Where We Are: Socio-Ecological and Health Profile of the Philippine LIFEcourse study in CARdiovascular disease Epidemiology (LIFECARE) Study Sites

Elmer Jasper B. Llanes,[1,2] Paulette D. Nacpil-Dominguez,[2] Rody G. Sy,[1,3,2]
Nina T. Castillo-Carandang,[2,4,5] Felix Eduardo R. Punzalan,[1,2,4] Paul Ferdinand M. Reganit,[1,2]
Wilbert Allan G. Gumatay,[2] Olivia T. Sison,[2,4,5] Queenie G. Ngalob[2] and Felicidad V. Velandria[2]

[1]*Department of Medicine, College of Medicine and Philippine General Hospital , University of the Philippines Manila*
[2]*LIFEcourse study in CARdiovascular disease Epidemiology (LIFECARE) Philippines Study Group, Lipid Research Unit, UP-PGH, UP Manila*
[3]*Cardinal Santos Medical Center, San Juan City, Metro Manila*
[4]*Department of Clinical Epidemiology, College of Medicine, University of the Philippines Manila*
[5]*Institute of Clinical Epidemiology, National Institutes of Health, University of the Philippines Manila*

ABSTRACT

Objective. This study aims to describe the socio-ecological and health profile of the Philippine LIFECARE study sites, its health care services and leading causes of mortality and morbidity.

Methods. This is a prospective cohort study that recruited participants aged 20-50 years from Metro Manila and four provinces (Bulacan, Batangas, Quezon, Rizal). Study sites were characterized according to their geographical area, terrain and environmental profile, and available health care system.

Results. 3,072 subjects were included, with male-to-female ratio of 1:1.3 and majority aged 30-50 years. Metro Manila was the most congested site. Two-thirds of the 62 villages (*barangays*) were rural, outside the town proper, and in lowlands. One-fourth were along coastal area. Almost all were accessible by public transportation. Majority have reduced forest cover, but were relatively safe from environmental hazards. Rural health units, hospitals, and professional health care workers were concentrated in Metro Manila. Leading cause of morbidity was respiratory tract infection, while cardiovascular diseases caused most of mortalities.

Conclusion. Study sites were mainly rural, outside the town proper and in lowlands, with available public transportation. There is an unequal distribution of health resources. Cardiovascular diseases is still the leading cause of mortality. The disparities in geographical access to health care play an important role in shaping human health.

Key Words: LIFECARE Philippines, socio-ecologic, health

Corresponding author: Elmer Jasper B. Llanes,, MD
Section of Cardiology
Department of Medicine
Philippine General Hospital
University of the Philippines Manila
Taft Avenue, Ermita, Manila 1000 Philippines
Telephone: +632 5548400 local 3670
Email: ejbl1011@yahoo.com

Introduction

The Philippines is an archipelago composed of 7,107 islands with an area of 300,000 square kilometers. These islands are grouped into three regions namely: Luzon, Visayas and Mindanao. In 2010, the country's total population is 92.34 million with an estimated increase of 1.9% annually. Life expectancy at birth in the Philippines is at 71.7 years which is higher by 4.5 years than the world's average of 67.2 years. Females are expected to live longer than males by 5.53 years.[1] .

Health service delivery in the country has evolved into dual delivery systems of public and private provision, covering the entire range of health interventions with varying degrees of emphasis at different health care levels. Around 40 percent of Philippine hospitals are public. In 2012, the Department of Health (DOH) released a new classification system of hospitals and other health facilities with specific guidelines for scope of services and functional capacity for each classification, and overall operating standards. Hospitals are mainly classified as general or as DOH hospitals. General hospitals provide services for all kinds of illnesses, diseases, injuries or deformities. It has emergency and outpatient services primary care services, family medicine, pediatrics, internal medicine, obstetrics-gynecology, surgery including diagnostic and laboratory services, imaging facility and pharmacy. These hospitals are further classified into the following: (1) Level 1 includes isolation facilities, maternity, dental clinics, 1st level x-ray, secondary clinical laboratory with consulting pathologist, blood station, and pharmacy; (2) Level 2, includes level 1 services and departmentalized clinical services, respiratory units, intensive care unit (ICU), neonatal intensive care unit (NICU) and high risk pregnancy unit (HRPU), tertiary clinical laboratory, and 2nd level x-ray; (3) Level 3, include level 2 services and teaching/training, physical medicine and rehabilitation, ambulatory surgery, dialysis, tertiary laboratory, blood bank, 3rd level x-ray.[2]

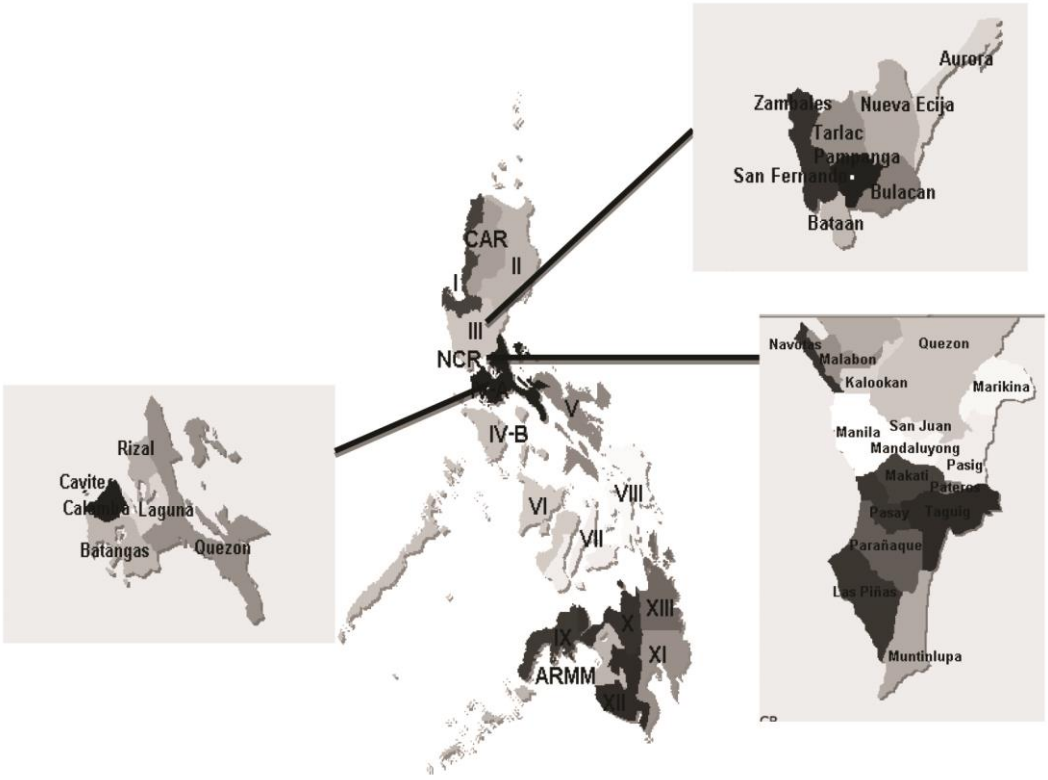

Figure I. Map of the LIFECARE study sites showing the geographical location of the included municipalities in the study (http://www.nwpc.dole.gov.ph/rtwpb.html, Cited 2014 Jan 18)

Morbidity and mortality statistics provide basic information for the management of healthcare systems, and for planning and evaluation of health service delivery. In 2009, the ten leading causes of morbidity were Acute Respiratory Tract Infection with a rate of 1203.6 per 100,000 population, followed by Acute lower respiratory tract infection and Pneumonia, Bronchitis/Bronchiolitis, Hypertension, Acute Watery Diarrhea, Influenza, Urinary Tract Infection, Pulmonary TB, Injuries, and Acute Febrile Illness. On the other hand, the top ten causes of mortality were Diseases of the Heart (109.4 per 100,000 population), Diseases of the Vascular System (71.0), followed by Malignant Neoplasms, Pneumonia, Accidents, Tuberculosis all forms, Chronic Lower Respiratory Diseases, Diabetes Mellitus, Nephritis, Nephrotic Syndrome and Nephrosis, and certain conditions originating in the perinatal period.[3]

The LIFE course study in CARdiovascular disease Epidemiology (*LIFECARE*) was conceptualized to determine the effect of socioeconomic and lifestyle factors, and psychosocial stress in the development of cardiovascular disease (CVD). It will also attempt to ascertain the effect of CVD on health care utilization and quality of life. LIFECARE is a collaboration of four Southeast Asian countries, namely: the Philippines, Malaysia, Indonesia and Thailand, with coordination provided by Singapore. It is a cohort study with initial data collection conducted in 2009 and a repeat visit in 2014-2015. This paper will describe the socio-ecological profile of the Philippines study sites, derived from the initial community survey in 2009.

Objectives

General: To describe the basic socio-ecological and health profile of towns and cities enrolled in the Philippine LIFECARE study.

Specific:

1. To characterize the geographic profile of the study sites.
2. To describe the existing health services, and leading causes of morbidity and mortality in the study sites.

Materials and Methods

The LIFECARE study was a prospective cohort study which visited Metro Manila and 4 provinces (Bulacan, Batangas, Quezon and Rizal) in Luzon. The current paper only reports the data from the 2009-2010 baseline survey as the repeat survey is currently underway (2014-2015). Ethics approval was obtained from the Research Ethics Board of the University of the Philippines Manila, and the

Institutional Review Board of Cardinal Santos Medical Center.

Municipalites *(towns)* were selected by convenience sampling based on accessibility, safety, and security of the field team. Barangays *(villages)* were selected in consultation with the City/Municipal Health Officers, and Planning and Development Officers of the local government units (LGUs). Effort was exerted to capture the socio-ecological and geographic diversity of barangays (e.g., rural and urban; major sources of household income – farming, fishing, etc.; geographic location – lowland, coastal, upland, et cetera).

The Department of Finance mandated through Department Order No. 23-08 which was issued in 2008 that "The income classification of Provinces, Cities and Municipalities serves, among other purposes, as basis for the determination of the financial capability of Local Government Units (LGUs) to provide in full or in part the funding requirements of developmental projects and other priority needs in their locality." Average annual income for 1st income class provinces was PhP 450 million or more; 1st class city was PhP 400 million or more; 1st income class municipality was PhP 55 million pesos or more. For a 2nd income class municipality the average annual income was PhP 45M or more but less than PhP 55M while it was PhP 35M or more but less than PhP 45M for 3rd income class municipalities.[4]

There is no readily available disaggregated data at the barangay level for income classification. The province of Bulacan and the town of San Miguel were classified as 1st in terms of income class while the town of Pandi was classified as 2nd income class. Batangas province and Tanauan City were 1st income class whereas the town of Laurel was 3rd. Quezon province and the 2 towns (Tiaong, Sariaya) as well as Rizal province and the town of Angono which were included in LIFECARE were all 1st income class. The cities of Makati and Marikina were classified as 1st income class while the city of Manila (wherein the district of Malate is located) was a highly urbanized area and was classified as a "special class city" (along with Quezon City).

An updated household list of the various barangays was obtained from the LGUs and entered into Microsoft Excel 2007® and duplicates were removed. Random selection of 2,160 households was done using systematic random sampling. We pre-selected a larger number of households in the highly urbanized barangays of Metro Manila as it was more difficult to locate potential study participants in these barangays. By "household" we mean people who live in the given living quarters, share income and expenditures, and conduct housekeeping together. A list of eligible participants per household was generated from which only one member was randomly selected using the Kish method.

The study was composed of four phases, which recruited 3,072 apparently healthy participants aged 20 to 50 years old. The first phase involved validation of the Filipino versions of three measurement scales which assessed pyschosocial distress and quality of life: the 10-item Kessler Psychological Distress Scale (K10), Short Form 36 (SF36) and EuroQoL (EQ-5D).[5]

The second phase was a community survey which gathered the demographic, anthropometric, lifestyle and socioeconomic profile of the respondents. This included completion of an interviewer-administered questionnaire which contained sections on 1) psychosocial distress in relation to the socioeconomic status using the previously validated SF-36, EQ5D and K10; 2) health care utilization; and 3) overall health status via quality of life assessment. Blood examinations for lipid profile, fasting blood glucose, genetic and inflammatory markers were also done. Lastly, ankle brachial index and electrocardiogram (ECG) testing were performed for each participant. Excluded were those who had a history of existing cardiovascular disease (myocardial infarction, stroke or peripheral arterial disease), malignancy, pregnant or lactating women, have plans to migrate outside their community within the next 5 years and those who stay at home for only once a month (e.g. working or studying outside the barangay). All participants were able to speak Tagalog (Filipino native language) or English, and gave their informed consent to join the study.

The field team was assisted by a barangay health worker or any knowledgeable local resident to locate the selected households, and to attest that the household member was indeed living in that household, and that inclusion criteria were met. In the event the said household member was not present during the initial visit, an appointment was made for a face-to-face interview at their convenience. A maximum of 3 visits (including weeknights and weekends) was done before the selected member was considered unavailable. Written informed consent was usually obtained during the initial visit while most interviews were conducted during the third visit.[5]

The third and fourth phases of the study entail follow-up of the respondents after 4-5 years from the initial survey. Data similar to those gathered in the second phase will be collated and analyzed to see if these will have any effect on the development of cardiovascular risk factors as well as cardiovascular disease during the entire duration of the study.

All basic information regarding the geography of the study sites was gathered from national data sources (such as the census), and from information provided by the municipal development officers of the local government units.

Results and Discussion

A total of 3072 participants were included in the Philippine cohort of the LIFECARE Study. The participants were recruited from urban and rural areas of Metro Manila and 4 nearby provinces (Bulacan, Batangas, Quezon and

Rizal). In total, the participants were sampled from 10 municipalities and 62 barangay units. There were more females in all study areas, and across all age groups, at a cumulative male to female ratio of 1:1.3. The 20-29 years old age group was the least represented (28%) while 35.8% and 36% of participants were from the 30-39 and 40-50 years old age groups, respectively (Table 1).

The municipality of Sariaya has the largest land area, while Marikina has the smallest. Metro Manila (National Capital Region) was the most populous, reflecting the extensive relocation of people to urban areas. Comparing the density of population to land area, Marikina (urban) was thirty times more crowded than Sariaya (rural). The national data in 2010 revealed that the three study sites were among the most populated regions in the country, wherein CALABARZON (which included Rizal, Batangas, Quezon) had 12.61 million, followed by National Capital Region (11.86 million) and Central Luzon (which included Bulacan) (10.14 million). They comprise more than one-third of the total population.[6]

Of the 427 barangays in the selected cities and towns, sixty two barangays (14.52%) were included in the study. Forty three barangays (69.35%) were classified as rural, while the rest were urban. Metro Manila was entirely urban, while the rest was mostly rural (Table 2). In the 2010 national data, the level of urbanization in the country was 45.3 percent with an annual increase of 4.0 percent since 2007.[7]

In the Philippines, a "barangay" (village) is the smallest political unit into which cities and municipalities (towns) in the Philippines are divided. A barangay consists of less than 1,000 inhabitants residing within the territorial limit of a city or municipality, and administered by a set of elective officials.[8]

"Urban" areas are defined as either [1] in their entirety, all municipal jurisdictions which, whether designated chartered cities, provincial capital or not, have a population density of at least 1,000 persons per square kilometer: all barangays; [2] poblaciones or central districts of municipalities and cities which have a population density of

Table 1. Total population by age and sex group by local government unit

	Age Group and Sex							
	20-29 years old		30-39 years old		40-50 years old		Total	
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)
Metro Manila	21	25	18	45	20	55	59	125
(n = 184)	(11.41)	(13.59)	(9.78)	(24.46)	(10.87)	(29.89)	(32.07)	(67.93)
Bulacan	134	160	145	196	135	199	414	555
(n = 969)	(13.83)	(16.51)	(14.96)	(20.23)	(13.93)	(20.54)	(42.72)	(57.28)
Batangas	109	119	122	166	131	169	362	454
(n = 816)	(13.36)	(14.58)	(14.95)	(20.34)	(16.05)	(20.71)	(44.36)	(55.64)
Quezon	99	107	145	163	120	175	364	445
(n = 809)	(12.24)	(13.23)	(17.92)	(20.15)	(14.83)	(21.63)	(44.99)	(55.01)
Rizal	39	48	47	55	44	61	130	164
(n = 294)	(13.27)	(16.33)	(15.99)	(18.71)	(14.97)	(20.75)	(44.22)	(55.78)
TOTAL	402	459	477	625	450	659	1329	1743

Supplemental Table 1. Total population by age and sex group by city and municipality

City/Municipality	Age group and Sex							
	20-29 years old		30-39 years old		40-50 years old		Total	
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)	Male n (%)	Female n (%)
Metro Manila (n = 184)	(11.41)	(13.59)	(9.78)	(24.46)	(10.87)	(29.89)	(32.07)	(67.93)
Makati	12	13	8	29	7	35	27	77
Manila	3	4	4	6	2	3	9	13
Marikina	6	8	6	10	11	17	23	35
Bulacan (n=969)	(13.83)	(16.51)	(14.96)	(20.23)	(13.93)	(20.54)	(42.72)	(57.28)
Pandi	65	73	66	93	61	94	192	260
Sta. Maria	69	87	79	103	74	105	222	295
Batangas (n=816)	(13.36)	(14.58)	(14.95)	(20.34)	(16.05)	(20.71)	(44.36)	(55.64)
Laurel	67	56	70	91	65	85	202	232
Tanauan	42	63	52	75	66	84	160	222
Quezon (n=809)	(12.24)	(13.23)	(17.92)	(20.15)	(14.83)	(21.63)	(44.99)	(55.01)
Sariaya	31	59	84	78	65	73	180	210
Tiaong	68	48	61	85	55	102	184	235
Rizal (n=284)	(13.27)	(16.33)	(15.99)	(18.71)	(14.97)	(20.75)	(44.22)	(55.78)
Angono	39	48	47	55	44	61	130	164
TOTAL	402	459	477	625	450	659	1329	1743

at least 500 persons per square kilometer; [3] poblaciones or central districts not included in [1] and [2] regardless of the population size which have the following: (a) street pattern or network of streets in either parallel or right angle orientation; (b) at least six establishments (commercial, manufacturing, recreational and/or personal services); (c) at least three of the following: (i) a town hall, church or chapel with religious service at least once a month; (ii) a public plaza, park or cemetery; (iii) a market place, or building, where trading activities are carried on at least once a week; (iv) a public building, like a school, hospital, puericulture and health center or library; [4] barangays having at least 1000 inhabitants which meet the conditions set forth in [3] above and where the occupation of the inhabitants is predominantly non-farming or fishing. While "rural" areas are defined as all poblaciones or central districts and all barrios that do not meet the requirements for classification of urban.[9]

Majority of the 62 study barangays (69.35%) were outside the poblacion or town proper. All the barangays (except for one in Makati district 2) were relatively easily accessible by public transportation. Seventy-one percent (71%) of the barangays were located in lowland areas, while the rest were in upland or mountainous areas. On the other hand, almost a quarter of the barangays (16.12%, mainly located in Batangas, Quezon and Rizal) were in the coastal area. The Philippines' coastline is considered as one of the longest in the world, and about 54% of the municipalities are located in the coastal zone.[10] Filipinos to a great extent, depend on coastal resources for food, livelihood and other needs.[10]

Most of the municipalities were found to have reduced forest cover except in Pandi and Laurel. Understandably, Makati and Malate have no forest cover being the business districts in the country. A good number of the barangays (specifically those in Malate, Marikina, Pandi and Tanauan) were relatively safe from environmental physical hazards, while the rest were either predisposed to landslide, or flood especially those located along the coast (Table 3).

Forest cover was approximately one fourth of the country's total land area. Deforestation may be caused by shifting cultivation, forest fires and over-logging; and conversion of forest lands for other purposes (e.g., agriculture, settlements, infrastructure et cetera). In addition to these, the forests are subject to typhoon and other wind damage.[10]

The study sites in Metro Manila had the highest number of health centers units but no barangay health units were installed. This was in contrast with municipalities in the provinces where the vast majority of health stations were situated in the barangays. One municipality (Laurel) had a single rural health unit installed. However, municipalities in Metro Manila had the highest ratio of individuals served per health unit since these areas were also the most populous (Table 4).

Similarly, municipalities in the Metro Manila had the most number of hospitals. Private outnumber public hospitals by at least thrice in all of the study sites. Among the provinces, only Batangas and Rizal had public hospitals. Majority of the hospitals were either level 1 or 2 (Table 4). During the time this study was conducted, the older classification system of hospitals, that is Levels 1-4, was utilized. Of the 1,781 hospitals in the Philippines, about 60% (or 1,080) are privately owned and operated; the rest (40% or 701) are government-owned and –operated, both national and local. Most of the hospital beds in public and private hospitals are found in Level 2 and Level 3 hospitals.[11]

With regard to distribution of health care workers -- physicians, nurses and midwives were concentrated in Metro Manila. Similar to the national data, most hospitals and healthcare professionals are based in urban areas, specifically in NCR. Regions III and IV-A (which are relatively near to metropolitan Manila) tend to have a higher proportion of government health workers than other more

Table 2. Characteristics of the study barangays by geographical area

Region	National Capital Region (NCR)			Region III Central Luzon		Region IV-A CALABARZON		Region IV-A CALABARZON		Region IV-A CALABARZON
Province	Metro Manila			Bulacan		Batangas		Quezon		Rizal
Municipality	Makati (District2)	Malate (District5)	Marikina	Sta. Maria	Pandi	Tanauan	Laurel	Sariaya	Tiaong	Angono
Land Area (hectares)*†	2,736	3,855	2,150	9,092	3,120	10,716	7,129	21,216	16,838	2,622
Total population**	529,039	77, 513	424,150	218,351	66, 650	152,393	35,674	138,894	91,559	102,407
Total number of barangays in the municipality	33	183	16	24	22	48	21	43	27	10
Total number of barangays included in LIFECARE	3 (all urban)	3 (all urban)	2 (all urban)	8 (7 urban)	8 (7 rural)	8 (7 rural)	8 (all rural)	8 (7 rural)	8 (7 rural)	6 (all rural)

*National Statistical Coordination Board, 2007
†City Planning Office
**National Statistics Office, 2010

Table 3. Geographical profile of LIFECARE barangays*

Region	National Capital Region (NCR)			Region III Central Luzon		Region IV-A CALABARZON		Region IV-A CALABARZON		Region IV-A CALABARZON
Province	Metro Manila			Bulacan		Batangas		Quezon		Rizal
Municipality (n)	Makati District 2 (3)	Malate District 5 (3)	Marikina (2)	Sta. Maria (8)	Pandi (8)	Tanauan (8)	Laurel (8)	Sariaya (8)	Tiaong (8)	Angono (6)
Town Proper										
Inside Poblacion	0	0	1	0	1	1	0	8	0	6
Outside Poblacion	3	3	1	8	7	7	8	0	8	0
Accessibility										
Easily Accessible by public transportation	2	3	2	8	8	8	8	8	8	6
Terrain										
Upland/ Mountainous	2	0	1	0	2	1	5	1	0	6
Lowland/ plain	1	3	1	8	6	7	3	7	8	0
Coastal (fresh/salt water)	0	0	0	0	0	1	3	2	0	4
With forest cover	0	0	1	2	8	0	7	3	4	0
No forest cover	3	3	1	6	0	8	1	5	4	6
Environmental Physical Hazards										
Flood prone areas	2	0	0	4	0	0	7	4	2	5
Landslide prone areas	0	0	0	0	0	0	1	1	0	0

*Data provided by the Municipal Development Officer

Table 4. Description of the health care system of the LIFECARE study sites*

Region	National Capital Region (NCR)			Region III Central Luzon		Region IV-A CALABARZON		Region IV-A CALABARZON		Region IV-A CALABARZON
Province	Metro Manila			Bulacan		Batangas		Quezon		Rizal
Municipality	Makati Dist 2	Malate Dist 5	Marikina	Sta. Maria	Pandi	Tanauan	Laurel	Sariaya	Tiaong	Angono
No. of RHU	17	11	17	2	5	1	1	0	0	1
No. of BHS	0	0	0	22	19	45	0	37	25	11
Ratio pop/RHU+BHS	31,120	28,515.5	30,542	9,677.6	2,930	3,211	35,674	4,158	4,004.6	10,571.5
Number of Hospitals by Classification										
Private	0	3	9	5	0	5	0	2	3	3
Level 1	0	1	2	1	0	1	0	1	2	1
Level 2	0	0	6	4	0	3	0	1	1	2
Level 3	0	0	1	0	0	0	0	0	0	0
Level 4	0	2	0	0	0	1	0	0	0	0
Public	1	2	1	0	0	1	1	0	0	1
Level 1	1	0	1	0	0	1	1	0	0	0
Level 2	0	0	0	0	0	0	0	0	0	1
Level 3	0	0	0	0	0	0	0	0	0	0
Level 4	0	2	0	0	0	0	0	0	0	0
Total Number of Hospitals	1	5	10	5	0	6	0	3	3	4
Physicians	14	20	21	5	3	2	1	1	1	2
Nurses	27	35	21	6	4	10	1	1	4	2
Midwives	36	23	47	25	13	24	3	3	15	9
BHW	121	60	100	65	22	257	109	109	200	64
BNW	0	0	7	24	91	48	29	29	33	6

*Bureau of Health Facilities and Services, Department of Health, 2012

Abbreviations: Dist, District; RHU, Rural Health Units; BHS, Barangay Health Stations; pop, population; BHW, Barangay Health Workers; BNW, Barangay Nutrition Workers

remote regions like those in Mindanao. In rural areas (mostly in Visayas and Mindanao), healthcare facilities are limited to lying-in and barangay clinics, and healthcare providers are typically social workers and midwives.[12,13] In 2004, the average density of doctors was 1.14 to 1000 population, nurse-to-population ratio was 4.43 per 1000, and midwife-to-the population ratio 1.70 per 1000.[14]

In the Philippines, for government and private health workers in hospitals in 2006, the nurse-to-physician ratio was 3:1, while the midwife-to-physician ratio was 2:1.[14] Inadequacy of health workers was reflected in this study, wherein approximately the nurse-to physician ratio is 1-2:1. In contrast, midwife-to physician ratio appears to be acceptable in the provinces at 3-15:1.

In the provinces, barangay health workers (BHWs) outnumber the professional health care workers. Tiaong municipality in Quezon province had the highest density of BHWs per barangay health station at 8:1 ratio. There was paucity of barangay nutrition workers (BNWs) in Metro Manila. In the provinces, majority of municipalities had at least one BNW per barangay health unit with Pandi municipality in Bulacan province having the highest density at 4:1. Two municipalities in the province, Sariaya and Angono, had less than one BNW per barangay health unit. This observed limited access to health care may help in the understanding of the current health status of the community.

Although not observed consistently in all, disparity in available health services is evident in certain study sites, such as Tanauan and Laurel, and this can be fairly explained in terms of income classification. Because Tanauan City is considered as 1st income, versus the town of Laurel, which is 3rd, it is expected that the workers and facilities and workers are more readily accessible.

Across all municipalities, the leading cause of morbidity was respiratory tract infection (Table 5). This finding paralleled the regional morbidity data except that in Region 3, wherein hypertension ranked first.[3] In our survey, infectious diseases still predominated as causes of morbidity, but it is also noteworthy to mention that hypertension was consistently listed.

Cardiovascular diseases, reported in many forms such as myocardial infarction, ischemic heart disease etc., were the leading cause of mortality across all areas, followed by pneumonia, and malignant neoplasms (Table 6). Although regional data were not available for comparison, the figures were closely similar to that of the national statistics. In 2009, heart disease mortality due to myocardial infarction accounted for 44% of cases. In terms of place of occurrence - NCR, CALABARZON and Central Luzon, reported the highest incidence of deaths.[3] The trend for other noncommunicable diseases, such as malignant neoplasm and diabetes mellitus, was also noted to be steadily increasing in our country for the past years.[3]

Limitations of the Study

There is a paucity of readily available data at the barangay level on the employment and economic status of barangay residents. It is also beyond the scope of this paper to discuss level of education and employment. These are discussed in another article which describes the clinical cardiovascular risk profile of the Philippine LIFECARE cohort in relation to socio-demographic factors.[15]

Conclusion

Most of the participants were aged 30-50 years and mainly females. Majority were rural barangays, located outside the town proper, and in lowland areas. Approximately a quarter of the barangays were along the coast. Most of the areas had reduced forest cover, but were found to be relatively safe from environmental hazards. There was unequal distribution of hospitals and healthcare professionals, mainly concentrated in NCR. Across all municipalities, the leading cause of morbidity was

Table 5. Top 10 causes of morbidity in the LIFECARE study sites (2009)

	National Capital Region (NCR)			Region III Central Luzon		Region IV-A CALABARZON		Region IV-A CALABARZON		Region IV-A CALABARZON
	Metro Manila			Bulacan		Batangas		Quezon		Rizal
	Makati	Malate	Marikina	Sta. Maria	Pandi	Tanauan	Laurel	Sariaya	Tiaong	Angono
1	ARI	ARI	Acute Nasopharyngitis	ARI	ARI	ARI	ARI	ARI	ARI	Not available
2	UTI	Bronchitis	Acute Pharyngitis	Fever	HPN	Influenza	Infected wound	Influenza	HPN	-
3	Pneumonia	Diarrhea	Acute Tonsillitis	Diarrhea	MSDO	HPN	UTI	Dental Problem	Diarrhea	-
4	Bronchitis	Pneumonia	Bronchitis	Infected wound	UTI	AGE	HPN	UTI	Pneumonia	-
5	Dermatitis	PTB	UTI	HPN	AGE	Bronchitis	Diarrheal disease	HPN	UTI	-
6	HPN	BA	Diarrhea	Skin rashes	Wound	PTB	AGE	Skin Problem	PTB	-
7	Diarrhea	DF	HPN	BA	ATP	Pneumonia	EENT	Wounds	Anemia	-
8	BA/ COPD	Conjunctivitis	Infected wound	UTI	DM	Heart disease	Vitamin deficiency	BA	Acute Ear Infection	-
9	PTB	Influenza	BA	Anorexia	H Rxn	DF	MSDO	Diarrhea	Mumps	-
10	VI	Chicken pox	VI, unspecified	Primary complex	Acute Bronchitis	CA	Vertigo	Tonsillitis	Skin disease	-

*Source: Municipality/City Health Office

Abbreviations: URI/URTI, Upper Respiratory Infection; ARI, Acute Respiratory infection; UTI, Urinary Tract Infection; HPN, Hypertension; BA, Bronchial Asthma; COPD, Chronic Obstructive Pulmonary Disease; PTB, Pulmonary Tuberculosis; VI, Viral infection; DF, Dengue Fever; MSDO, Musculoskeletal disorder; ATP, Acute tonsillopharyngitis; DM, Diabetes Mellitus; DF, Dengue Fever; CA, Cancer

Table 6. Top 10 causes of mortality in the LIFECARE study sites (2009)

	National Capital Region (NCR)			Region III Central Luzon		Region IV-A CALABARZON		Region IV-A CALABARZON		Region IV-A CALABARZON
	Metro Manila			Bulacan		Batangas		Quezon		Rizal
	Makati	Malate	Marikina	Sta. Maria	Pandi	Tanauan	Laurel	Sariaya	Tiaong	Angono
1	Heart Disease	Heart disease	AMI/IHD/ CAD	CVA	Heart disease	AMI	HPN	IHD	AMI	Not available
2	Pneumonia	Pneumonia	HCVD	Pneumonia	CA	Pneumonia	Pneumonia	Degenerative Disease/ MOF	CA	-
3	CA	HCVD	Pneumonia	CA (all forms)	CVA	DM	Heart disease	CVA/HPN/ CVD	Accident	-
4	CVD	CA	CA (all forms)	AMI	ARF	Lung CA	CA	CA	HCVD	-
5	Injury/ Accident	DM	CVD/ Stroke	Accident	Accident	GSW	PTB	COPD	Pneumonia	-
6	DM	PTB	Traumatic injuries (all causes)	PTB	DM	Sepsis	Accident	DM	MOF	-
7	Kidney Disease	CVA	DM	ARF	PTB	PTB	MOF	Pneumonia	Renal failure	-
8	HPN	UTI	PTB	CAD	Pancreatitis	Coronary arrest	Renal failure	Accident	COPD	-
9	BA/ COPD	Prematurity	CKD	COPD	COPD	Acute respiratory arrest	Liver disease	Undetermined DOA	DM	-
10	Liver disease	BA	BA	Sepsis	Pneumonia	HF congestion	Acute pancreatitis	Renal Failure	Cardio Respiratory Failure	-

* Source: Municipality/City Health Office

Abbreviations: CA, Cancer; CVD, Cerebrovascular Disease; DM, Diabetes mellitus; HPN, Hypertension; BA, Bronchial Asthma; COPD, Chronic Obstructive Pulmonary Disease; HCVD, Hypertensive Cardiovascular Disease; DM, Diabetes mellitus; PTB, Pulmonary Tuberculosis; CVA, Cerebrovascular Accident; CVD, Cerebrovascular Disease; AMI, Acute Myocardial Infarction; IHD, Ischemic Heart Disease; CAD, Coronary Artery Disease; CKD, Chronic Kidney Disease; ARF, Acute Renal Failure; GSW, Gunshot Wound; HF, Heart Failure; MOF, Multiple Organ Failure

respiratory tract infection, while cardiovascular diseases caused most of deaths. The observed diversity of the study sites and its current health status and resources, may provide valuable information in translating the subsequent findings of the LIFECARE study into relevant policies and programs to address the health service delivery.

Acknowledgments

We would like to gratefully acknowledge and thank the following Municipal Planning and Development Officers (Mr. Tomas C. Aguilar Jr. – Marikina; Engr. Merlina G. Pangilinan and Engr. Antonio Xenon L. Nalde – Makati; Mrs. Nancy Unidad – Angono, Rizal; Engr. Zosimo R. Baiza – Tiaong, Quezon; Mrs. Nieves Borja – Tanauan, Batangas; Engr. Ciriaco Calinisan – Laurel, Batangas; Mrs. Fortunata Lorenzo – Sta. Maria, Bulacan; Engr. Freddie Concepcion – Pandi, Bulacan; Mr. Homer Rabas – Manila) and Mr. Guillermo Lipio Jr., statistician from the National Statistics Office who gave us assistance and provided information for this paper. The authors are thankful for the unwavering contribution of our support team (Rona May de Vera, Rachel Longalong, and Alma Amparo) and the field interviewers, making this project successful. We also thank our colleagues in Singapore, Indonesia, Malaysia and Thailand for their cooperation in the LIFECARE study. The following organizations provided financial assistance to this project: Pfizer Asia, Pfizer International, Pfizer Philippines, Department of Health (Philippines), Philippine Council for Health Research and Development, Diabetes Philippines, Philippine Society of Hypertension, and the Philippine Lipid and Atherosclerosis Society. The University of the Philippines Manila through the College of Medicine and the National Institutes of Health's Institute of Clinical Epidemiology also supported the project.

References

1. Life expectancy of women at birth, Philippine Statistics Authority, National Statistics Office 2005-2010 [Online]. 2011 [cited 2013 Nov 4]. Available from http://www.census.gov.ph/content/life-expectancy-birth-women.
2. Health service delivery profile, WHO and Department of Health, Philippines [Online]. 2012 [cited 2013 Nov 4]. Available from http://www.wpro.who.int/health_services/service_delivery_profile_philippines.pdf .
3. The 2009 Philippine Health Statistics, Department of Health, National Epidemiology Center [Online]. [cited 2014 Jan 23]. Available from http://www.doh.gov.ph/sites/default/files/PHILIPPINEHEALTH STATISTICS 2009.pdf.
4. Philippine Statistics Authority - National Statistical Coordination Board. Income Classification for Provinces, Cities and Municipalities [Online]. 2008 [cited 2014 Nov 17]. Available from http://www.nscb.gov.ph/activestats/psgc/articles/con_income.asp.
5. Castillo-Carandang NT, Sison OT, Grefal ML, et al. A community-based validation study of the Short-Form 36 Version 2 Philippines (Tagalog) in two cities in the Philippines. PLoS ONE. 2013; 8(12): e83794.

6. The 2010 Census of Population and Housing Reveals the Philippine Population at 92.34 Million, Phillipine Statistics Authority, National Statistics Office [Online]. 2012 [cited 2014 Jan 23]. Available from http://www.census.gov.ph/content/2010-census-population-and-housing-reveals-philippine-population-9234-million.
7. Urban Barangays in the Philippines (Based on 2010 CPH), Philippine Statistics Authority, National Statistics Coordination Board [Online]. 2013 [cited 2014 Jan 23]. Available from http://www.census.gov.ph/content/urban-barangays-philippines-based-2010-cph.
8. Concepts and Definitions, Local Government Units, 1997-2014, Philippine Statistics Authority-National Statistics Coordination Board [Online]. [cited 2014 Jan 23]. Available from http://www.nscb.gov.ph/activestats/psgc/articles/con_lgu.asp.
9. Concepts and Definitions, Urban/Rural Classification, 1997-2014, Philippine Statistics Authority-National Statistics Coordination Board [Online]. [cited 2014 Jan 23]. Available from http://www.nscb.gov.ph/activestats/psgc/articles/con_urbanrural.asp.
10. Compendium of Basic ENR Statistics for Operations and Management (Second Edition) (2000-2008), Department of Environment and Natural Resources [Online]. [cited 2014 Feb 7]. Available from http://www.denr.gov.ph/images/stories/combined_compendium_enr_stat_2000_2008.pdf.
11. Department of Health, Bureau of Health Facilities and Services 2009. Overview of Health Sector Reform in the Philippines and Possible Opportunities for Public-Private Partnerships, Asian Institute of Management [Online]. 2010 [cited 2014 Jan 25]. Available from http://www.aim.edu/files/download/131.
12. Overview of Health Sector Reform in the Philippines and Possible Opportunities for Public-Private Partnerships, Asian Institute of Management [Online]. 2010 [cited 2014 Jan 25]. Available from http://www.aim.edu/files/download/131.
13. National Statistical Coordination Board. 2010. Philippine national health account 2007 [Online]. 2012 [cited 2014 Jan 25]. Available from http://www.nscb.gov.ph/stats/pnha/2010/default.asp.
14. Romualdez AG, dela Rosa JFE, Flavier JDA, Quimbo SLA, Hartigan-Go KY, Lagrada LP, et al. World Health Organization. The Philippines Health System Review. Health Systems in Transition Vol. 1 No. 2. Asia Pacific Observatory on Health Systems and Policies. Manila, WHO WPRO, [Online]. 2011 [cited 2014 Jan 25]. Available from: http://www2.wpro.who.int/asia_pacific_observatory/resources/Philippines_Health_System_Review.pdf.
15. Punzalan FER, Sy RG, Sison OT, et al. The Cardiovascular Risk Profile of the Philippine LIFECARE cohort. Acta Med Philipp. 2014; 48(2).