Journal of the American Mosquito Control Association, 16(2):114–123, 2000
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PEOPLE'S KNOWLEDGE AND PRACTICE ABOUT DENGUE, ITS VECTORS, AND CONTROL MEANS IN BRASILIA (DF), BRAZIL: ITS RELEVANCE WITH ENTOMOLOGICAL FACTORS

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ABSTRACT. In South America, the epidemiology and ecology of dengue fever are strongly associated with human habits because the vector *Aedes aegypti* is strictly urban. Thus, the evaluation of people's knowledge and practice (PKP) is of great importance to improve integrated control measures. A PKP evaluation has been done in a suburb of Brasilia. Thirty questions were submitted to 130 habitants about income level, education, sources of information, specific knowledge about dengue, vector biology, and control measures applied. Other questions were about the responsibility of dengue control and the opportunity of applying a fine to people who would not cooperate with the control measures. Level of PKP was fairly high, either for housekeepers, workers, or students. The mosquito bite was cited as source of infection by 60.8% of interviewed people but 22.3% had no knowledge about this topic. The most cited symptoms in association with dengue were fever (73.1%), headache (66.2%), and rash (35.4%). Knowledge about mosquito biology and control was also fairly accurate, as demonstrated by 96.9% of answers. Elimination of water containers was the most efficient means according to 73% of people. Such action should be done mainly by the citizen (75.3% of answers). Despite the good PKP, correlations existed only between the PKP about vector biology and presence of potential breeding containers in March, and between the PKP about the disease and potential breeding containers in April. In conclusion, global educational campaigns may have a real impact on the PKP but this did not result in effective control of the mosquito breeding containers by the people.

KEY WORDS community, educational campaign, *Aedes aegypti,* entomological survey, questionnaire

INTRODUCTION

Since 1991 imported dengue cases have been detected and confirmed in the Federal District (FD) of Brazil (Pires et al. 1991). Since 1994 an increase was observed in the number of imported cases, with autochtonous transmission in the Brasilia area and Goiás State border since 1997 (Dusi et al. 1996). To increase community knowledge and awareness about dengue and its prevention, a national mass education campaign was promoted by various public health sectors and levels (country, states, municipalities), each summer (November–March) since 1995, mainly through television (TV) and radio. According to data provided by the Ministry of Health (*Assessoria de Comunicação Social*), TV spots were transmitted 73 times (49 30-sec-long spots and 24 60-sec-long spots) for Brasilia (FD) into 17 programs (4 channels) during February 1997. At the country-wide level, 30-sec-duration spots were transmitted 27 times (6 programs in 1 channel), also during February 1997. During the same period, a 30-sec-duration spot was transmitted 30 times by radio in the FD.

Because no evaluation of people's knowledge and practice (PKP) has been previously conducted in the FD, the present work was aimed at studying a community under risk, with regard to dengue etiopathogeny and control, and to associate these data with vector prevalence in the same area. Because the educational campaign was released on a national scale, comparing the situation of the chosen sample with any control population was not possible. However, any association between the PKP and presence or absence of the vector in the houses of interviewed people was thought to be of interest for detecting some communication failure or success of the campaigns. Another goal of the present work was to establish some reference data for future comparative studies of PKP at the community level.

MATERIALS AND METHODS

The study area was a small neighborhood called DVO, with ca. 300 homes, which resulted from a recent housing development in the city of Gama (Fig. 1). Each house usually has a backyard where containers may be found (nonuseful containers, water reservoirs, hollow trunks, and so on). Residents are served with piped water and weekly garbage collection. The distribution of mosquito breeding sites was evaluated through house-to-house inspection, as during routine surveys, with collection of larval specimens for further identification in the laboratory. In all homes attended to by the surveyors, all domestic collections of water were recorded as "potential" and classified according to 13 categories. The houses with at least 1 immature of *Aedes aegypti* (L.) were considered to be positive. A questionnaire was applied to the community living in the same houses, with 30 questions, of which 5

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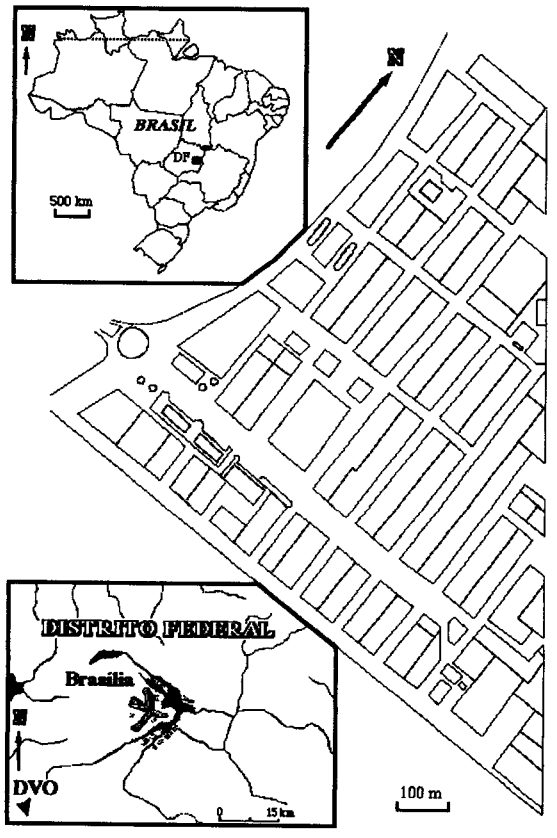

Fig. 1. Map of the DVO neighborhood, Gama City, Federal District, Brazil.

were open ended and 25 had specific choices, covering socioeconomic status, education, availability and frequency of garbage collection, knowledge of dengue symptoms, vector biology, and control measures. Incompletely answered questionnaires were discarded from analysis.

Potential and positive mosquito breeding sites and answers to the questionnaire were considered as the variables, which were submitted to multifactorial analysis methods, aiming to demonstrate eventual associations between PKP variables and entomological factors. The ADE-4 statistical package (Thioulouse et al. 1997) was used. Data structure was studied by principal component analysis (PCA: column normalization and row ponderation by number of rows) and correlations between entomological and PKP variables were looked for by coinercia analysis (COI). The significance of the latter was tested by Monte-Carlo simulations (n = 1,000/run).

RESULTS

Socioeconomic pattern of the sampled population

The socioeconomic pattern of the population was evaluated through 17 topics (Table 1). The 97 women and 33 men who answered the PKP survey were 5–74 years old (mean = 33.6 ± 14.7 years). Only 1 man explicitly refused to answer the questionnaire. The mean monthly income by family was 4.4 times the minimum salary, that is, approximately US$572. The mean level of education was 4 years of primary school (64.6%), and 22.3% of the peo-

Table 1. Values of social variables characterizing the DVO population, obtained from a questionnaire submitted in April 1997. These variables were not included in the statistical analysis.

Socioeconomic pattern of the population sample	No. or range	% or mean
Female	97	74.6
Male	33	25.3
Age (years)	5–74	33.5
Primary school (years)	0–8	4
Secondary school (years)	1–3	1
Presence at home (morning)	104	80
Presence at home (afternoon)	94	72.3
Presence at home (night)	79	60.7
No. of people/house	1–14	5.1
No. of people working outside	0–7	1.6
No. of people working at home	0–6	1.9
No. of rooms	1–7	2.6
No. of bathrooms	0–4	1.2
No. of TVs	0–3	1.2
Car (yes)	46	35.3
Car (no)	83	63.8
Monthly income (number of minimum salaries)	0–26	4.4
Monthly income (do not know)	9	6.9
Garbage collecting (yes)	130	100
Frequency of garbage collecting (daily)	45	34.6
Frequency of garbage collecting (days)	1–3	1.7
Frequency of garbage collecting (do not know)	5	3.8

Table 2. Results of entomological surveys done in DVO in March and April 1997, in the houses of people interviewed (120 and 128 houses, respectively).

Types of containers	Potential containers				Containers with *Aedes aegypti*			
	March		April		March		April	
	n	%	*n*	%	*n*	%	*n*	%
Bottle, can, plasticware	512	40.3	524	39.8	3	8.3	8	33.3
Plant pots	238	18.7	270	20.5	1	2.7	0	0
Drum, barrel, tub, tank, clay deposit	227	17.8	244	18.5	2	5.5	0	0
Car junk, construction material	137	10.8	113	8.5	4	11.1	1	4.1
Tires	99	7.8	88	6.6	23	63.8	12	50.0
Phytothelmata (plant and tree trunk)	32	2.5	18	1.3	0	0	0	0
Water reservoir	11	0.8	23	1.7	1	2.7	3	12.5
Well, cistern	7	0.5	20	1.5	0	0	0	0
Gutter	6	0.4	16	1.2	2	5.5	0	0
Total	1,269	100	1,316	100	20	16.6	17	13.2

ple had attended secondary school. At least 15 different types of occupations were represented. The majority of respondents were houseworkers (46.1%), students (21.5%), and manual workers (15.3%). The mean number of TVs per home was 1.2.

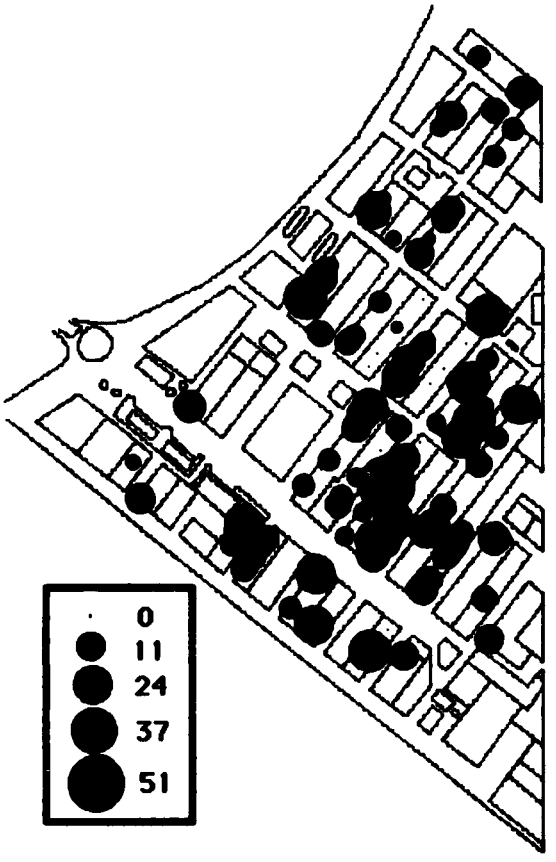

Fig. 2. Containers potential for *Aedes aegypti* in DVO neighborhood, Gama City, Federal District, Brazil, April 2–30, 1997.

Entomological surveys

A preliminary entomological survey of 177 houses, conducted from February 17 to February 25, 1997, revealed 33 positive houses (house index = number of positive houses/number visited = 18.6%); all containers in the positive houses were treated with Abate® (Cyanamid, Rio de Janeiro, Brazil). During a 2nd and more extensive survey, from March 10 to March 19, 1997, 295 houses were visited, where 2,398 and 31 containers were potential and positive, respectively. No treatment was applied. Considering only the 120 houses where people responded to the questionnaire the next month (see below), 36 of 1,269 containers were positive, and the house index was 16.6% (Table 2). Of the positive containers, 63.8% were tires, which are generally considered very productive. During a 3rd entomological survey, from April 2 to April 30, 1997, the PKP questionnaire was also applied and 130 people from 128 houses answered it fully. The house index was 13.2%, with 24 pos-

Table 3. Values of people's knowledge and practice variables about sources of information on dengue and its prevention, obtained from questionnaire submitted in April 1997.

Sources of information	*n*	%
TV	123	94.6
Radio	96	73.8
National Health Foundation workers	94	72.3
Newspapers	42	32.3
Friends or neighborhood	26	20
School	25	19.2
Leaflets	16	12.3
Posters	11	8.4
Family	13	10
Community meetings	5	3.8
Secapoça dengue prevention competition	5	3.8
Work colleagues	5	3.8
Hospital	2	1.5
Books	2	1.5
Church	2	1.5

Table 4. Values of people's knowledge and practice variables about dengue disease, obtained from questionnaire submitted in April 1997.

Dengue disease and symptoms	*n*	%
Know how dengue is contracted (yes)	101	77.7
Know how dengue is contracted (no)	29	22.3
From mosquito bite	79	60.8
From still water	10	7.7
From accumulated water	10	7.7
From garbage	4	3.1
From contaminated water	2	1.5
From cans	2	1.5
From the bite of *Aedes aegypti*	1	0.8
From clean water	1	0.8
From tires	1	0.8
Symptoms: fever	95	73.1
Symptoms: headache	86	66.2
Symptoms: rash	46	35.4
Symptoms: body pains	25	19.2
Symptoms: lack of appetite	19	14.6
Symptoms: vomiting	16	12.3
Symptoms: nausea	15	11.5
Symptoms: tiredness and weakness	15	11.5
Symptoms: eye pain	14	10.8
Symptoms: do not know	12	9.2
Symptoms: diarrhea	10	7.7
Symptoms: sickness	7	5.4
Symptoms: giddiness	5	3.8
Symptoms: pain at back of the neck	4	3.1
Symptoms: stomach pain	1	0.8
Sick people would be taken to the hospital	64	49.2
Sick people would be taken to a first aid post	34	26.2
Sick people would be taken to a physician	29	22.3
Do not know what to do with sick people	4	3.1
Notify the disease to National Health Foundation	3	2.3
Would give water to sick people	2	1.5
Would leave sick people at rest	1	0.8

itive (Fig. 3) among 1,414 potential containers (Fig. 2). A comparison between the distributions of the 2 successive surveys of potential and positive containers in the houses of the people interviewed (128) did not show a significant change. Bottles and cans with water rose from 3rd to 2nd rank, and positive water reservoirs from last to 3rd. Despite their high prevalence, plant pots, drums, tanks, and so on became negative on the last survey.

PKP survey

A high proportion of people who answered the questionnaire stated that they were at home during the afternoon (72.5%), when the risk of dengue transmission is highest. The PKP results about sources of information are shown in Table 3: TV was the main source of information about dengue (94.6%), followed by radio (73.8%) and health staff (72.3%). All students (25) received information at school. Answers about dengue disease are summarized in Table 4: 22.3% of people did not know how dengue is contracted, but 60.8% mentioned mosquito bites. Three symptoms for dengue predominantly were cited: fever (73.1%), headache (66.2%), and skin rash (35.4%). Nobody cited dengue hemorrhagic fever. Hospitals were the place most cited for attendance of sick people. Table 5 gives the PKP about the mosquito vector: 96.9% of the people have heard about mosquitoes, 60% associated them with still water (irrespective of container type), and 29.2% had already seen mosquito larvae. Only 30.8% knew that the dengue mosquito has a diurnal biting habit. Knowledge about prevention and control of dengue is reported in Table 6: 73% of people thought that elimination of containers is the best control method and that it is mainly the responsibility of the citizen (75.3%); the same proportion approved the idea of fining contraveners. The following control methods were reported to have been used effectively by the people interviewed: 45.3% eliminated bottles and cans and 19.2% changed the water in plant pots weekly; however, 10.7% did not apply any measure.

Statistical analysis

Because multiple responses (= modalities) were allowed for some questions, the associations be-

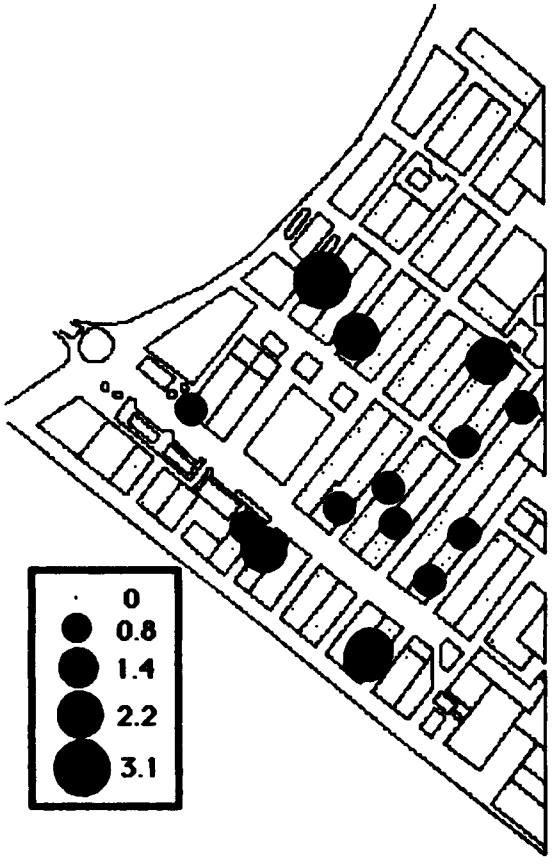

Fig. 3. Containers positive for *Aedes aegypti* in DVO neighborhood, Gama City, Federal District, Brazil, April 2–30, 1997.

tween these modalities were 1st considered by principal components analysis (PCA), in order to recode these groups as new variables before performing further treatment (Appendix 1). Thus, the answers about sources of information (Table 3) were grouped into 3 blocks: "FNS staff–radio–TV," "school–friends–newspapers," and "others." Questions about the source of infection by dengue virus (Table 4) were also grouped into 3 blocks: "mosquito bite," "do not know," and the "containers." The open-ended question on the disease resulted in 15 different modalities, including answers of "do not know." Respondants cited 4 distinct groups of symptoms: "fever–headache," "vomiting–lack of appetite–body pain," "eye pain–weakness–nausea," and rash. Hemorrhagic fever was not cited, despite the information given during the TV spots. When the question was about the best place for treating people with dengue, 2 groups of answers appeared opposite on the 1st principal component of the PCA: hospital and private physician–health post (Table 4). The PCA done on the data about entomological knowledge (Table 5) showed only a mild association between

Table 5. Values of people's knowledge and practice variables about vector biology, obtained from questionnaire submitted in April 1997.

Biology of the dengue vector	*n*	%
Have heard about dengue vector (yes)	126	96.9
Have heard about dengue vector (no)	4	3.1
Breeding in still water	78	60.0
Breeding in clean water	30	23.1
Breeding in (do not know)	18	13.8
Breeding in tires	12	9.2
Breeding in water	9	6.9
Breeding in plant pots	6	4.6
Breeding in water on the ground	5	3.8
Breeding in cans	4	3.1
Breeding in bottles	2	1.5
Breeding in containers with water	2	1.5
Breeding in garbage	1	0.8
Breeding in drain of bathroom	1	0.8
Have seen the mosquito larva (no)	92	70.8
Have seen the mosquito larva (yes)	38	29.2
Where (in plants)	8	6.2
Where (in a tire)	7	5.4
Where (in the water reservoir)	6	4.6
Where (in a can)	4	3.1
Where (in a bucket)	1	0.8
Where (in a bottle)	1	0.8
Where (in a tile)	1	0.8
Where (in the garden)	1	0.8
When the mosquito bites (do not know)	72	55.4
The mosquito bites during the day	40	30.8
The mosquito bites at night	19	14.6

the "plant pots–bottles–cans–tires" group of modalities and 1st principal component. However, when considering the questions about control measures, the 1st principal component of the PCA showed clear oppositions between "space spraying–insecticide use" and "container elimination" on one hand, and "government agencies" and "citizen" on the other hand. This fact may suggest that much is yet to be done to integrate various control strategies.

The data that were transformed as described above were then examined for correlation (COI analysis) between entomological variables and PKP, that is, positive or potential containers vs. sources of information, knowledge on disease, vector, and control. No significant correlation was found between the presence of the mosquito and PKP except between "potential containers in March" vs. "information about vector biology" and between "potential containers in April" vs. "information about the disease." However, the nature of these interactions is unknown and perhaps incidental.

DISCUSSION

Studies conducted in Puerto Rico (Clark et al. 1992) and Honduras (Fernandez et al. 1993) showed a significant reduction in the infestation index for *Ae. aegypti* after prevention campaigns that included education. Kroeger et al. (1995) in Colom-

Table 6. Values of people's knowledge and practice variables about dengue prevention methods effectively applied, as obtained from questionnaire submitted in April 1997.

Prevention of dengue and vector control	*n*	%
Eliminated bottles	59	45.3
Prevented accumulation of rain water	47	36.1
Eliminated cans	32	24.6
Changed water in plant pots weekly	25	19.2
Covered water tanks	25	19.2
Covered barrels	23	17.6
Maintained tires dry	22	16.9
Maintained plant pots dry	16	12.3
Used aerosol insecticide	14	10.7
Did nothing	14	10.7
Threw away plants	14	10.7
Covered tires	14	10.7
Put tires in a closed place	10	7.6
Used repellent	8	6.1
Cleaned the garden	3	2.3
Put insecticide in tires	3	2.3
Turned over the bottles	3	2.3
Cleared gutter and drainpipe	2	1.5
Closed the bottles	1	0.7
Threw away the tires	1	0.7
Dried off the barrel	1	0.7
Put insecticide in plants	1	0.7
Control is continued (yes)	112	86.1
Control is continued (no)	10	7.6
Best control methods (remove containers)	95	73
Best control methods (space fogging)	30	23
Best control methods (insecticide use)	20	15.3
Best control methods (mosquito netting)	5	3.8
Best control methods (cleaning)	4	3
Best control methods (do not know)	4	3
Best control methods (avoiding water and waste accumulation)	3	2.3
Best control methods (individual means)	1	0.7
Responsibility (citizen)	98	75.3
Responsibility (government)	50	38.4
Responsibility (National Health Foundation)	36	27.6
Responsibility (Secretary of Health)	26	20
Responsibility (do not know)	4	3
Responsibility (nobody)	1	0.7
Fine (yes)	98	75.3
Fine (no)	29	22.3
Fine (do not know)	1	0.7

bia found a high infestation index, correlated with limited knowledge of the community with regard to dengue, its vectors, and control. The same facts were deduced from an educational campaign aimed at controlling malaria (Kroeger et al. 1996). Authors working in Malaysia (Ayyamani et al. 1986) reported similar facts as those observed in this study, showing that information about dengue and its prevention reach the community mainly through the TV and radio; part of the population does not associate the mosquito and the disease; and the best control solution is to prevent mosquito proliferation. Similar results were also observed concerning mosquito control responsibility and opportunity of fining. However, their work did not evaluate the actual presence of the vector in the studied houses.

In Trinidad and Tobago (Rosenbaum et al. 1995), no correlation was demonstrated between preventive measures adopted by citizens and their knowledge about dengue. The situation in DVO is seemingly the same, where the distribution of potential containers was correlated with knowledge about the mosquito (March) or the disease (April) only, but never with the preventive measures although, as shown by the analysis of results of the questionnaire, the population has fairly good knowledge about dengue prevention and control. The decrease in the house index found during our last 2 surveys probably was due to meteorological factors, that is, lower relative humidity and night temperatures during the end of summer.

So far, few studies have been conducted on PKP on dengue and its prevention in Brazil. National educational campaigns, done through TV and other mass communication means, certainly contribute to growing knowledge about dengue and its vector in

the population but have little impact on mosquito infestation (Yasumaro et al. 1998). The present study confirmed this. With the exception of a study done in Goiania City (Goias State), where 60% of 30 sampled districts have shown a lowering of larval indexes after an educational and refuse-collecting campaign (Santos et al. 1998), the impact of the latter could not be objectively estimated because of lack of a PKP survey before the education campaign. Even in the case of the last cited study, no control area (without specific information and refuse collecting) was defined, thus limiting the scope of the conclusions. The same drawback occurred during our study, where no control area (without mass media) was available. As shown by Macoris et al. (1997), future studies should place more emphasis on the implementation of community-based control actions than on education, at least in large cities where PKP levels are higher. The same research team has tested local newsletters as channels for communication and information about dengue and concluded that these did not result in any increase in PKP (Mazine et al. 1996). Despite the lack of studies, at least in Brazil, it would be better (and perhaps more cost-effective) to conduct educational campaigns at the government level and to look for community-based projects for prevention of the disease. A pilot study on control of filariasis (Regis et al. 1996) has shown that the participation of schools may be essential for long-term community-based prevention, combining short- and long-term effects. Distribution of positive containers may depend upon many social or human factors, apart from vector behavior or meteorologic factors, and only studies integrating all these aspects would ascertain their relative importance and relationships (Dias 1991).

ACKNOWLEDGMENTS

This work was financially supported by the Research Institute for Development (IRD, formerly ORSTOM), France, the Health Institute of Federal District (ISDF), and the National Health Foundation (FNS-MS), Brazil.

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APPENDIX 1

People's knowledge and practice and entomological variables used in statistical analysis. Those original variables (left column) that were not recoded or grouped together (right column) did not contribute significantly in the preliminary analysis, and were thus discarded for subsequent treatments.

Code of initial variable	Description	New variable
ITV	Media sources of information about dengue, vectors, and control	Media
Irad		Media
Ijorn		Media
Ifol		Media
Ipan		Media
Iseca		Media
Iliv		Media
IFNS	Social (other people) sources of informations about dengue, vectors, and control	Social
Iami		Social
Iesc		Social
Ifam		Social
Ireu		Social
Icol		Social
Ihosp		Social
Iigr		Social
PgPic	The biting mosquito is the source of infection	MosqBite
PgNS	Do not know how the disease is contracted	DnKDis
PgAgPa	Containers are the source of infection	ContInf
PgAgPo		
PgLix		
PgAgCo		
PgLata		
PgAeAe		
PgAgLi		
PgPneu		
SinFeb	Dengue symptoms	Sympt
SinDoCab		
SinMan		
SinDoCo		
SinFaAp		
SinVom		
SinEnj		
SinFraq		
SinDoOl		
SinNS		
SinDiar		
SinMaEs		
SinTon		
SinDoNuc		
SinDoEst		
DoenHosp	Where will sick people be attended?	
DoenPost		
DoenMed		
DoenFNS		
DoenAg		
DoenRep		
DoenNS		
ReprAgPa	Places of mosquito breeding	MosqBreed

APPENDIX 1
Continued

Code of initial variable	Description	New variable
ReprAgLi		
ReprNS		
ReprPneu		
ReprAg		
ReprVaso		
ReprAgPoc		
ReprLata		
ReprGar		
ReprRecAg		
ReprSuj		
ReprRalo		
ViLarN	Do not know the mosquito larva	
ViLarPl		
ViLarPn		
ViLarCx		
ViLarLat		
ViLarBald		
ViLarGar		
ViLarTelh		
ViLarQuin		
PicaNS	Do not know when the mosquito is biting	
PicaDia		
PicaNoi		
EliGar	Control means used to eliminate mosquitoes	Elim
EliChu		
EliLat		
EliTCx		
EliPlTr		
EliTTan		
EliPnSec		
EliPlSec		
EliAer		
EliNada		
EliPnCob		
EliPlAc		
EliPnFec		
EliRepel		
EliPnVen		
EliGarRev		
EliLimp		
EliCalha		
EliPnJf		
EliEmGar		
EliPnFor		
EliTamSec		
EliPlVen		
ComRem	What are the best control methods?	Control
ComBor		
ComVen		
ComTela		
ComLimp		
ComNS		
ComEvAg		
ComInd		
RespCid	The citizen may be responsible for dengue control	RespCit
RespGov	Governmental institutions may be responsible for dengue control	RespGov
RespFNS		
RespSecr		

APPENDIX 1
Continued

Code of initial variable	Description	New variable
RespNS RespNing	Do not know who is responsible for dengue control	
Mult	Is favorable to fine those with positive containers in their house	
MultNS		
TotalDepot	Total number of potential containers	TotalPot
Pot.A	Potential containers: tires	Pot.A
Pot.B	Potential containers: barrel, tub, tank	Pot.B
Pot.C	Potential containers: plant pots	Pot.C
Pot.D	Potential containers: car junk/construction material	Pot.D
Pot.E	Potential containers: bottles/can/plasticware	Pot.E
Pot.F	Potential containers: cistern/well	Pot.F
Pot.G	Potential containers: water reservoir	Pot.G
Pot.H	Potential containers: phytothelmata (bromeliad, tree trunk)	Pot.H
Pot.I	Potential containers: domestic sewer	Pot.I
Pot.J	Potential containers: swimming pool	Pot.J
Pot.K	Potential containers: gutter	Pot.K
TotalPos	Total number of positive containers	TotalPos
Pos.A	Positive containers: tire	Pos.A
Pos.B	Positive containers: barrel, tub, tank	Pos.B
Pos.C	Positive containers: plants pots	Pos.C
Pos.D	Positive containers: car junk/construction material	Pos.D
Pos.E	Positive containers: bottles/can/plasticware	Pos.E
Pos.G	Positive containers: water reservoir	Pos.G
Pos.H	Positive containers: phytothelmata (bromeliad, tree trunk)	Pos.H
Pos.I	Positive containers: domestic sewer	Pos.I