers to the total number of times a plant remedy (either a plant mixture or a single plant) was reported for treating a specific health condition in New York City by the sample population. Out of 175 interviewees, 97 mentioned medicinal plants that were used "only in New York City" for treatment of health problems.

**IAR-values were calculated for health conditions mentioned at least ten times, based on the following formula: $(n_a-n_r)/(n_a-1)$, with n_a representing the citation frequency of an ailment and n_r being the number of different plant remedies cited to treat that ailment. IAR-values fluctuate between "0" and "1," with "0" representing no consensus at all and "1" total consensus.

that they have a primary culinary application (as fruits, vegetables, staple foods, or condiments) and are also used by Dominicans for medicinal purposes. Table 2.2 lists twenty-six plants used in New York City that were cited at least ten times. Foods constituted the majority of the most frequently cited plants (twenty-two of twenty-six, or 85 percent).

According to table 2.2, *Aloe vera* (L.) Burm.f., commonly known by Dominicans as *sábila* (English common name: aloe), is the most popular and most versatile species. It is used in New York City to treat twenty-two different ailments, and—based on the citation frequency for individual ailments—its major uses include diabetes, obesity, and cancer. The plant part that is used is the inner leaf gel (called *cristál*) that is obtained after peeling the leaves. Several of the uses recorded for *sábila* in New York City are corroborated by literature from the Dominican Republic or the Caribbean, including its application for flu and common cold, asthma, wounds and other skin conditions, hair care, and constipation (see table 2.2 for references). However, other applications for this species according to the published literature were not recorded in the data subset of New York City. These include its use for menstrual disorders, liver ailments, inflammation, burns, and as a vermifuge. Although menstrual disorders were not mentioned specifically in the present study for the NYC data subset, other uses reported for *sábila* in New York City that are related to the genito-urinary system include vaginal discharge, cleansing of the reproductive organs, and infertility. Balick et al. (2000) report on the use of *Aloe vera* by Latino healers in New York City for treatment of uterine fibroids (benign connective tissue tumors). NYC participants cited the raw tubercles of *papa* (potato, *Solanum tuberosum* L.), and to a lesser extent the fried seeds of *bija* (lipstick tree, *Bixa orellana* L.), rather than *sábila* for burns. No NYC uses as a vermifuge were reported for any plant species in the present study, probably because intestinal parasites are common in the tropics but not in a temperate urban setting.

A comparison of plants reported as used "in New York City only" and literature data from the Dominican Republic and the Caribbean (table 2.2) shows that the literature confirms most of the major medicinal uses for different species in New York City. Hence, the use of any of the following plants to treat flu and/or common cold is similar between New York City and the Dominican Republic: *limón* (lime and lemon, *Citrus aurantifolia* (Christm.) Swingle and *Citrus limon* (L.) Burm.f., respectively) (juice, 19 citations); *cebolla* (onion, *Allium cepa* L.) and *cebollín* (shallot, *Allium cepa* var. *aggregatum* G. Don) (juice, 16 citations); *manzana* (apple; *Malus* spp.) (tea from fruit, 11 citations); *canela* (cinnamon, *Cinnamomum verum* Presl) (tea from bark, 11 citations); *higuereta* (castor bean, *Ricinus communis* L.) (oil from seeds, 9 citations); *berro* (watercress, *Nasturtium officinale* R. Br.) (juice, 6 citations); *jengibre* (ginger, *Zingiber officinale* Roscoe) (tea from root, 6 citations); *naranja agria* (bitter orange, *Citrus aurantium* L.) (tea from leaves, 6 citations); *sábila* (juice, 4 citations).

Table 2.2. Medicinal Plants Used by Dominican Immigrants in New York City That Were Cited at Least Ten Times During the Survey. Plants are ranked according to decreasing cumulative citation frequency (cit. freq.) and are presented as follows: local name {scientific name, family} [reference number**]

Cit. freq.	Medicinal use	Alone (A) or Mixed with other plants (M)	Administration	Use in the Dominican Republic and the Caribbean* according to literature data
56 citations: *sábila* {*Aloe vera* (L.) Burm.f., Asphodelaceae}[Pic-Dom-130, Pic-Dom-133, Ref-IV-20]				
6	diabetes	A, M	oral	
5	obesity	A, M	oral	
5	cancer, incl. leukemia (prevention and treatment)	A, M	oral	
4	high cholesterol	A, M	oral	
4	flu and common cold	A, M	oral	flu and common cold[2,6]
3	asthma	M	oral	asthma[2]
3	bronchitis and cough	A, M	oral	
3	skin fungi, incl. *Pityriasis versicolor* (*paños*)	A	oral, topical	skin patches[2]
3	wounds, cuts and scratches	A	oral, topical	cuts and scratches[2], anti-hemorrhagic (styptic)[1]
3	skin and hair care	A	oral, topical	baldness[2]
3	vaginal discharge	A	oral, "ovule"	
2	constipation	A, M	oral	digestive, constipation[1]
2	trauma, to increase muscle strength	M	oral, topical	
2	sinusitis	A, M	oral	
1	arthritis	A	oral	
1	furuncles (*nacíos*)	A	topical	
1	insect bites, swelling of the legs	A	oral	
1	toothache	A	topical	
1	ophthalmic	A	topical	
1	infertility	A	oral	
1	cleanse the reproductive organs	M	oral	
1	AIDS	A	oral	menstrual disorders[1,5] liver ailments[1] inflammation and burns[1] purgative, vermifuge[1]

(continued)

Table 2.2. Continued

47 citations: *ajo* {*Allium sativum* L., Alliaceae}[pic-dom-8]				
21	hypertension	A	oral	hypertension[1,4,7]
4	stomachache, ulcers	M	oral	flatulence and stomach problems[2,6,7]
3	hypotension	A	oral	
3	high cholesterol	A, M	oral	
3	fungal skin infections	A	topical	skin problems, including candidiasis and rash[2]
2	rheumatism	A, M	oral, topical	rheumatism[1]
2	asthma	M	oral	
2	obesity	A, M	oral	
2	bronchitis and cough	A, M	oral	
1	insomnia	M	oral	
1	diarrhea	A	oral	
1	flu and common cold	M	oral	febrifuge[2,4]
1	depression	M	oral	
1	uterus (unspecified)	M	oral	uterus ("raises the uterus")[5] vermifuge[1,2,4] toothache and earache[2,4] "bad blood"[2]
43 citations: *cebolla* {*Allium cepa* L., Alliaceae}[Pic-Dom-32] and *cebollín* {*Allium cepa* var. *aggregatum* G. Don, Alliaceae}[Pic-Dom-36]				
16	flu and common cold	A, M	oral	common cold[1]
11	asthma, chest (unspec.)	A, M	oral	"chest congestion" (*pecho apretado*)[7]
10	bronchitis and cough	A, M	oral	bronchitis, respiratory infections[1,2,8]
2	sinusitis	M	oral	
1	rheumatism	M	oral	
1	acne	A	topical	
1	ulcers (unspec.)	A	oral	
1	obesity	M	oral	
				edema[1] kidney problems[7] oral candidiasis[2] infertility[5]
40 citations: *limón/limon agrio* {*Citrus aurantifolia* (Christm.) Swingle, Rutaceae}[Pic-Dom-78] and {*Citrus limon* (L.) Burm.f., Rutaceae}[Pic-Dom-75]				
19	flu, fever and common cold	A, M	oral, internal	flu and common cold[1,2,3,6,7] febrifuge[1,2,3,6]
4	cough, chest (unspec.)	A, M	oral	cough[2]
4	high cholesterol	M	oral	

3	asthma	M	oral	
3	rheumatism	A, M	oral	rheumatism[9]
3	diarrhea	A, M	oral	diarrhea[1,2,3,7,9], dysentery[1]
2	sinusitis, headache	A	oral, internal	headache[2]
2	trauma, bruises	A	topical	
2	diabetes	M	oral	
1	vaginal discharge	A	oral	
1	herpes zoster (*culebrilla*)	A	ritual	
1	kidney problems	M	oral	
1	fungal skin infections	A	topical	fungal skin infections (*mazamorra*)[7]
1	diuretic	M	oral	
				ophthalmic[1, 2]
				abundant menstruation[5]
				gonorrhea[1]
				earache[2]
				scurvy[1]
				flatulence[9]
				inflammation[9]
				antidote for Euphorbiaceae poisoning[1]

30 citations: *avena* {*Avena sativa* L., Poaceae}[Pic-Dom-25]

26	high cholesterol	A, M	oral	
1	diabetes	A	oral	
1	obesity	M	oral	
1	hypertension	A	oral	
				spasmolytic[1]
				CNS tonic[1]

29 citations: *manzanilla* {*Matricaria recutita* L., Asteraceae}[Pic-Dom-92, Ref-IV-27]

9	menstrual pain, labor pain, and puerperium	A, M	oral	menstrual pain and puerperium[2,4], uterine colic, menstrual disorders[5]
6	insomnia and CNS tranquilizer	M	oral	nervousness[5]
3	stomachache and flatulence	A, M	oral	stomachache, diarrhea, spasmolytic and carminative[1,2,4]
3	bronchitis and cough	M	oral	
2	asthma	M	oral	
1	blood circulation	A	oral	
1	infertility	A	oral	
1	cysts	M	oral	tumors[5]
1	sinusitis	A	internal	
1	depression	M	oral	

(continued)

Table 2.2. Continued

1	flu and common cold	M	oral	febrifuge (*Chrysanthemum parthenium*)[1] wound healing[1]
27 citations: *berro* {*Nasturtium officinale* R. Br., Brassicaceae}[Pic-Dom-23]				
12	asthma, chest (unspec.), cleanse lungs	A, M	oral	expectorant[1]
9	bronchitis and cough	A, M	oral	bronchitis[1]
6	flu and common cold	A, M	oral	flu[6]
				diuretic[1] tuberculosis[1] diabetes[1] aphrodisiac[1] scurvy[1]
24 citations: *jengibre* {*Zingiber officinale* Roscoe, Zingiberaceae}				
6	flu and common cold	M	oral	flu and common cold[1,2,3,4,6], febrifuge[2,4,6]
4	labor pain and puerperium	A	oral	
4	rheumatism	A, M	oral, topical	rheumatism[1,7]
2	sinusitis	A, M	oral, topical	
2	sprains and back pain	M	oral, topical	
1	obesity	M	oral	
1	constipation	M	oral	
1	skin fungi	A	topical	
1	cough	A	oral	cough[2,4], respiratory infections[1]
1	diabetes	M	oral	
1	hypothermia	A	oral	hypothermia[1] tonic[1] indigestion, carminative, stomachache[1,2,4,6,9] toothache[1] aphrodisiac[1] asthma[2] diarrhea[2,4] vomiting[2,4] regulates menstruation[5] facial paralysis[1]

23 citations: *higuereta* {*Ricinus communis* L., Euphorbiaceae}[Pic-Dom-68]				
9	flu and common cold	A, M	oral	flu and common cold[1,6]
5	asthma	A, M	oral	asthma (*pecho apretado*)[2,4,7,8, 9]
4	sinusitis	M	topical	headache[1,2,4]
3	bronchitis and cough	A, M	oral	chest (unspec.)[1], respiratory infections[2,4]
1	rheumatism	A	topical	rheumatism[2,4]
1	AIDS	M	oral	
				toothache, earache[2,4,7,8, 9]
				constipation[2,4]
				burns[2,4]
				trauma[2,4]
				sprains[2,4]
				tumors[5]
				purgative, vermifuge[1]
				wounds, abscesses (veterinary use)[1]
22 citations: *canela* {*Cinnamomum verum* Presl, Lauraceae}[Pic-Dom-31]				
11	flu and common cold	M	oral	febrifuge[7]
3	hypotension	A, M	oral	
2	asthma, chest (unspec.)	M	oral	
2	diarrhea, intestinal problems	M	oral	diarrhea[2,4]
2	bronchitis and cough	M	oral	
1	menstrual pain	A	oral	
1	hair loss	M	topical	
				vomiting[2,4,7, 9]
				headache[7]
19 citations: *apiol* celery {*Apium graveolens* L., Apiaceae}[Pic-Dom-18]				
6	high cholesterol	M	oral	
3	bronchitis and cough	A, M	oral	hoarseness[1]
3	hypertension	M	oral	
2	kidney problems	M	oral	edema (diuretic)[1]
2	diabetes	M	oral	
2	obesity	M	oral	
1	anemia	M	oral	
				rheumatism[1]
				scurvy[1]
				carminative[1]
				bruises[1]
				ulcers[1]

(continued)

Table 2.2. Continued

18 citations: *piña* {*Ananas comosus* (L.) Merr., Bromeliaceae}[Pic-Dom-114]				
7	high cholesterol	A, M	oral	
3	obesity	M	oral	
2	rheumatism	A, M	oral	
2	diabetes	M	oral	
2	hypertension	M	oral	
1	diuretic	M	oral	diuretic[1,6]
1	constipation	M	oral	
				parasites, vermifuge[1]
				digestive[1]
				ulcers[1]
				antidote for poisoning[1]
				regulates menstruation[1,5]
				cough[6]
17 citations: *rábano* {*Raphanus sativus* L., Brassicaceae}[Pic-Dom-118]				
7	asthma, chest, lungs (unspec.)	M	oral	
7	bronchitis and cough	M	oral	respiratory infections[1]
3	flu and common cold	M	oral	
				diuretic[1]
				gallstones[1]
15 citations: *naranja agria* {*Citrus aurantium* L., Rutaceae}[Pic-Dom-101, Pic-Dom-104, Pic-Dom-105]				
6	flu	M	oral	flu, febrifuge[1,2,3,6,7,9]
5	sinusitis, headache	A, M	oral, topical	headache[2,7,9]
2	hypertension	A, M	oral	hypertension[7,9]
1	obesity	M	oral	
1	high cholesterol	M	oral	
				laxative, purgative[1]
				antiseptic[1]
				hemostatic[1]
				colic, flatulence[2],
				stomach problems[7],
				vomiting[9]
				opthalmic[2]
				diarrhea[2]
				intestinal parasites[2]
				cough[2]
				chest congestion (*pecho apretado*)[6]
				sweating[5]
				burns[7,9]

15 citations: *tilo* {*Tilia* spp., Malvaceae}[Ref-IV-26]				
5	CNS tranquilizer	A, M	oral	
5	insomnia	A, M	oral	
2	flu and common cold	M	oral	
1	intestinal problems	M	oral	
1	depression	M	oral	
1	menstrual pain	M	oral	
15 citations: *manzana* {*Malus* spp., Rosaceae} [Pic-Dom-95]				
11	flu and common cold	A, M	oral	common cold[1]
2	diarrhea	A, M	oral	
1	cough	M	oral	cough[1]
1	depression	M	oral	
				mild laxative[1]
14 citations: *pepino* {*Cucumis sativus* L., Cucurbitaceae}[Pic-Dom-116]				
7	high cholesterol	A, M	oral	
3	hypertension	A, M	oral	
2	obesity	M	oral	
2	diabetes	A, M	oral	
14 citations: *anís de estrella* {*Illicium verum* Hook. f., Illiciaceae}[Pic-Dom-17]				
3	flu and common cold	M	oral	
3	menstrual pain	M	oral	
2	abdomen, intestines (unspec.)	M	oral	
2	vaginal discharge	M	oral	
1	insomnia	M	oral	
1	CNS tranquilizer	M	oral	
1	depression	M	oral	
1	cysts of the reproductive organs	M	oral	
13 citations: *bija* {*Bixa orellana* L., Bixaceae}[Pic-Dom-20, Ref-IV-15]				
3	anemia	A, M	oral	"weakness"[7,8, 9]
3	diabetes	A, M	oral	
3	burns	A, M	topical	burns[2,4,6,7,8, 9]
2	vaginal discharge	A, M	oral	vaginal infections[1]
1	leukemia	M	oral	
1	ulcers (unspec.)	A	oral	
				antidote for poisoning[1]
				trauma[6,7,8, 9]
				flu[6], febrifuge[1]
				insect repellant[1]

(continued)

Table 2.2. Continued

13 citations: *perejil* {*Petrosel:num crispum* (Mill.) Nyman ex. A.W. Hill, Apiaceae}[Pic-Dom-113]				
4	high cholesterol	A, M	oral	
3	rheumatism	A, M	oral, topical	
2	regulates blood pressure, circulation	A	oral	
1	diabetes	M	oral	
1	obesity	A	oral	
1	cough	M	oral	
1	diuretic	M	oral	diuretic[1] carminative[1] febrifuge[1] contusions[1] insect bites and stings[1] emmenagogue, regulates menstruation[1,5] infertility[5] sweating[5] kidney ailments[1]
12 citations: *malagueta* {*Pimenta dioica* (L.) Merr., Myrtaceae}[Pic-Dom-97, Ref-IV-25]				
6	diabetes	A, M	oral	
4	diarrhea and vomiting	A, M	oral	vomiting[2,4,7,8,9]
1	labor pain and puerperium	M	oral	
1	chest (unspec.)	M	oral	
11 citations: *zanahoria* {*Daucus carota* L., Apiaceae}[Pic-Dom-140]				
3	high cholesterol	A, M	oral	
1	impotence	M	oral	
1	vision	A	oral	
1	flu	M	oral	
1	diabetes	M	oral	
1	immunostimulant, "good for blood"	M	oral	tonic[1]
1	diarrhea	M	oral	diarrhea, intestinal ailments[1]
1	fungal skin infections (*paños*)	M	oral	
1	hypertension	M	oral	
				stomach and liver ailments[1] regulates menstruation[5] tumors[5]

10 citations: *yerba buena, hierba buena* {*Mentha* spp., Lamiaceae}[Pic-Dom-70]				
3	stomach ailments, incl. ulcers and gastritis	A	oral	stomach ailments, indigestion, vomiting, colic[1,4,7]
2	hair care	M	topical	
1	diabetes	M	oral	
1	furuncles (*nacíos*)	A	topical	
1	burns	A	topical	
1	hypertension	A	oral	hypertension[8, 9]
1	menstrual pain	A	oral	
				cough[1]
				flu[3,4,6], febrifuge[3,6]
				diarrhea[4]
10 citations: *maiz* {*Zea mays* L., Poaceae}[Pic-Dom-87]				
7	kidney problems, incl. stones	A, M	oral	kidney problems, incl. stones[1,2,3,4,6,7,8, 9]
2	vaginal discharge	A, M	oral	
1	urinary infection	M	oral	
				diuretic[1]
				heart ailments[1]
				rheumatism[1]
				prostatitis[1]
				liver ailments[1]
				inflammation[2,4]
				edema[2,4]
				regulates menstruation[5]
10 citations: *papa* {*Solanum tuberosum* L., Solanaceae}[Pic-Dom-109]				
6	burns	A, M	topical	burns[7]
1	ulcers (unspec.)	A	oral	gastroduodenal ulcers[2]
1	cough	M	unspec.	
1	pain (unspec.)	A	topical	
1	sinusitis	M	topical	headache[2,4]
				baldness[2]
				hematoma[2]
				flu[6]

*The following countries in the Caribbean are included: Dominican Republic, Haiti, Antigua, Barbados, Belize, Costa Rica, Cuba, Dominica, Granada, Guadalupe, Guatemala, Honduras, Martinique, Nicaragua, Panama, Puerto Rico, and Caribbean regions of Mexico, Columbia, and Venezuela

**The reference number refers to the Dominican plant portfolio collection (Pic-Dom) and/or the bagged samples reference collection from Ina Vandebroek (Ref-IV) (see Material and Methods for more details). Plant family names are in agreement with Haston et al. (2007). [1]Liogier (2000); [2]Germosén-Robineau (2005); [3]Peguero et al. (2001); [4]Germosén-Robineau (1997); [5]Ososki et al. (2002); [6]Peguero (2002); [7]Robineau (1986); [8]Germosén-Robineau (1995); [9]Germosén-Robineau (1991)

In both New York City and the Dominican Republic, several of the species recorded for treatment of flu and common cold are also used for respiratory conditions, including watercress (asthma, 12 citations; bronchitis and cough, 9 citations); *cebolla* and *cebollín* (asthma, 11 citations; bronchitis and cough, 10 citations); *rábano* (radish, *Raphanus sativus* L.) (asthma, 7 citations; bronchitis and cough, 7 citations); *higuereta* (asthma, 5 citations; sinusitis, 4 citations; bronchitis and cough, 3 citations); bitter orange (sinusitis, 5 citations); lime and lemon (cough, 4 citations); and *sábila* (asthma, 3 citations).

Apart from these two large clusters of health conditions (common cold/flu and disorders of the respiratory system), there are other major uses that overlap between those reported in New York City and the Dominican Republic. These include: (a) oral administration of *dientes de ajo* (garlic cloves, *Allium sativum* L.) to treat hypertension (21 citations) and stomach problems (4 citations); (b) tea of *manzanilla* (chamomile, *Matricaria recutita* L.) to calm menstrual and labor pain (9 citations) and insomnia/nervousness (6 citations); (c) tea of *barba de maíz* (corn silk, *Zea mays* L.) for kidney problems and kidney stones (7 citations); (d) application of *papa* (potato, *Solanum tuberosum* L.) to soothe burns (6 citations); (e) application of ginger root for rheumatism (4 citations); and (f) tea of *malagueta* (allspice, *Pimenta dioica* (L.) Merr.) for vomiting (4 citations).

As table 2.2 shows, minor medicinal uses that were mentioned only once or twice in the dataset of plants used "in New York City only" are generally not supported by literature from the Dominican Republic. This illustrates the usefulness of conducting quantitative surveys with a large group of participants and querying the sample population systematically about a given set of health conditions. This methodological approach allows for: (a) identification of those ailments for which people know many herbal remedies; and (b) evaluation of the popularity and specificity of each herbal remedy as expressed by its citation frequency for different ailments. In the present study, herbal remedies were most frequently cited for flu and common cold (107 use reports, see table 2.1). These 107 use reports involved thirty different plants. Of these, nine plants were cited five times or more, and eight of them are listed in table 2.2. Moreover, a comparison with literature data from the Dominican Republic shows that for each of these eight plants, their use in New York City as a remedy for treating flu and common cold is in agreement with their use in the Dominican Republic. Hence, after migration to New York City, Dominicans continue to make use of the same remedies they previously used in the Dominican Republic for treating flu and common cold, and this knowledge seems to be generalized among immigrants. A similar conclusion can be drawn for respiratory conditions. Asthma and bronchitis/cough respectively rank fourth and fifth according to frequency of mention, and the pooled number of different medicinal plants reported for both health conditions is thirty-four. Seven plants from this group were cited more than five times (aloe, radish, watercress, onion, lemon and lime, shallot and castor bean) and

their use for respiratory conditions is similar to that in the Dominican Republic and/or the Caribbean.

Medicinal plant applications recorded in New York City that were not corroborated by literature data from the Dominican Republic are major uses for elevated levels of cholesterol by oral administration of the following plants: *avena* (oats, *Avena sativa* L., 30 citations); *piña* (pineapple, *Ananas comosus* (L.) Merr., 7 citations); *pepino* (cucumber, *Cucumis sativus* L., 7 citations), *apio* (celery, *Apium graveolens* L., 6 citations); *limón* (lemon and lime, 4 citations); *sábila* (aloe, 4 citations) *perejil* (parsley, *Petroselinum crispum* (Mill.) Nyman ex. A.W. Hill, 4 citations); and *zanahoria* (carrot, *Daucus carota* L., 3 citations). Neither is the use of *sábila* to treat diabetes (6 citations), cancer (5 citations), and obesity (5 citations) confirmed by DR literature data. A similar observation can be made for other plant species that are used in New York City to treat hypotension, hypertension, obesity, and insomnia, such as: *tilo* (linden, *Tilia* spp., a tea of linden flowers and leaves serves as a tranquilizer and for insomnia, 10 citations); cinnamon (tea for hypotension, 3 citations); pineapple (supernatant from the fruit skin soaked in water taken internally for obesity, 3 citations); cucumber (juice for hypertension, 3 citations). All these plants, except *sábila* and *tilo,* are food plants. It is likely that Dominicans in New York City are more frequently diagnosed with these health conditions than their peers in the Dominican Republic because of a more generalized use of screening facilities for these "urban lifestyle illnesses" in New York City as compared to the Dominican Republic, and/or a higher prevalence rate of these illnesses in New York City. It is known that cities are both the source of serious threats to the health of the public and the source of many public health innovations (Galea et al. 2005). Hence, these plant uses may well represent "newly acquired" applications after immigration to New York City.

Some Caribbean reference books and more anecdotal publications were not included in the literature review (e.g., Cordero 1978; Núñez Meléndez 1982; Liogier 1990; Estevez and Baez 1992; Longuefosse 1995). The reasons for excluding a literature source were: (1) it was not clear whether the publication was based on a voucher collection, which is important for the correspondence between local and scientific plant names (Cordero 1978; Estevez and Baez 1992); or (2) the precise (country) origin of specific ethnobotanical information provided in the literature source was unclear, or the information presented was based on a compilation from other literature sources, sometimes outside the Caribbean area (Cordero 1978; Núñez Meléndez 1982; Liogier, 1990; Estevez and Baez 1992); or (3) the Dominican Republic is not the principal Caribbean study site (Núñez Meléndez 1982; Longuefosse 1995). Although the Dominican ethnobotanical literature references cited here are not exhaustive, they do include the primary available publications that are specific to the Dominican Republic. The literature data presented in table 2.2 provide a suitable comparison with our NYC data subset since it was derived from the most important, systematic, eth-

nobotanical studies based on good botanical practices conducted in the Dominican Republic to date (Balick 1999).

Conclusion

A comparison of medicinal plant uses reported by Dominican immigrants in New York City for the treatment of thirty common health conditions with a review of the Dominican ethnobotanical literature has resulted in the documentation of similarities and differences in the medicinal applications of herbal remedies between host and home country. The use of specific plant species to treat flu/common cold and respiratory disorders in New York City is in agreement with their use in the Dominican Republic. Moreover, knowledge about herbal remedies for these two groups of health conditions is generalized among respondents as evidenced by the high citation frequency of individual plant species and the high index of agreement on remedies for these illnesses. On the other hand, plant uses reported for elevated levels of cholesterol were not confirmed by the DR literature and hence may be specific to New York City. The incorporation and disappearance of medicinal plants in healing pharmacopoeias is a continuous process that responds to both external and internal challenges. These include limited availability of herbal remedies, prevalence of diseases, and the loss of cultural practices and plant knowledge. Nearly all the plants used to treat cholesterol are food plants, which are readily available in New York City. Hence, it is likely that the use of these plants has evolved in response to immigrants having to deal with a new lifestyle in a different environment, where they might be diagnosed with diseases previously unfamiliar to them, while at the same time they are confronted with a limited number of herbal healing resources. All the plants listed in the present study are currently available in the Dominican Republic as well as in New York City, but many may not always have been easily accessible in the past. For example, apples have only become available on a year round basis in markets and supermarkets in Santo Domingo since about twenty years ago, and even more recently in rural areas in the Dominican Republic (Peguero, pers. comm.). Further research is needed to determine whether these plants are also currently used in the Dominican Republic to treat cholesterol, hypertension, insomnia, and diabetes. Presently, we are conducting comparative research in the Dominican Republic using the same questionnaire that was administered in New York City with minor modifications. This will allow us to make a direct transnational comparison of frequently treated illnesses and herbal remedies.

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