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The Central America Diabetes Initiative (CAMDI):
COSTA RICA, EL SALVADOR, GUATEMALA,
HONDURAS AND NICARAGUA



(INITIAL PROPOSAL, APRIL 2002)

DIVISION OF DISEASE PREVENTION AND CONTROL
PROGRAM ON NON-COMMUNICABLE DISEASES

PAN AMERICAN HEALTH ORGANIZATION /
WORLD HEALTH ORGANIZATION

Participating countries

Honduras, Guatemala, Nicaragua, El Salvador and Costa Rica

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Summary

The Central America Diabetes Initiative (CAMDI) is a response to a subregional workshop that took place in San Salvador in March 2000. The workshop was sponsored by The Diabetes Declaration of the Americas (DOTA) and PAHO. A baseline screening for diabetes will identify people that are currently suffering the disease (diagnosed and undiagnosed) to access the current level of diabetes care. Furthermore, a demonstration project of a diabetes intervention program is proposed to be established in each participating communities. A multinational expert committee will decide on the specific intervention program to be developed.

For CAMDI, the following components are proposed:

1. Phase I

- Identification of target population of people with diabetes.
- Access the quality of diabetes care.

2. Phase II

- Implementation of an integrated one-year-intervention program that would include improvement of quality of diabetes care and an educational program for medical personnel and people with diabetes.
- Implementation of an educational program in diabetes targeting the general population.

This project is a seed initiative that should lead to the development of a national diabetes program in participating countries. This document outlines Phase I of CAMDI, which is consistent with HCN's Project on Risk-Factor Surveillance.

I. Background (Development Problems)

Diabetes and hypertension are two closely related chronic diseases that have been recognized as a significant threat to the health and economic well being of the population in socio-economically developed countries such as North America and Europe. However, it is increasingly becoming evident that these diseases are already having a significant impact among less developed or developing countries such as those in Central and South America. The migration of the population from rural to urban centers may bring a significant reduction in mortality due to childhood diseases as well as a decrease in infant mortality at the same time that an increase in non-communicable diseases is observed.

Diabetes and hypertension are considered to be the scourges of societies of 'plenty'. In particular because these diseases are considered to be closely related to risk factors that are known to be prevalent in developed countries and are specially related to plentiful, high calorie – high fat, processed foods, the availability and consumption of high fat high calorie diets and the adoption of sedentary life styles. Although a genetic predisposing factor to these diseases is also recognized in certain populations, it is undeniable that modifiable risk factors such as diet, and physical activity are increasingly becoming very important public health concerns for developing countries. The fact that diabetes and hypertension are significant contributors to heart disease; which is the principal cause of death in developed countries, has called for heightened attention to these conditions in developed countries; many of which already have heart disease as the principal cause of death among their adult populations.

There is a lack of suitable data about the prevalence of diabetes and other chronic diseases in Central America. In Guatemala, El Salvador, Honduras, Nicaragua and Costa Rica there is very little information about non-communicable diseases. The majority of Central American countries are in a transition period with respect to the epidemiology of chronic diseases such as diabetes mellitus, cardiovascular diseases, and the associated risk factors like obesity, sedentary life styles, hypercholesterolemia, and others, which today represent the main diseases in the adult population.

NCD surveillance is expensive and difficult to carry out without resources and infrastructure. Small studies and information gathered from clinical providers in Central America suggests that there is an increase in the number of persons affected by chronic conditions such as diabetes and cardiovascular diseases. It is estimated that there are 19 million individuals with diabetes in Latin America and the Caribbean Region. In Central America alone the number of diabetics is estimated to be over 1 million. The following tables provide information about the estimated number of adults and children with diabetes in the Americas and the target region.

Population Estimates for Central America for 2000 & 2025 and Expected Increase in Percent

Country	2000	2025	Increase (%)
Belize	120,000	235,000	96
Costa Rica	2,171,000	3,733,000	72
El Salvador	3,224,000	6,153,000	91
Guatemala	5,634,000	12,422,000	120
Honduras	3,063,000	6,630,000	116
Nicaragua	2,324,000	5,415,000	133
Panama	1,688,000	2,637,000	56
Total Central America	18,224,000	37,225,000	104

Source: WHO, King et al, 1998.

Estimated Population with Diabetes in Central America for 2000 & 2025 and Expected Increase in Percent

Country	2000	2025	Increase (%)
Belize	5,000	14,000	180
Costa Rica	107,000	257,000	140
El Salvador	142,000	347,000	144
Guatemala	235,000	640,000	172
Honduras	104,000	306,000	194
Nicaragua	106,000	297,000	180
Panama	85,000	194,000	128
Total Central America	784,000	2,055,000	162

Source: WHO, King et al, 1998.

Diabetes is an expensive disease. The estimated cost of taking care of diabetic individuals in Central America is approximately of \$900 million annually, including medications (insulin and oral hypoglycemics), hospitalizations, medical visits and treatment of complications .

Estimated Cost of Diabetes in Central America

Component	Cost
Death	\$93 million
Disability	\$ 1,694 million
Medications	\$530 million
Hospitalizations	\$40 million
Medical Consultations	\$79 Million
Complications	\$178 million
Total Cost	\$2,616 million

Source: PAHO, HCN 2001.

Due to the increase in the incidence and prevalence of these chronic diseases it is necessary to start surveillance programs with a goal of utilizing the collected data for resource planning, and implementation of preventive strategies and treatment programs. Furthermore with the recently released report Diabetes Prevention Program (DPP), a major National Institute of Health (USA) study of type 2 Diabetes, we now have strong evidence that populations at risk can delay or prevent the development of type 2 diabetes. The DPP found conclusively that with moderate exercise and change in diet people can reduce their risk of developing type 2 diabetes by 58%.

There is a clear and urgent need to carry out a concerted, well planned study of the regional burden of these diseases and related risk factors. National health planners need this information in order to reallocate resources to mount effective early detection and prompt treatment campaigns (secondary prevention).

Agency Capacity

The Pan American Health Organization (PAHO) has a long history and demonstrated strong capacity to organize multi-national projects, work with multiple organizations and agencies; and carry out complex epidemiological and health services analyses.

The CARMEN Project has been successfully implemented in multiple countries in Latin America and Canada. In the Caribbean a new multinational program as part of the CARMEN network is being developed under the name of CARLI.

The SABE (*Salud Bienestar y Envejecimiento*, Spanish for Health, Wellbeing and Aging) Project recently conducted a baseline survey in seven sites located in seven countries in Latin America and the Caribbean and its results will become available soon.

At present an important diabetes related project where PAHO, through its El Paso (USA) Field Office, has a strong participation with the Collaborative United States/Mexico Border Diabetes Prevention and Control Project (USMBDPCP). This bi-national, multi-agency project is designed to accomplish two goals. Phase I will assess the prevalence of diabetes, related behavioral risk factors, and access to health services for the border population. Then using the information obtained in Phase 1 the project will seek to develop community interventions (Phase2), such as diabetes prevention and education programs. This five year 2 million dollar project seeks to develop a diabetes control strategy and infrastructure among the populations of the US-Mexico border, a region that has a long history of some of the highest rates of poverty, lacking basic sanitation services and is also among the most medically underserved regions.

In addition, the Pan American Health Organization has launched a diabetes action plan, **“The Diabetes Initiative for the Americas” (DIA)**, which goal is to improve the capacity of the health systems and services in member countries in order to organize programs for the surveillance and control of diabetes in the Americas.

DIA has three objectives:

- 1) Improve the availability and use of epidemiological data
- 2) Promote a rational use of available resources through the implementation and evaluation of primary care services for diabetics
- 3) Promote the design and development of educational and self-management programs, that take into account the socio-cultural characteristics of each region.

The main components/activities of DIA are as follows:

- 1) Surveillance: promotes the surveillance of diabetes through prevalence surveys, evaluation of mortality, the cost of the care of diabetics and the frequency of chronic complications.
- 2) Development/implementation and evaluation of National diabetes programs in order to improve the medical care of diabetics.
- 3) Primary prevention: together with other NCDs through the CARMEN project.

This project proposes the development and implementation of national survey studies based on the recommendations provided at two regional meetings sponsored by The Pan American Health Organization (PAHO) in San Salvador, El Salvador, March 8-9, 2000, and in Tegucigalpa, Honduras, November 13-14, 2000. These meetings were convened to get agreement on technical aspects and the methodology to be used for the study. They were carried out with multidisciplinary groups of experts working with these chronic conditions in the target countries *(See annex 3 for a list of participants)*.

The following are some of the barriers for diabetes control and prevention identified in the region:

- 1) Lack of support from the governments – diabetes is not a health priority.
- 2) Insufficient funds for diabetes treatment and control programs.
- 3) Deficient epidemiological data and surveillance systems.
- 4) Lack of application of norms for the management of diabetes.
- 5) Lack of health education and promotion at the primary and secondary level.
- 6) Lack of human resources for diabetes prevention and control .

As mentioned previously, the proposed study will be conducted in five countries in Central America, and will result in data and information urgently needed to determine the true burden of these diseases. It will provide public health planners and policy makers with the information that they need in order to allocate resources to the control of these diseases. Also, it will stimulate the development of social marketing campaigns and other national efforts to reduce the impact of the modifiable risk factors that are responsible for the increased burden of these health conditions.

II. Goal (s) (Development Objective)

To reduce the burden of diabetes in five Central America countries.

III. Project Purpose (Immediate Objective)

The goals of Phase I of this project are:

To determine the prevalence of diabetes mellitus, hypertension and other risk factors for non-communicable diseases among people 20 years of age and older, in five capital cities of Central America.

To provide a profile of medical care and self care practices of people with diabetes.

The immediate objectives for phase I of this project are:

- 1) To implement a multinational household survey that will provide valuable information about the burden of diabetes, hypertension and other risk factors for NCD.
- 2) To determine the prevalence of obesity and sedentary life style well known behavioral risk factors for NCD.
- 3) To investigate the profile of medical attention and self care practices of people with diabetes.

IV. Project Strategy

1) Overview of the Project

The lack of information available about chronic diseases in the Central American region prompted PAHO to organize two regional meetings. The Pan American Health Organization as a leader in Public Health in the Americas sponsored two workshops with experts from the region to identify specific areas to initiate actions in the field of diabetes surveillance and control. As a result of these meetings, the countries in the region began the development of a proposal for the implementation of national household surveys.

The present study will provide a baseline for phase 2, which will be an intervention aiming to improve care for people with diabetes through education and improvement of medical care. At the same time phase 3 will provide an intervention program for the identified people at risk of presenting type 2 diabetes. This program will be implemented through the CARMEN Project.



Present Situation

The target countries Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua are in various stages of proposal development for the implementation of a national household survey.

Costa Rica: A National Household Survey conducted in 1998 showed a diagnosed diabetes prevalence of 2.2% in males and 3.4% in females among those aged 15 years and more. There was a prevalence of 9.4% in individuals 40 and older. Cardiovascular diseases caused 37% of all deaths in 1991. The average cost of care per patient with diabetes was \$1,835.00 in 1997.

El Salvador: El Salvador has an estimated population of 6.8 million. It also has a very young population with a median age of 21 years. San Salvador, the capital city has 31.76% of the population. In this country 56.7% are urban dwellers. Infectious diseases are prevalent in El Salvador and as in all the other countries in the region the older population suffers from chronic diseases. El Salvador has data suggesting an increase in the prevalence of diabetes and cardiovascular diseases. Cardiovascular diseases caused 20.6% of all deaths in 1997.

Guatemala: A national Commission for the prevention, detection, treatment and control of cardiovascular diseases and diabetes was created in July, 2000. The Commission is working in collaboration with the Medical School, Medical Associations and the Diabetes Association. At this point a location for the study has been selected, Villanueva (one of the Barrios in the capital city), located approximately 20 kilometers from the capital city has a

population of 192,069 inhabitants and a total of 38,857 households. Census tract data has been identified, and financial support from the Ministry of Health has been solicited.

Honduras: The target population is from the central district in Tegucigalpa. The members of the survey coordinating group have been identified and already conducted meetings where the changes to the proposal were discussed and agreed upon. They are in the process of hiring a person to carry out the investigation.

Nicaragua: Cardiovascular diseases caused 23% of all deaths in 1996. Diabetes mortality was 9.1 per 100,000 population for males and 10.8 per 100,000 inhabitants among women in 1995. Managua, Nicaragua is a city with over one million inhabitants and over 220,000 households. At this point various meetings have been conducted with the purpose of educating health officials at the national level and for gathering information. Meetings related to technical and methodological aspects of the project are also taking place on a regular basis.

Methodology

In this section we will outline the necessary steps in order to carry Phase I of the project, the multinational survey of diabetes, hypertension and risk factors for non-communicable diseases in Central America.

An expert team will be created at both the country and the sub regional level. At PAHO, a group of experts has been identified to work with this project under the direction of Dr. Alberto Barceló, Regional advisor from the Program on Non Communicable Diseases dedicated to diabetes. This team will consist of individuals with expertise in household survey design, epidemiology, biostatistics, training, development and implementation.

The task of each country will be to adapt the survey to their local needs in agreement with the sub-regional team. They will also be responsible for training the interviewers, implementing the survey and evaluating the household survey data. To ensure that all team members follow the guidelines outlined by the study a training manual will be used to formally train all interviewers in each country. This training manual will provide clear guidelines about the study and the coordination with the health units personnel and laboratory staff. A field test of the survey will be conducted prior to implementation in each country to evaluate the functionality of questionnaires, diagnostic tests and measurements.

The international sub-regional committee that will provide guidance to the project will be made up of one project representative from each country one of PAHO staff from each of the countries the PAHO regional advisor (Dr. Alberto Barceló) and temporary advisors that may be contracted as needed

Data Collection and Management

The following table shows the variables and indicators for the study:

Variables	Indicators
Main Variables	
• Diabetes Mellitus	Fasting plasma glucose and/or OGTT-2-hour plasma glucose
• Hypertension	Seated Blood Pressure
Secondary Variables	
• Obesity	Body mass index
• Sedentarism	Physical activity level (questionnaire)
• Hypercholesterolemia	Total Blood cholesterol (blood sample)
• Food habits	Food frequency (questionnaire)
• Tobacco and alcohol use	Smoking habit and alcohol intake questionnaires
• Family history	Diabetes and/or cardiovascular disease in parents, siblings and children
• Socio-demographic	Sex, age, education, socio-economic status

Diagnostic Criteria

Diabetes Mellitus

Values for Diagnosis of Diabetes Mellitus and Other Categories of Hyperglycemia				
	Glucose concentration, mmol/litre (mg/dl)			
	Whole blood		Plasma	
	Venous	Capillary	Venous	Capillary
Diabetes Mellitus: Fasting or 2 h after glucose load ^a	≥6.1 (≥110) ≥10.0 (≥180)	≥6.1 (≥110) ≥11.1 (≥200)	≥7.0 (≥126) ≥11.1 (≥200)	≥ 7.0 (≥126) ≥12.2 (≥220)
Impaired Glucose Tolerance (IGT): Fasting value (if measured) and 2 h after glucose load ^a	<6.1 (<110) and ≥6.7 (≥120)	<6.1 (<110) and ≥7.8 (≥140)	<7.0 (<126) and ≥7.8 (≥140)	< 7.0 (<126) and ≥ 8.9 (≥160)
Impaired Fasting Glycaemia (IFG): Fasting and (if measured) 2 h post glucose load	≥5.6 (≥100) and <6.1 (<110) <6.7 (<120)	≥5.6 (≥100) and 6.1 (<110) <7.8 (<140)	≥6.1 (≥110) and <7.0 (<126) <7.8 (<140)	≥ 6.1 (≥110) and <7.0 (<126) <8.9 (<160)
^a For epidemiological or population screening purposes, the 2-hour value after 75g oral glucose may be used alone. For clinical purposes the diagnosis of diabetes should always be confirmed by repeating the test on another day unless there is unequivocal hyperglycemia with acute metabolic decompensation or obvious symptoms. Glucose concentration should not be determined on serum unless red cells are immediately removed, otherwise glycolysis will result in an unpredictable under-estimation of the true concentration. It should be stressed that glucose preservatives do not totally prevent glycolysis. If whole blood is used, the sample should be kept at 0-4°C or centrifuged immediately, or assayed immediately. Reproduce from ¹				

¹ World Health Organization. *Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications*. Report of a WHO Consultation. Geneva, 1999. WHO/NCD/NCS 99.2.

Hypertension

Classification of blood pressure *

Category	Systolic (mm Hg)		Diastolic (mm Hg)
Optimal	<120	and	<80
Normal	<130	and	<85
High-Normal	130-139	or	85-89
Hypertension			
Stage 1	140-159	or	90-99
Stage 2	160-179	or	100-109
Stage 3	≥ 180	or	≥ 110

* Reproduced from ²

Implementation

The process to be followed for the implementation of the survey by the country teams is described below.

1. **Interviewer Selection:** Interviewers will be selected by each country. Such individuals may already be employees of the Health Department or consultants who reside in the target city. The interviewers must be experienced in community work and will also be trained for this study. Persons with experience in field work will be preferred.
2. **Training of Interviewers:** All interviewers will be provided with a training manual that covers the standard survey procedures as well as training materials designed specifically for the survey. They will receive official training on how to obtain informed consent, administer the questionnaire, and keep necessary records. They will be taken to an on-site location and will be shown how to enumerate and randomly select households. They will also be trained to obtain Anthropometric measures according to a written protocol. They should also learn about all laboratory tests that will be performed as part of the study.
3. **Interviews:** The interviewers will administer the survey in person at the subject's home or another appropriate location. An adult, 20 years or older will be selected from among the adults residing in the household listed on the enumeration form. The interviewer will then explain the purpose of the survey and ask the participant for his/her consent to

² Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VI). Arch Intern Med 1997, 157:2413-2446.

participate in the study. A consent form will be then read to and signed by the participant before proceeding with the interview and Anthropometric measures. Anthropometric measures will be taken by the interviewers of each participant.

4. **Clinical Data Collection:** Following completion of the interview, Anthropometric measures of height, weight, waist and hip circumferences and blood pressure will be obtained. The equipment to be used in the study (sphygmomanometers and scales) should be standard and must be calibrated per protocol. Blood pressure will be taken following recommendations of the Joint National Committee³. Using a stationary stadiometer each participant's height will be assessed bare footed. The weight will be assessed having the individual wearing light street clothing and without shoes, using a portable calibrated scale. In order to estimate the waist/hip ratio, waist measurements will be taken at the level of the umbilicus, and the hip circumferences at the maximal protrusion of the gluteal muscles. Once the interview and the Anthropometric measures are finished, the interviewer will proceed to provide instructions to the subject about the next part of the study which includes an appointment to attend a nearby clinic for lab Tests . The participant will be given instructions on fasting and an appointment for the local health unit in order to have his or her blood drawn for a fasting plasma glucose test and or OGGT.
5. **Multinational Training Session:** Interviewer Trainers will receive a training course including field work and data collection (questionnaire, measurement) to ensure comparability of all procedures across the region. Each country will designate an interviewer trainer (This function may be included in the tasks of the project coordinator).
6. **Laboratory tests:** The 1999 WHO Criteria for the diagnosis of diabetes will be used. The subject will come the testing area having fasted for 8 hours blood sample will be taken for fasting glucose and cholesterol (Total & LDL) levels. Two hours later a 2 hour- Glucose Tolerance blood glucose sample will also be obtained after an overload of 75 gms of glucose. Those individuals previously diagnosed, as diabetics will only have a fasting glucose sample taken.
7. **Schedule for Survey Administration:** The survey interview of 1 hour will be conducted during the evenings or on weekends at the respondent's home, followed by a visit to nearby health center for measurements (blood pressure, high and weight, waist and hips circumferences) and blood sample.
8. **Data Entry:** Trained data entry staff will code and enter the survey data at each site, using a double entry method.
9. **Survey Verification:** A random selection of records will be selected for evaluation and to look for discrepancies.
10. **Field Test of Protocol:** In order to test and refine the study protocol before implementing the country household survey a field test will be conducted. It will include the interviewers training manuals, tracking forms, the survey instrument and the laboratory tests. The field test will be conducted with a sample of 20 individuals in each site. The interviewers will go through the consent forms, the interview and laboratory testing.

³ Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VI). *Arch Intern Med* 1997, 157: 2413-2446.

11. **Quality Control:** The interviewers will be monitored through periodic field observations by the research team and regular consultation with the project coordinator/director. Additionally, the Country Project Director will contact a 10% random sample of subjects within three to four hours of the interview and asked to repeat selected survey questions.

Management Information Systems (MIS)

The software package EPINFO will be used for the analysis. However, because of limitation in software in some countries, supervision and technical assistance as needed will be provided by the regional steering committee

Data Analysis

Raw survey data will be entered at the local level through EPINFO and will be transferred to PAHO headquarters in Washington, DC into a *SPSS and Wesvar program/database* for its analysis. This program will verify data for duplicate entries, internal consistency, out of range values and proper skip patterns, and will perform basic statistical analysis.

Standardization of Clinical and Laboratory Data Collection by Country

An external lab will be established as quality control for blood glucose and cholesterol measurements. The Centers for Disease Control and Prevention (CDC), Atlanta, U.S.A. will be asked to provide this service.

Data Dissemination

Preliminary findings will be included in a regional report which will be made available to the participating countries. Also the participating countries will write their own reports which will be published in peer reviewed journals and reports. A discussion of the survey results must take place at each country level with participation of the medical community and the media to create awareness in providers and the general population about the impact of these diseases and the importance of starting prevention and control efforts. An intervention committee will be created at both country and sub regional level. Plans for intervention addressing people at risk and people with diabetes will be them decided upon.

Study Design

Phase I of this project will be a population-based survey using multistage stratified sampling.

Ethical Considerations

Approval will be sought from ethical committee at PAHO and participating countries. An informed consent form will be obtained from each participant.

Subjects and Sample Size

Subjects: The subjects for this study are all individuals male and female 20 years of age and older that live in the target area.

Sample Size: The size of the sample will be the same for the five cities, approximately 2,400 individuals for a total of 12,000 for the entire region. The sample size will be calculated using the following formula:

$$N = \frac{z^2 pq (DEFF)}{d^2}$$

Where:

- z: value of the standard normal distribution for the desired confidence level
- p: expected prevalence level q=1-p
- DEFF: the effect of the multistage design
- d: desired half-width of confidence interval

The size of the sample was calculated based on the expected prevalence data of diabetes for each age group per region, a design effect of 2 and a confidence level of 95%. We added 10% to the initial sample size to account for no response. The sample size per country should be as shown in the following table.

Table1: Sample Size Estimate

Age Group	Estimated Prevalence	Desired Confidence Interval	Sample Size	Final Sample Size (adjusted for participation rate)
20 – 39	1%	1%	762	855
40 – 64	10%	3%	770	855
65 and older	15%	4%	614	685
Total			2146	2395

Sampling Methodology

- a) A multistage cluster sampling will be conducted for each selected population of each country. In the first stage, census tracts, the primary sampling unit, will be selected. The sample will be stratified by age (age groups: 20-39 years, 40-64 years, 65 years and more).

In the second stage, we will select compact segments (secondary sampling units). All households within the selected compact segments will be selected into the sample. In the third stage, eligible people will be selected systematically within each age strata.

- A. Census tract selection:** 50 census tracts selected in each country target area.
- B- Selection of compact segments**
- C- Selection of subjects**

Survey Instrument

The survey instrument is a questionnaire that has been developed by the Program on Non-Communicable Diseases and has been updated. This questionnaire has modules for diabetes and hypertension as well for the collection of data on risk factors for this and other non-communicable diseases (available on request or at PAHO web site http://www.paho.org/English/HCP/HCN/ncd_surv_tools.htm in both languages English and Spanish). Changes to the survey questionnaire should reflect variations at the country level. All must be approved by the PAHO team. All components of the questionnaire include core and optional questions. Core questions are the recommended minimal questions to be included on each subject. Optional questions are recommended only to provide additional information on each subject.

Geographical Area and Target Group per Country

The targeted countries are Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua

Costa Rica

The sample population will be from the San José metropolitan area. This area has a total of 810,256 individuals 20 and older living in a total of 237,602 individual homes. The following table shows the population 20 and older stratified by age group.

Age Group	Population	Inhabitants/Homes	Sample Size
20 – 39	442,861	1.86	855
40 – 64	307,402	1.29	855
65 and older	79,993	0.34	685
Total	810,256	3.41	2395

Using the age group 40 to 64, compact segments can be defined that include an average of 14 households. By selecting two compact segments per census tract, a total of 1400 households will be visited in 50 Census tracts. Individuals will be selected, to cover the desired sample size for each of this population group. In these households people can be systematically selected from each one of the stratum (20-39, 40-64 and 65+) depending on population density.

El Salvador

The target population will be located in the capital city, San Salvador. San Salvador has a population of 289,587 inhabitants older than 20 years of age living in a total of 44,967 individual homes. The following table shows the population 20 and older stratified by age group.

Age Group	Population	Inhabitants/Homes	Sample Size
20 – 39	173,295	3.85	855
40 – 64	91,874	2.04	855
65 and older	24,418	0.54	685
Total	289,587	6.44	2395

The sampling procedure will be similar to that described for Costa Rica.

Guatemala

The target population is located in the neighborhood (barrio) of Villa Nueva in the capital, Guatemala City. This neighborhood has a total of 115,422 individuals 20 and older living in individual homes. The following table shows the population 20 and older stratified by age group.

Age Group	Population	Inhabitants/Homes	Sample Size
20 – 39	76,062		855
40 – 64	33,704		855
65 and older	5,656		685
Total	115,422		2395

The sampling procedure will be similar to that described for Costa Rica.

Honduras

The *target population* is located in Tegucigalpa, the capital of Honduras. The sample will be selected from 373,113 individuals 20 and older who live in a total of 189,591 individual homes. The following table shows the population 20 and older stratified by age group.

Age Group	Population	Inhabitants/Homes	Sample Size
20 – 39	232,970	1.53	855
40 – 64	111,794	0.74	855
65 and older	28,349	0.19	685
Total	373,113	2.45	2395

The sampling procedure will be similar to that described for Costa Rica.

Nicaragua

The target population is located in Managua, the capital of Nicaragua. The sample will be selected from 414,971 individuals 20 and older who live in a total of 165,165 individual homes. The following table shows the population 20 and older stratified by age group.

Age Group	Population	Inhabitants/Homes	Sample Size
20 – 39	267,130	1.62	855
40 – 64	118,195	0.72	855
65 and older	29,646	0.18	685
Total	414,971	2.51	2395

The sampling procedure will be similar to that described for Costa Rica.

VI. Project Impact

The project looks to demonstrate needs for non-communicable disease (NCD) prevention and control programs at the national and subregional level. The information collected should serve as a basis for national health education campaigns and allocation of funds for the treatment of these chronic diseases at each country level.

As a result of these surveys, National Quality Improvement programs for care and prevention of the risk factors for diabetes should follow. The training of clinical providers on the latest treatment and diagnostic tools must start as soon as possible in each target country. Coordinated prevention/education campaign efforts with participation from the public and private sector of each country must be started as soon as possible. The benefits of exercise and appropriate diet for the control of hypertension are also well known. However, as indicated above the DDP Study now provides very good evidence that through diet and exercise type 2 diabetes can be prevented.. This important finding highlights the need to have an accurate epidemiological profile of diabetes and its risk factors in order to plan effective primary prevention strategies in these countries.

VII. Evaluation

Process Evaluation

Since this project model maybe recommended for other cities in the target countries and other regions in the Americas, we want to conduct a process evaluation to learn what the difficulties faced by each team in the target countries and how to improve the process. Therefore, a coordinated monitoring process will take place in each country by the evaluation team to document any problems faced and how the team resolved them. If possible, we will consider a short survey questionnaire of a sample of participants to seek out consumer input about the survey and their recommendations for improvement. This is also useful for the interviewers because it provides feedback about the process.

The national team in collaboration with the regional evaluator will be in charge of the supervision of the process evaluation.

Annex 3: Participants

Function	Name	Institution
Regional Project Director	Dr. Alberto Barceló	PAHO, Washington DC
Costa Rica		
Project Director	Dr. José M Angulo	Caja del Seguro Social
Focal Point	Dr. Myriam Cruz	PAHO
El Salvador		
Project Director	Dr. Martha D de Maza	Asociación de Diabetes
Focal Point	Dr. Armando Bañuelos	PAHO
Guatemala		
Project Director	Dr. Patricia Orellana	Ministry of Health
Focal Point	Dr. Enrique Gil	PAHO
	Dr. Manuel Ramirez	INCAP, PAHO
Honduras		
Project Director	Dr. Ruben Palma	Fundación de Diabetes
Focal Point	Dr. Luis M Amendola	PAHO
Nicaragua		
Project Director	Dr. Martha Pastora	Ministry of Health
Focal Point	Dr. Lesbia Altamirano	PAHO

Annex 4: Questionnaires

Available at http://www.paho.org/English/HCP/HCN/ncd_surv_tools.htm