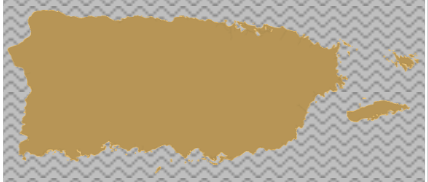

Cancer in Puerto Rico 2004-2009

Cancer Incidence and Mortality

Puerto Rico Central Cancer Registry

Centro Comprensivo de Cáncer
universidad de puerto rico

Registro Central de Cáncer de Puerto Rico

Departamento de Salud
Gobierno de Puerto Rico

Cancer in Puerto Rico 2004 - 2009

Editor:
Nayda Figueroa-Vallés, MD, MPH, CTR: Director, Puerto Rico Central Cancer Registry

Analysis:
Analysis and Research Unit of the Puerto Rico Central Cancer Registry
Karen J. Ortiz-Ortiz, MA, MPH, CTR
Naydi Pérez-Ríos, MS
Erick Villanueva-Rosa, MSC
Maricarmen Traverso-Ortiz, MPH

Collaborators:
Carlos R. Torres-Cintrón, MPH
Tonatiuh Suárez-Ramos

Correspondence to:
Luz I. Acevedo (lacevedo@rcpr.org)

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Puerto Rico Central Cancer Registry Staff

Director

Nayda R. Figueroa-Vallés, MD, MPH

Office Systems Administrator

Luz Idalia Acevedo

Administrator

Edwin Ortiz Matias, MA

Pathology & Follow Up Coordinator

Verónica Rivera López, CTR

Case Processing Unit Coordinator

Yadira Román Ruiz, CTR

Coordinator of Education and Trainings

Edna Pagan Acevedo, BS, CTR

Quality Control Coordinator

Maria F. Merced Vélez, CTR

Tumor Registrars

Ana Alicea Sánchez

Gladys Ojeda Reyes, BS, CTR

Ileana Veguilla Rosario, BS, CTR

Iván Serrano Santiago, BS

Julio A. Arce Cortés, BS, CTR

Maribel Ramos Cordero

Maricarmen Traverso Ortiz, BS, MPH

Nivia E. Vázquez Cubano, BS, CTR

Analysis and Research Coordinator/ Biostatistician

Karen J. Ortiz Ortiz, MA, MPH, CTR

Epidemiologist/ Biostatistician

Naydi Pérez Ríos, MS

Biostatistician

Carlos R. Torres Cintrón, MPH

Demographer

Erick Villanueva Rosa, BA, MSC

Database Administrator

Cristino Ruiz Rivera, AS

Programmer Analyst

José M. Rivera Rosario, BA

Programmer Consultant

Omar Centeno Rodríguez, LIC

Letter from the Director

Dear Puerto Ricans:

Cancer is the second leading cause of death in our Island resulting in nearly 5,000 deaths annually. In 2009, nearly 13,000 Puerto Ricans developed cancer. The Puerto Rico Central Cancer Registry is pleased to present the report **Cancer in Puerto Rico 2004-2009.**

This Report is a review of the status of cancer in Puerto Rico. It presents a description of the incidence and mortality data for cancer in PR for the period of 1987 to 2009. In addition, it describes the distribution of the main types of cancers that affect our population.

Puerto Rico Central Cancer Registry is a key part in cancer research. This information is essential to identify changes in cancer occurrence in Puerto Rico and to set priorities in comprehensive cancer control. It should serve as the guide for the development and implementation of interventions aimed at diminishing the burden of the disease in our population, as well as to measure the outcomes of such interventions.

Nayda R Figueroa-Vallés, MD, MPH

Director
Puerto Rico Central Cancer Registry
University of Puerto Rico Comprehensive Cancer Center

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Data Sources and Methods

Incidence Data

Population based reporting of newly diagnosed cancers was fully implemented in Puerto Rico in 1950. The primary source of data on cancer incidence is the medical record. Staff at health care facilities (including hospitals, physicians' offices, therapeutic radiation facilities, freestanding surgical centers, and pathology laboratories) abstract data from patients' medical records and report these data to the PRCCR. Standards for data abstracting, collection, and reporting to PRCCR are based on the North American Association of Central Cancer Registries (NAACCR) standards (1). Incidence data contained on this report are based on cases of primary cancer that were diagnosed among residents from Puerto Rico between January 1, 1987 and December 31, 2009.

Underreporting of Cancer Veterans Administration (VA) Hospital

Veteran's Health Administration (VHA) hospital in Puerto Rico did not report cancer cases to the Puerto Rico Cancer Registry (PRCCR) from 2006 through 2009. Although there is no way to know how many unreported cancer cases were diagnosed in this facility, historically VHA-reported cases have accounted for approximately 2.5 to 4.0 percent of all new cancers report to the PRCCR. As a result, rates of new cancer diagnoses (incidence rate) for 2006-2009 in this publication are based upon case counts that the PRCCR believes to be underestimates of the true counts. This lack of reporting affects the interpretation of cancer statistics presented in this publication.

Selection Criteria

The cases included in this report are only from residents of Puerto Rico. Persons who were treated in Puerto Rico but were residents of another country at the time of the cancer diagnosis were not included in this report. Cases reported to the PRCCR with unknown age (< 0.4%) were excluded from the analyses. No unknown or ambiguous gender was observed for the study period (1987-2009). Cases of unknown site at diagnosis accounted for 7,584 (3.3%) incident cancers, and were included in the counts and rates for all sites combined (1987-2009). The coding of cancer as unknown or ill-defined exerts a downward bias on the rates of the

specific cancers that were the true sites. Cases with unknown municipality of diagnosis for the period of 2005-2009 were excluded only from the calculations of municipality-specific rates (4.3%). For this report, only malignant (invasive) cancers were included, except for *in situ* bladder cancers that were combined with invasive bladder cancers and are included in the total for all invasive cancer sites combined. *In situ* and invasive bladder cancers were combined because of the difficulty in the interpretation of the information used by pathologists to describe the extent of invasion of bladder cancers which is not always available or reliable (2). Carcinoma *in situ* of the cervix and basal and squamous cell carcinomas of the skin were excluded, with the exception of those of the skin of the genital organs (3).

Case Definition

A "case" is defined as a primary cancer, and the anatomic site recorded is the site of tumor origin. Additional tumors that result from the spread or metastasis, of cancer to another organ were not counted as incidence cancers. Since individuals can have more than one primary cancer and each primary tumor counts as a case, the number of incident cases for a given year will be higher than the number of persons who were diagnosed as having cancer.

Childhood Cancer (00-19 years)

The incidence data used for the Childhood Cancer section was grouped according to the SEER modification of the International Classification of Childhood Cancers, Third Edition (ICCC-3) specifications based on ICD-O-3 (4). The ICCC presents childhood cancers in 12 groups classified primarily by morphology.

Mortality data were coded according to the International Classification of Diseases (ICD-10). The use of ICCC to describe the incidence of childhood cancer and, ICD-10 codes for mortality results in categories that in some cases are not strictly comparable. For these reasons, the mortality data are presented only for all sites cancers combined.

Classification of Anatomic Site

Primary anatomic site and histology type of case were coded according to the International Classification of Diseases for Oncology edition in use at the time of diagnosis. Cases diagnosed in 2000 which were originally reported using the second edition of the International Classification of Diseases for Oncology (ICD-O-2) (5) were converted to ICD-O-3 (6). All cancer cases diagnosed since 2001 were reported using ICD-O-3.

Cancers were grouped according to the convention of the SEER program (http://seer.cancer.gov/siterecode/icdo3_d01272003/). For children and adolescents, diagnostic groups were organized using the SEER Program's site/histology modification to the International Classification of Childhood Cancer (ICCC) (4, 7).

Microscopic Confirmation

For the period of 1987-2009, microscopic confirmation was obtained for 89.3% of the cases. Meanwhile, for the period of 2005-2009, microscopic confirmation was obtained for 91.1% of the cases.

Death Certificate Only Cases

The PRCCR is routinely linked with computerized death certificate files to identify persons who die of cancer, but whose cancer has not yet been reported. Unreported cancer-related deaths receive follow back to the reporting physician and facility to verify the diagnosis and to obtain more information, such as date of diagnosis, residence at diagnosis and treatment received. If a person death certificates lists cancer as the underlying cause of death, but the diagnosis cannot be verified thru follow back, the decedent is added to the Registry as a “death certificate only case” – that is, the death certificate is the only source of information on the patient’s cancer. Overall, 7.7% of cases in the Registry are “death certificate only” for the period of 1987-2009. While for the period 2005-2009, 5.4% of the cases are “death certificate only”.

Confidentiality

All data obtained by the PRCCR from the medical record of individual patients are held in strict confidence by the Registry. Researchers may obtain case-specific and/or patient

identifiable information from the PRCCR by submitting a written application that describes how the data will be used for scientific study. In situations where contact with a patient or patient's family is proposed, the applicant must substantiate the need for any such contact and submit approval from an Institutional Review Board. Upon favorable review by the PRCCR, the applicant must also agree to maintain the confidentiality and security of the data throughout the course of the study, to destroy or return to the Registry at the end of the study and to present material to the Registry prior to publication to assure that no identifiable information is released. Aggregate data (i.e. statistical information) from the Registry are considered open to the public and are available upon request.

Mortality

Computerized files containing information on cancer-related deaths were obtained from the Puerto Rico Department of Health, Division of Statistical Analysis, and Auxiliary Secretariat for Planning and Development (8) and from the Institute of Statistics of Puerto Rico (8). Death certificate master files from 1987-2008 were used for all years included in this report. Cause of death was coded by the International Classification of Diseases, Ninth Edition (ICD-9) for deaths occurring from 1987-1998 (9). Beginning in 1999 and thereafter, cause of death was coded by the International Classification of Diseases, Tenth Edition (ICD-10) (10). All mortality analyses presented in this report are the responsibility of the authors, and were not reviewed or endorsed by the Puerto Rico Demographic Registry prior to publication. Only deaths among Puerto Rican residents were included in these analyses. No unknown age was observed for the study period (1987-2008). Deaths of unknown site accounted for 8.67% of cancer related deaths and were not included in the analysis. Deaths with unknown municipality (residence of the patient at the moment of death) for the period of 2004-2008 were only excluded from the calculations of municipality-specific rates (0.05%).

Population Estimates

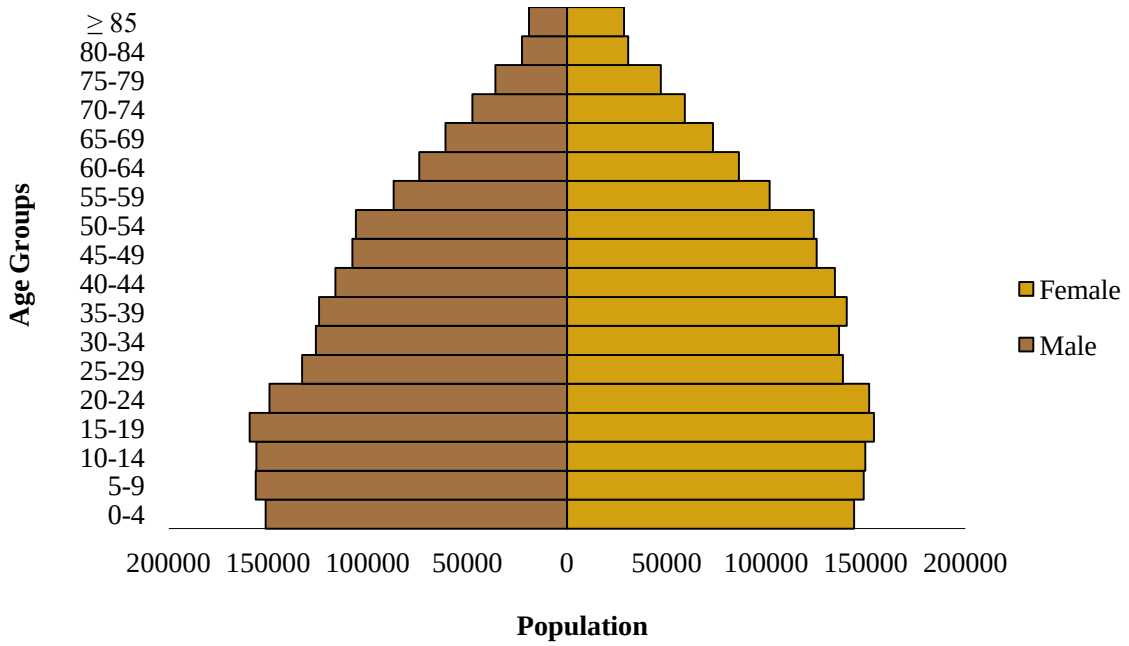
Until 2009 the annual midyear population estimates were obtained by age, sex and municipality of residence from the U.S Census Office of the Puerto Rico Planning Board. Population estimates were subjected to periodic revisions, which may have also modify the age and sex specified population distribution for all years in the series (e.g.Vintage-2008, Vintage-

2009). At this moment, population estimates are officially provided by the US Census Bureau. The rates presented in this report are internally consistent with the Intercensal population estimates, which represents the most recently and accurate released official population estimates. The Intercensal estimates were used instead of the Vintage-2009 because of the population change between the 2000 and 2010 Censuses.

Puerto Rico 2000-2010 Population Change

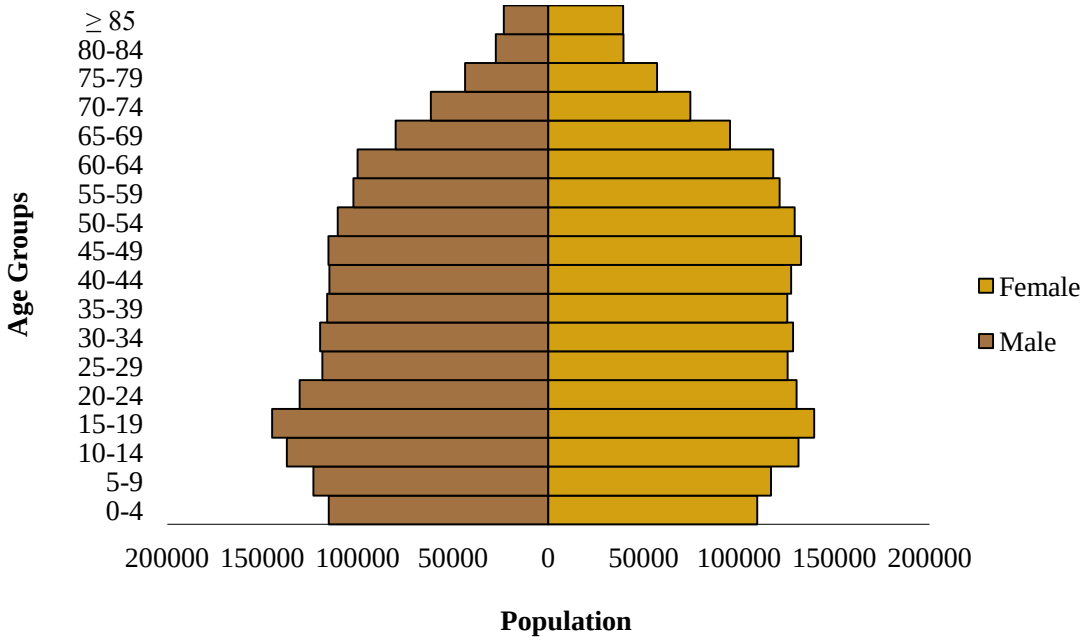
Official population estimates for calculation of rates were provided by the US Census Bureau. PRCCR has its own demographers working and analyzing the post-censal, intercensal, and projected populations. In 2000, a total population of 3,808,610 was estimated in PR; 32.0% of the population was under age 20; 35.5% between 20-44 years; 21.3% between 45-64 years; 9.9% between 65-84 years and 1.3% for 85+ years (see Figure 1). Although 80.5% of PR residents identified themselves as white in the 2000 Census, there is no official classification by race used in PR. This datum does not appear in any official document. PRCCR is collecting racial and ethnic data consistent with population data. Although classification by ethnicity is very good in PRCCR, the NAACCR Hispanic Identification Algorithm (NHIA) is used to enhance the identification of Hispanic/Latino persons with cancer.

FIGURE 1: POPULATION PYRAMID FOR PUERTO RICO, CENSUS 2000



In 2010 the total population of Puerto Rico was 3,725,789 habitants, which means a decrease of 82,821 persons in comparison with the 2000 census (N=3,808,610). Men represent the 48% of the total population, while women represent 52%. For 2010, 99.0% (3,688,455) of the habitants of the Island were Hispanic/Latino; of these 95.4% (3,554,642) were Puerto Rican. The decrease of the population had affected the age-sex structure of the Island population. For 2010 a total of 15% of the total population were 65 years and above (see Figure 2). Men had a median age of 35.1 years, while women had a median age of 38.6 years. The sex ratio was 93 males per each 100 females. The total population below poverty level represents a 44.8%.

FIGURE 2: POPULATION PYRAMID FOR PUERTO RICO, CENSUS 2010



Geospatial Cloropleth Maps

This report includes geospatial maps that graphically display the incidence and mortality cancer rates by primary site and municipality for PR. In the case of PR municipality level is equivalent to the county level. The maps were created using Arc GIS 9.2 (Geographic Information System), which allows users to visually compare incidence and mortality cancer rates for municipalities in PR. There are several methods that Arc GIS uses to categorize the class break values (e.g., equal-interval, quartiles, natural breaks, and standard deviations). There is no single best data classification method; each classification method has its advantages and disadvantages. For this report, the maps were created using quantile classification methods to

specify the number of data classes into which the data were categorized, leaving zero as a single category.

In quartile method classification, an equal number of observations are placed in each class. The rates for the areas of interest (e.g., municipalities) were first rank-ordered, and then an equal number of observations were placed in each class. The number of classes also determines the specific type of quartile map (three classes = tertile; four classes = quartile; five classes = quintile). Quartile maps can be helpful in identifying the spatial patterns of the relative rankings of rates within the geographic units of interest (e.g., municipalities) (14). The major disadvantage of the quartile classification is that it does not consider how the data are distributed. Therefore, if the data has a highly skewed distribution (e.g., many outliers) this classification will force data observations into the same class (either the lowest or highest, in this case) where this may not be appropriate; as a result, the quartile classification may give a false impression that there is a relatively normal data distribution. Rates can be unstable for those municipalities with small population counts. Caution must be required in interpreting incidence and mortality cancer rates at municipality level.

Statistical Terms

Age-Adjusted Rate

All rates in this document were age-adjusted to the Puerto Rico 2000 population. This allows the comparison of rates among populations between Puerto Rico's counties (municipalities), having different age distributions by standardizing the age-specific rates in each municipality to one standard population.

Age-Specific Rates

Age-Specific rates were calculated by dividing the number of cases or deaths in a specific age group by the total population at risk in that age group. Age at diagnosis or at death was categorized into (<1 year, 1-4 years, 10-14 years,… 85+ years).

Incidence vs. Mortality

Incidence refers to the number or rate of newly diagnosed cases of cancer. The incidence rate is calculated as the number of new cancers diagnosed in Puerto Rico (or specific municipality in the case of municipality-specific rates) during one year divided by the number of residents in the state or municipality during the year. Mortality refers to the number or rate of deaths from cancer.

The incidence and mortality rates were expressed as the number of cancers per 100,000 persons, except for childhood cancer rates which were expressed for 1,000,000 persons. In this report, the childhood cancer rates were presented as average annual rates per million because of the small number of cancer cases in children relative to adult cancers.

Cancer incidence rates is,

*Incidence rate = (New cancers / Population)*100,000*

The *numerator* of the incidence rate is the number of new cancers; the *denominator* of the incidence rate is the number of persons that are at risk for that cancer. The number of new cancers may include multiple primary cancers occurring in one patient. The primary site reported is the site of origin and not a metastatic site. The population used depends on the rate to be calculated. For cancer sites that occur in only one sex, the sex-specific population (e.g., females for cervical cancer) is used. The incidence rate can be computed for a given type of cancer or for all cancers combined. Except for 5-year age-specific rates, all incidence rates in this report are *age-adjusted* to the PR 2000 population.

Cancer death (or mortality) rate is,

*Mortality rate = (Cancer Deaths / Population)*100,000*

The *numerator* of the death rate is the number of deaths; the *denominator* of the mortality rate is the size of the population. As with the incidence rate, the population used depends on the rate to be calculated. The mortality rate can be computed for a given cancer site or for all cancers combined. Except for 5-year age-specific rates, all mortality rates in this report are *age-adjusted* (see below) to the PR 2000 population.

Annual Percent Change (APC)

This is the average rate of change (increase or decrease) in a cancer rate over several years and is used to measure trends over a specific period of time. The APC is calculated by fitting a least squares regression line to the natural logarithm of the annual rates (*r*) using the calendar year as a predictive variable: $ln\ (r) = m(year) + b$ (15, 16) as implemented in the National Cancer Institute's (NCI's) SEER*Stat software (13). From the slope of the regression line *m*, the APC is calculated as $EAPC = 100^{*}\ (e^{m} - 1)$. Testing the hypothesis that the APC is equal to zero is equivalent to testing the hypothesis that the slope of the line in the regression is equal to zero. The slope of the line is tested for significant increases or decreases (95% confidence intervals were recorded, and $p < 0.05$ was considered significant). The APC was calculated for incidence and mortality trends in specific primary sites where there were 15 or more incidence cases or deaths for each year reported during the period of 1987-2009 for incidence and 1987-2008 for mortality.

Relative Risks

The relative risk of developing or dying of cancer was calculated by dividing the age-adjusted rate in the population whose risk was being evaluated by the age-adjusted rate in the comparison population. A relative risk of 1.0 indicates that the risk of cancer is the same in the two groups. A relative risk greater than 1.0 indicates that the likelihood of cancer is greater in the group being studied than in the comparison population; conversely, a relative risk of less than 1.0 indicates that the cancer rates are lower in the group of interest.

Cautions on Interpretation

The validity of the cancer rates depends on the completeness of cancer reporting and on the accuracy of population estimates. Incidence data on this report are based on cases of primary cancers which were first diagnosed among the residents of Puerto Rico between January 1, 2005 and December 31, 2009 and were reported to the PRCCR as of March 2012. Additional cancer cases will continue to be reported to the PRCCR for 2009 and for earlier years and will be included in future reports. Population estimates released by the Puerto Rico Census Bureau are also subject to periodic revisions. For these reasons, rates in this report are not directly

comparable to those released in previous annual reports. Care should be taken in interpreting the data at the municipality level. One case of cancer in a municipality with a small population can cause the rate in that municipality to be very high relative to other municipalities in the island. For example, one case of cancer in a municipality with a population of 10,000 will result in a rate of cancer that is roughly twice as high as the rate of cancer in a municipality with population of 20,000 that also has only one case. Finally, caution should also be taken in the interpretation of age-adjusted incidence and mortality rates of counts that are less than 15 because these counts are too few to calculate a stable age-adjusted rate.

Small Numbers

When the numbers of cases or deaths reported to the PRCCR are small (such as being diagnosed with a rare disease), those counts might identify a person diagnosed with a rare type of cancer or a person in a small municipality with few cancer cases. To assure that no identifiable information is released and to avoid potential identification of patients, counts of cases that are fewer than 6 are not shown on this report.

Cancer in Puerto Rico: An Overview

Cancer Incidence and Mortality for the most recent years

This overview highlights some of the findings of this report and summarizes the status of cancer in Puerto Rico.

New cases in 2009 and deaths in 2008

In Puerto Rico 12, 906 new cancer cases were reported in the year 2009. Of these 6,898 (53.4%) were males and 6,008 (46.6%) were females. For the same year, prostate cancer was the most frequent cancer among males with 2,794 new cases and breast cancer was the most common among females with 1,776 cases. There were 871 new cases of colorectal cancer among males and 807 among females. Lung and bronchus cancer was also one of the most common cancer sites for that year with 477 new cases in males and 257 cases in females. For the year 2009, thyroid cancer featured as one of the most common cancer in females with 574 new cases.

Regarding the deaths attributed to cancer, during the year 2008 approximately 5,007 deaths due to cancer were reported. Of these 2,841 (56.7%) were in males and 2,166 (43.3%) were in females. For that year, prostate cancer was the most frequent cause of death due to cancer among males with 530 deaths, and breast cancer was the most common cause of death by cancer in females with 416 deaths reported. For 2008, there were 358 deaths by colorectal cancer among males and 270 deaths among females. Also, lung and bronchus cancer was among the most common causes of death by cancer with 371 deaths in males and 210 deaths in females on that year.

TABLE 1: INCIDENCE FOR SPECIFIC CANCER SITES BY SEX, PUERTO RICO, 2005-2009* †

Primary Sites	Male						Female					
	2005-2009			2009			2005-2009			2009		
	Rate*	Count‡	%	Rate*	Count‡	%	Rate*	Count‡	%	Rate*	Count‡	%
All Sites	***344.1***	***33,873***	***100.0***	***336.7***	***6,898***	***100.0***	***241.0***	***28,448***	***100.0***	***248.5***	***6,008***	***100.0***
Oral Cavity and Pharynx	13.7	1,356	4.0	13.1	270	3.9	3.5	420	1.5	3.5	87	1.4
Esophagus	6.2	614	1.8	5.9	120	1.7	1.2	154	0.5	1.4	37	0.6
Stomach	10.1	979	2.9	8.6	177	2.6	5.9	740	2.6	5.8	150	2.5
Colon and Rectum	45.4	4,459	13.2	42.5	871	12.6	32.1	3,944	13.9	31.7	807	13.4
Liver and Intra-hepatic Bile Duct	9.7	951	2.8	9.2	190	2.8	4.0	499	1.8	3.6	95	1.6
Pancreas	5.3	526	1.6	6.7	136	2.0	4.4	557	2.0	5.2	134	2.2
Larynx	6.5	642	1.9	5.7	118	1.7	0.6	70	0.2	0.5	13	0.2
Lung and Bronchus	21.8	2,152	6.4	23.2	477	6.9	9.8	1,213	4.3	10	257	4.3
Melanoma of the Skin	2.4	232	0.7	2.3	47	0.7	1.8	210	0.7	1.9	46	0.8
Breast	0.9	90	0.3	0.7	13	0.2	73.4	8,626	30.3	73.6	1,776	29.6
Cervix Uteri	~	~	~	~	~	~	10.1	1,092	3.8	11	235	3.9
Corpus and Uterus, NOS	~	~	~	~	~	~	17.0	2,010	7.1	17.3	418	7.0
Ovary	~	~	~	~	~	~	6.4	740	2.6	5.8	139	2.3
Prostate	138.8	13,885	41.0	133.5	2,794	40.5	~	~	~	~	~	~
Testis	2.9	259	0.8	2.9	51	0.7	~	~	~	~	~	~
Urinary Bladder	14.1	1,375	4.1	15.8	321	4.7	4.1	518	1.8	4.4	116	1.9
Kidney and Renal Pelvis	7.1	696	2.1	7.5	153	2.2	4.1	483	1.7	4.5	108	1.8
Brain and Other Nervous System	4.9	459	1.4	5.7	111	1.6	3.8	418	1.5	4.8	109	1.8
Thyroid	4.8	458	1.4	6.1	118	1.7	21.1	2,274	8.0	26.1	574	9.6
Hodgkin Lymphoma	2.7	250	0.7	2.5	46	0.7	1.9	194	0.7	2.1	42	0.7
Non-Hodgkin Lymphoma	11.8	1,136	3.4	11.4	225	3.3	9.0	1,076	3.8	9.8	242	4.0
Myeloma	3.6	357	1.1	3.3	67	1.0	2.8	354	1.2	2.5	65	1.1
Leukemia	7.3	686	2.0	6.2	119	1.7	4.9	559	2.0	4.5	105	1.7
Bones and Joints	0.9	87	0.3	0.9	15	0.2	0.8	82	0.3	0.7	17	0.3
Other Sites	23.0	2,224	6.6	23.1	459	6.7	18.3	2,215	7.8	17.5	436	7.3

*Rates are per 100,000 and age-adjusted to the PR 2000 population.

† Excludes basal and squamous cell carcinomas of the skin except when these occur on the skin of the genital organs, and in situ cancers except urinary bladder. Cases with age unknown were excluded/Statistics were generated from malignant cases only.

~ Not applicable.

‡ Counts < 15 are too few to calculate a stable age-adjusted rate.

TABLE 2: MORTALITY FOR SPECIFIC CANCER SITES BY SEX, PUERTO RICO, 2004-2008*

Primary Site	Male						Female					
	2004-2008			2008			2004-2008			2008		
	Rate*	Count‡	%	Rate*	Count‡	%	Rate*	Count‡	%	Rate*	Count‡	%
All sites	***146.4***	***13,815***	***100.0***	***144.5***	***2,841***	***100.0***	***87.8***	***10,669***	***100.0***	***85.9***	***2,166***	***100.0***
Oral Cavity and Pharynx	5.7	546	4.0	5.4	110	3.9	1.0	119	1.1	0.8	22	1.0
Esophagus	5.2	502	3.6	5.0	99	3.5	1.1	134	1.3	0.7	19	0.9
Stomach	8.0	747	5.4	7.0	137	4.8	3.8	474	4.4	3.0	78	3.6
Colon and Rectum	18.4	1,751	12.7	18.1	358	12.6	11.6	1,433	13.1	10.5	270	12.5
Liver and Intrahepatic Bile Duct	8.6	831	6.0	9.5	190	6.7	4.2	521	4.9	4.7	122	5.6
Pancreas	5.4	518	3.7	5.1	101	3.6	4.3	538	5.0	4.5	117	5.4
Larynx	2.8	270	2.0	2.7	54	1.9	0.2	29	0.3	0.3	07	0.3
Lung and Bronchus	19.1	1,838	13.3	18.6	371	13.1	8.7	1,073	10.1	8.2	210	9.7
Melanoma of the Skin	0.6	56	0.4	0.9	17	0.6	0.3	41	0.4	0.3	08	0.4
Prostate	28.3	2,570	18.6	27.8	530	18.7	~	~	~	~	~	~
Testis	0.3	28	0.2	0.3	5	0.2	~	~	~	~	~	~
Breast	0.3	26	0.2	0.4	7	0.5	16.9	2,006	18.8	17.0	416	19.2
Cervix Uteri	~	~	~	~	~	~	2.1	233	2.2	1.9	44	2.0
Corpus and Uterus, NOS	~	~	~	~	~	~	3.9	468	4.4	3.8	94	4.3
Ovary	~	~	~	~	~	~	3.9	465	4.4	3.6	90	4.2
Urinary Bladder	3.5	320	2.3	3.3	63	2.2	1.4	176	1.6	1.7	47	2.2
Kidney and Renal Pelvis	2.5	240	1.7	2.4	49	1.7	1.1	132	1.2	1.2	31	1.4
Brain and Other Nervous System	2.0	191	1.4	2.6	51	1.8	1.4	168	1.6	1.7	47	2.2
Thyroid	0.2	20	0.1	0.3	6	0.2	0.3	36	0.3	0.2	05	0.2
Hodgkin Lymphoma	0.5	50	0.4	0.5	9	0.3	0.3	34	0.3	0.4	09	0.4
Non-Hodgkin Lymphoma	4.9	468	3.4	3.4	67	2.4	3.2	378	3.5	3.1	78	3.6
Myeloma	2.9	276	2.0	2.9	58	2.0	2.1	261	2.4	2.2	57	2.6
Leukemia	5.3	495	3.6	4.6	88	3.1	3.2	373	3.5	3.1	76	3.5
Bones and Joints	0.7	69	0.5	0.6	11	0.4	0.4	50	0.5	0.3	08	0.4
Other Sites	21.1	2,001	14.5	23.2	458	16.1	12.6	1,527	14.3	12.5	317	14.6

*Rates are per 100,000 and age-adjusted to the PR 2000 population.
~ Not applicable.
‡ Counts < 15 are too few to calculate a stable age-adjusted rate.

Overview of All Sites of Cancer

Incidence for the Period of 2005-2009

Approximately, 62,321 persons in Puerto Rico were diagnosed with invasive cancer between 2005 and 2009; 33,873 were males and 28,448 were females. On average, approximately 6,775 males and 5,690 females were diagnosed annually with cancer (Table 1). In males incidence rates increased from 288.9 per 100,000 in 1987 to 336.7 per 100,000 in 2009, while females incidence rates increased from 203.9 per 100,000 in 1987 to 248.5 per 100,000 for 2009. Incidence rates among males had a slight increase with an average of 0.3% each year; in females the incidence rates increased by an average of 0.9% each year during this period. The increase was statistically significant for the females only ($p<0.05$).

For 2005-2009, the median age at diagnosis for cancer of all sites was 66 years. Approximately, 1.1% was diagnosed under age 20; 2.9% between 20 and 34; 10.7% between 35 and 49; 30.6% between 50 and 64; 39.1% between 65 and 79; and 15.6% were 80+ years of age.

Mortality for the Period of 2004-2008

For the period of 2004-2008, a total of 24,484 deaths due to cancer were registered; 13,815 were males and 10,669 were females (Table 2). On average for the period of 2004-2008, approximately, 2,763 deaths due to cancer in males and 2,134 deaths due to cancer in females occurred each year annually. Mortality rates for males decreased from 170.1 per 100,000 in 1987 to 144.5 per 100,000 in 2008, while female's mortality rates decreased from 103.1 per 100,000 in 1987 to 85.9 per 100,000 for 2008. The mortality rates among males, decreased by an average of 1.1% each year; also in females the rates decreased by an average of 1.0% annually. These decreases were statistically significant ($p<0.05$).

For 2004-2008, the median age at death for cancer for all sites was 72 years. Approximately, 0.4% were diagnosed under age 20; 1.4% between 20 and 34; 6.3% between 35 and 49; 23.0% between 50 and 64; 38.2% between 65 and 79; and 30.6% were 80+ years of age.

FIGURE 3: INCIDENCE AGE DISTRIBUTION FOR ALL SITES CANCER, PUERTO RICO 2005-2009

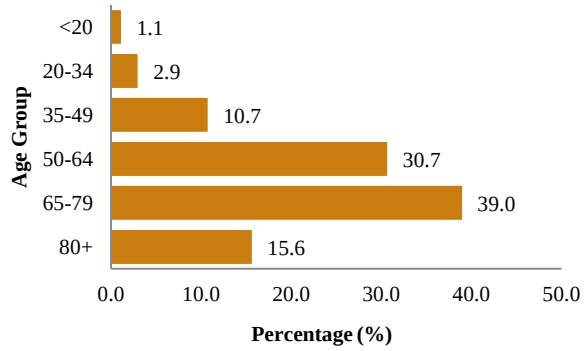


FIGURE 4: MORTALITY AGE DISTRIBUTION FOR ALL SITES CANCER, PUERTO RICO 2004-2008

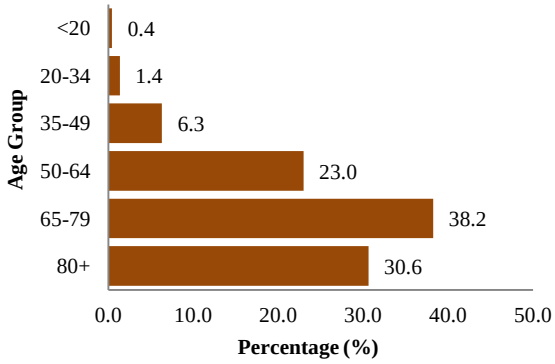


FIGURE 5: AGE-ADJUSTED ALL SITES CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

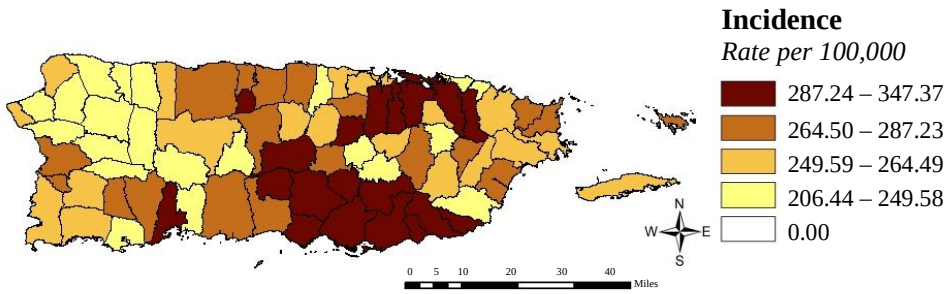
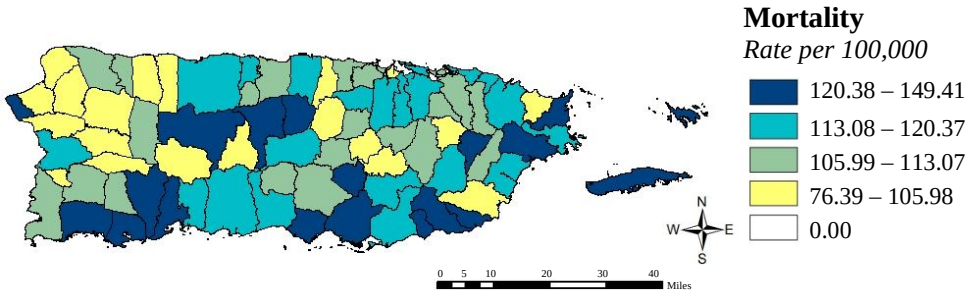


FIGURE 6: AGE-ADJUSTED ALL SITES CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Age and Sex (based on incidence data 2005-2009 and mortality data on 2004-2008)

The incidence and mortality of invasive cancer varies with age, sex and the type of tumor. About 54.7% of all new cases and the 68.9% of all death by cancer in Puerto Rico occur after the age of 65 years. Following is a description of the burden and types of cancers most often diagnosed and the principal cause of cancer deaths among males and females in various age groups.

FIGURE 7: THE MOST FREQUENT INCIDENT CANCERS BY AGE AND SEX, 2005-2009

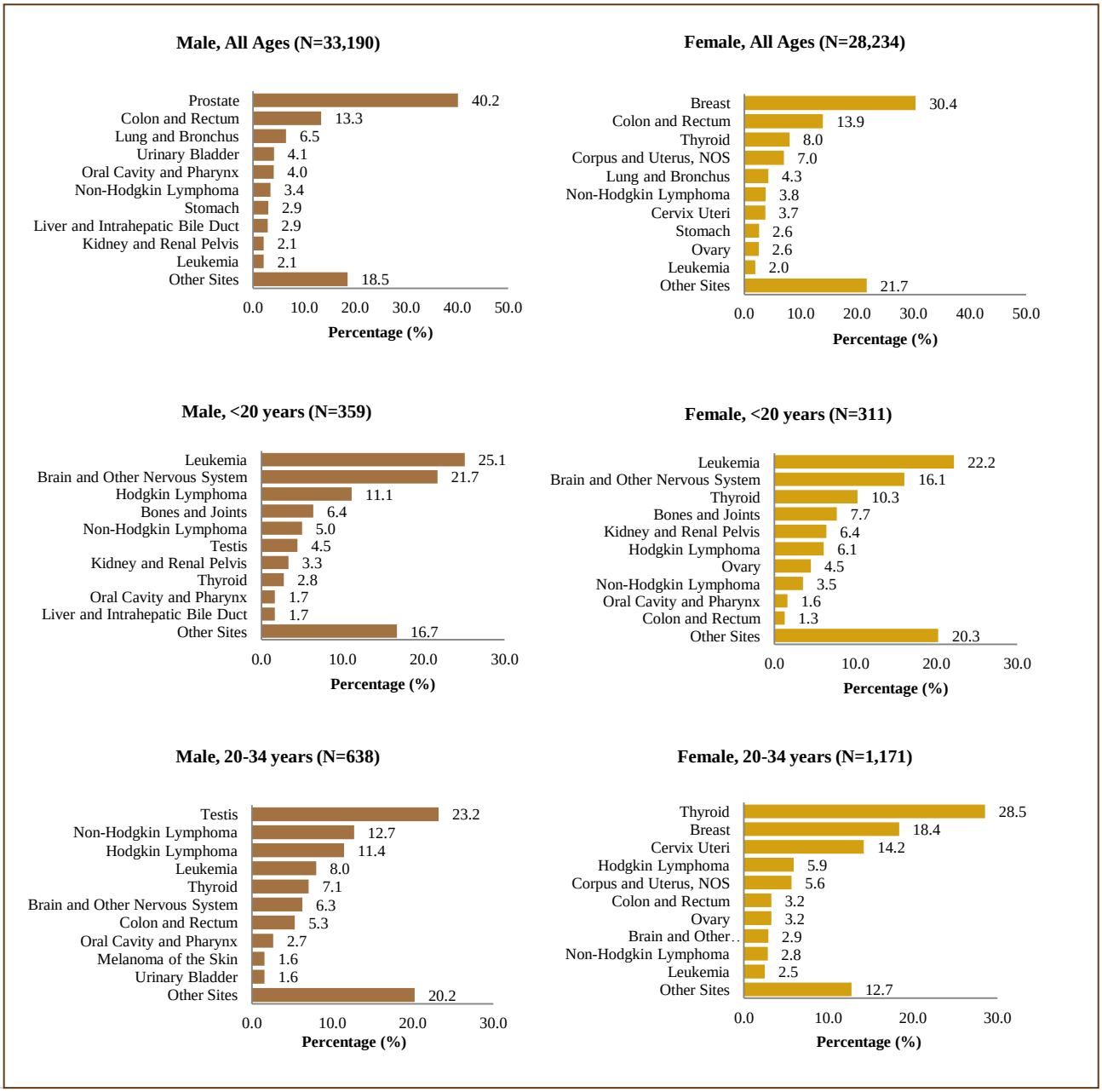


FIGURE 7: THE MOST FREQUENT INCIDENT CANCERS BY AGE AND SEX, 2005-2009, (CONTINUED)

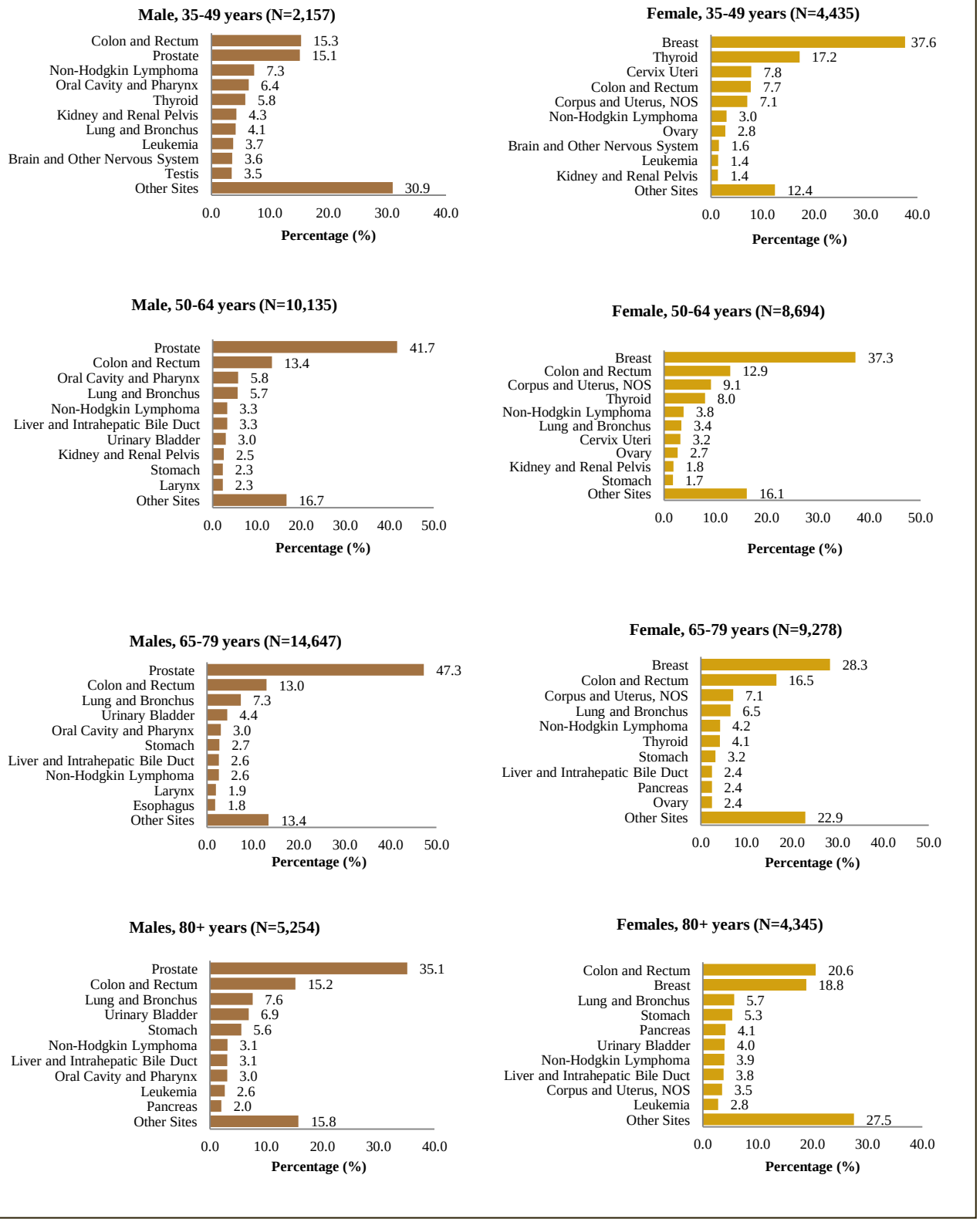


FIGURE 8: MOST FREQUENT CAUSES OF DEATH DUE TO CANCER BY AGE AND SEX, 2004-2008

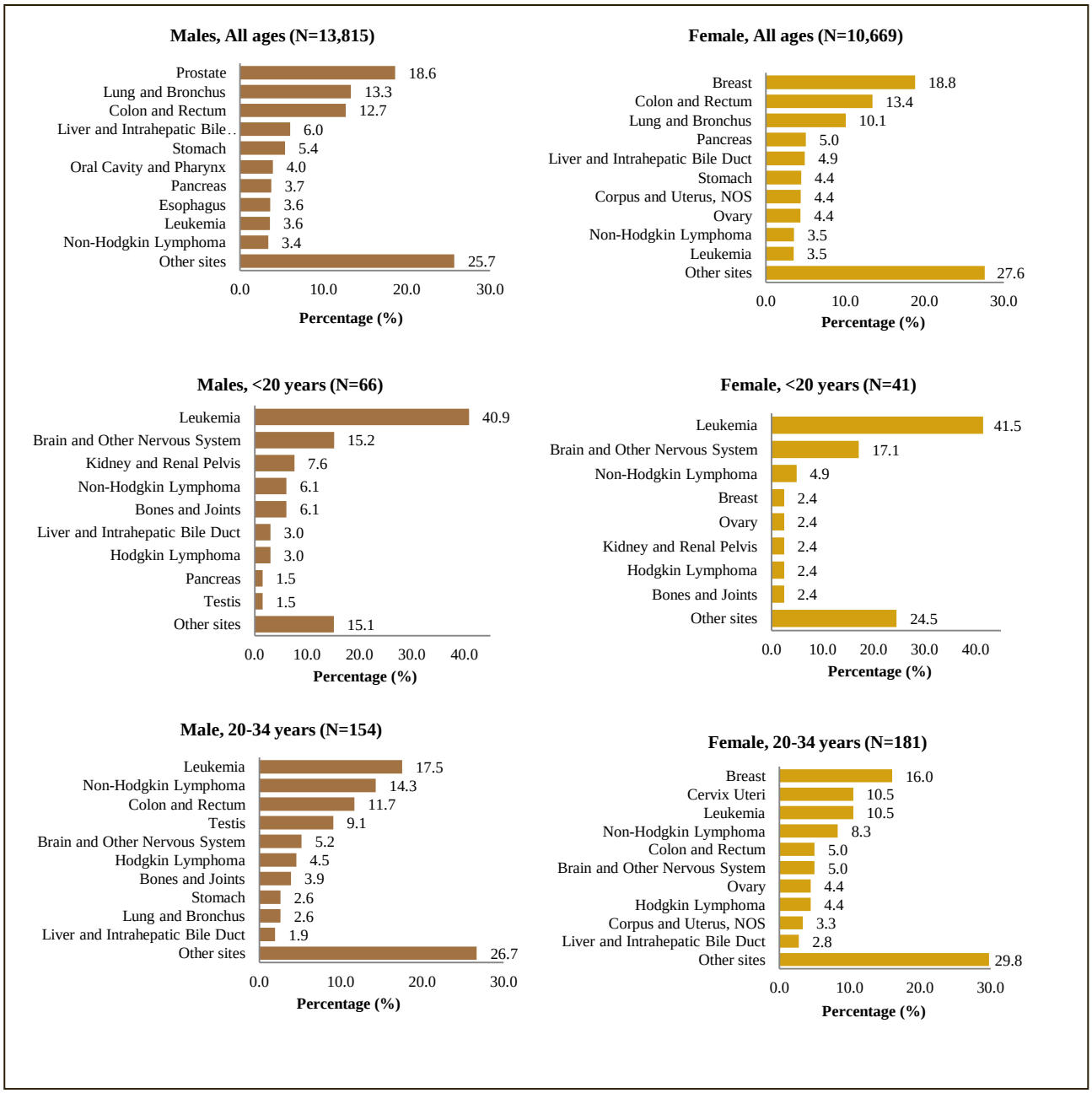
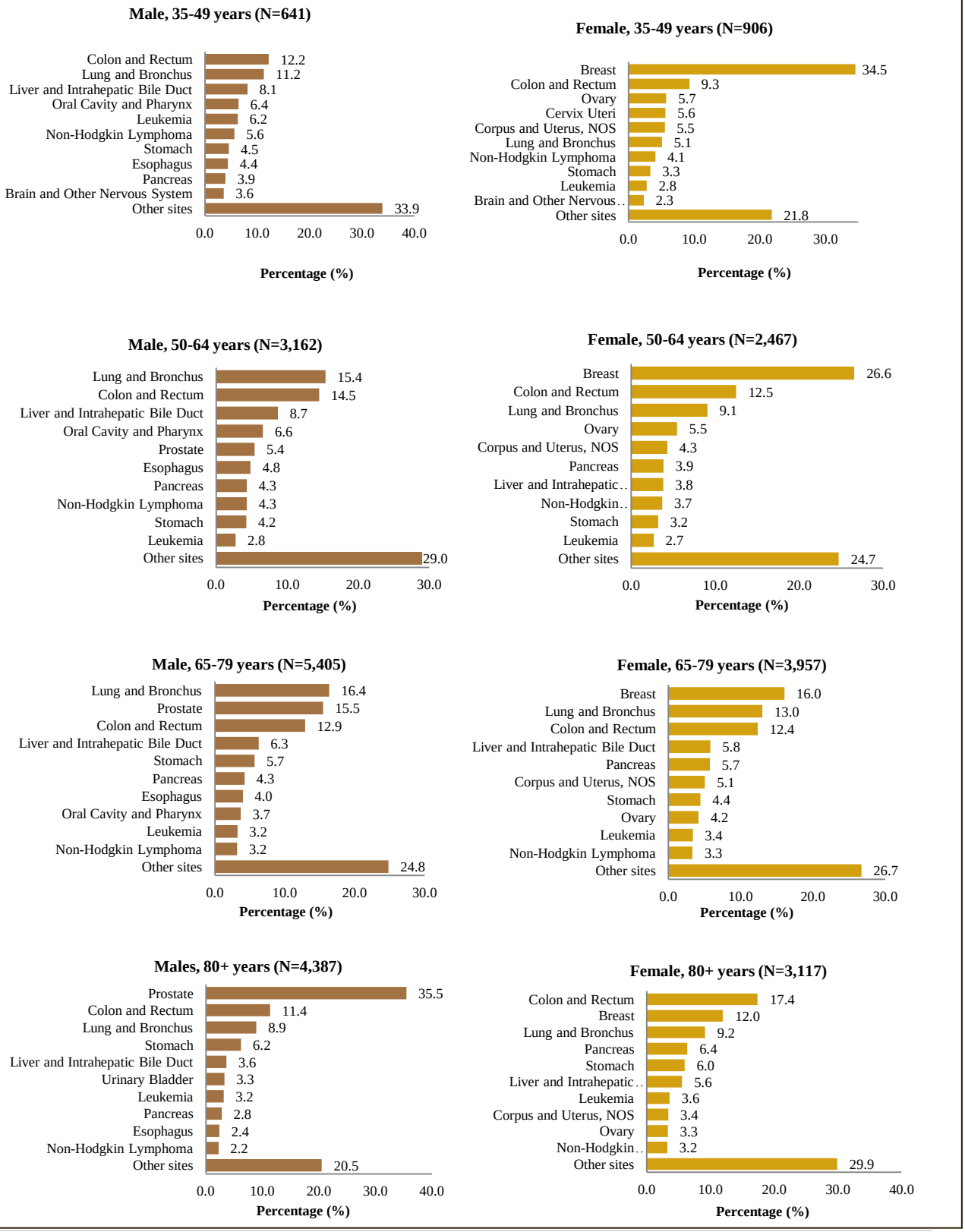


FIGURE 8: MOST FREQUENT CAUSES OF DEATH DUE TO CANCER BY AGE AND SEX, 2004-2008 (CONTINUED)



Cancer of the Oral Cavity and Pharynx

Oral cavity and pharynx cancer was one of the most commonly diagnosed cancers among males; during the period of 2005-2009, it ranks fifth after prostate, colorectal, lung and bronchus, and urinary bladder cancers. For the period of 2004-2008, oral cavity and pharynx cancer ranked in the sixth position resulting in one of the leading causes of death in males. Oral cavity and pharynx cancers are the cancers that occur in the mouth and the pharynx, a hollow tube about 5 inches long that starts behind the nose and leads to the esophagus and the trachea. The oral cavity and pharynx consists of many parts: lips, lining of cheeks, salivary glands, roof of mouth (hard palate), back of mouth (soft palate and uvula), floor of mouth (area under the tongue), gums and teeth, tongue, tonsils and pharynx; it has three parts: nasopharynx, oropharynx and hypopharynx. The following are known risk factors for oral cancer: smoking cigarettes, cigars, or pipes; using or chewing tobacco and dipping snuff; drink alcohol; human papillomavirus (HPV) infection; exposure to the sun, and a personal history of head and neck cancer (17).

For the period of 2005-2009, the median age at diagnosis for cancer of the oral cavity and pharynx was 63 years. The incidence rate among males decreased by an average of 3.2% ($p<0.05$) each year, while in females it decreased by an average of 2.4% ($p<0.05$) annually from 1987-2009 (Figure 9).

Key Points

- **Oral cavity and pharynx cancer accounted for 4.0% of all male cancers and 1.5% of all female cancers between 2005-2009.**
- **It was also accountable for 4.0% of all male cancer deaths and 1.1% of female cancer deaths between 2004-2008.**
- **An average of approximately 271 males and 84 females were diagnosed with oral cavity and pharynx cancer each year between the period of 2005-2009.**
- **Approximately 109 males and 24 females die from oral cavity and pharynx cancer each year during the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 13.7 per 100,000 males per year and 3.5 per 100,000 females per year.**
- **Cancer incidence for oral cavity and pharynx cancer was 4.3 times (Confidence Interval (CI) 95%: 4.0, 4.5) higher among males than among females, during 2005-2009.**
- **Between 2004-2008, the age-adjusted mortality rate was 5.7 per 100,000 males per year and 1.0 per 100,000 females per year.**
- **The mortality due to cancer was 6.0 times (CI 95%: 4.9, 7.3) higher among males than among females, during 2004-2008.**

For the period of 2004-2008, the median age at death for oral cavity and pharynx cancer was 67 years. Cancer mortality rate in males decreased by an average of 3.9% ($p<0.05$) each year, while in females it decreased by an average of 4.4% ($p<0.05$) annually from 1987-2008 (Figure 10).

FIGURE 9: AGE-ADJUSTED INCIDENCE RATES FOR ORAL CAVITY AND PHARYNX CANCER BY SEX, PUERTO RICO 1987-2009

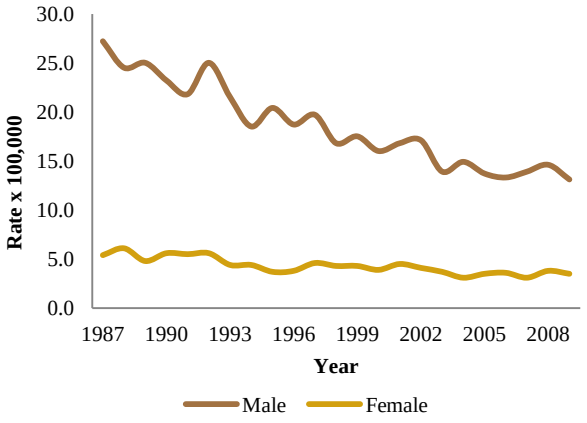


FIGURE 10: AGE-ADJUSTED MORTALITY RATES FOR ORAL CAVITY AND PHARYNX CANCER BY SEX, PUERTO RICO 1987-2008

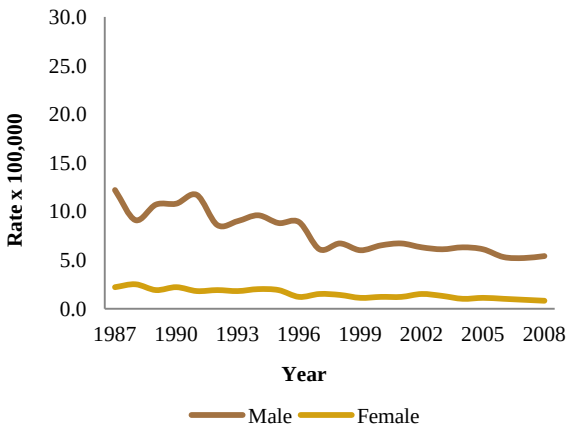


FIGURE 11: INCIDENCE AGE DISTRIBUTION FOR ORAL CAVITY AND PHARYNX CANCER, PUERTO RICO 2005-2009

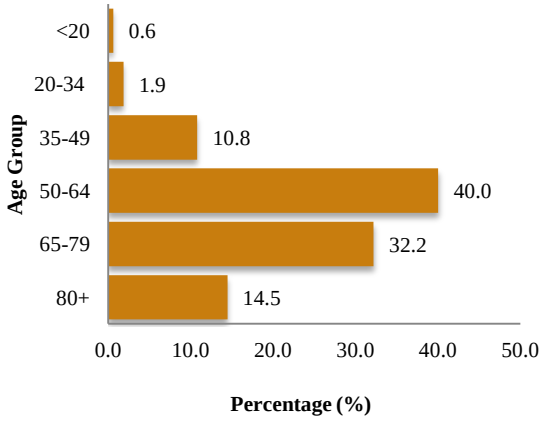


FIGURE 12: MORTALITY AGE DISTRIBUTION FOR ORAL CAVITY AND PHARYNX CANCER, PUERTO RICO 2004-2008

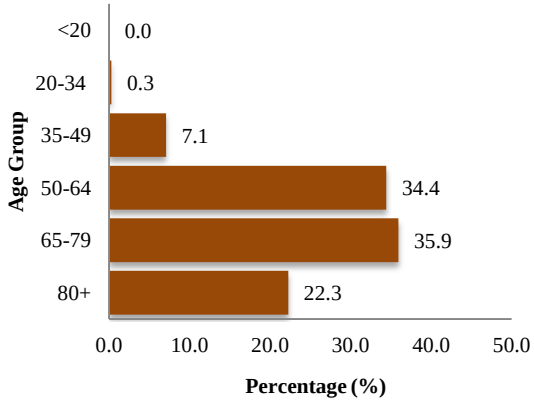


FIGURE 13: AGE-ADJUSTED ORAL CAVITY AND PHARYNX CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

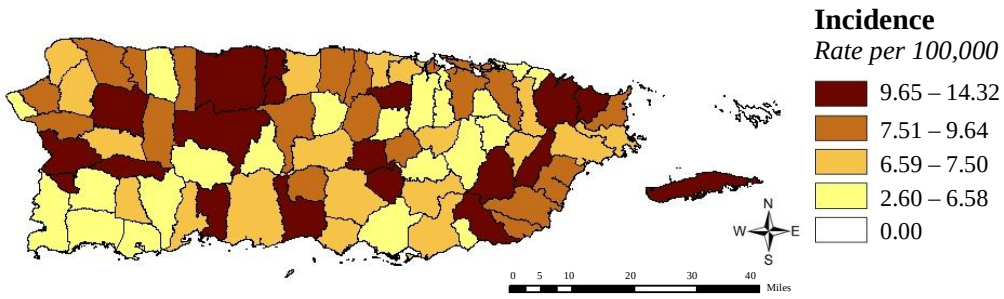
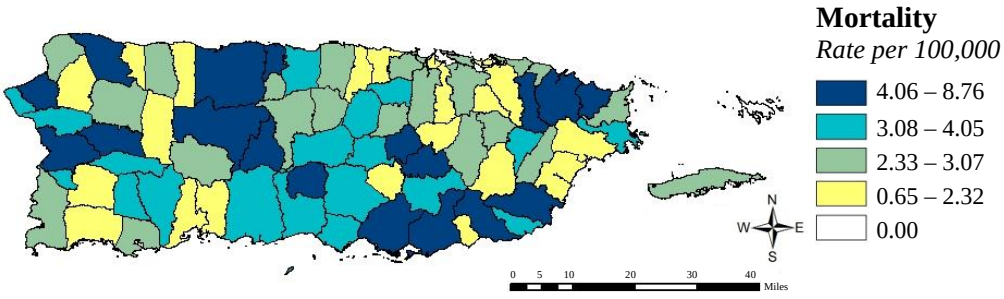


FIGURE 14: AGE-ADJUSTED ORAL CAVITY AND PHARYNX CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Colon and Rectum

Colorectal cancer was the second most commonly diagnosed cancer among males and females in Puerto Rico during the period of 2005-2009. Also it was one the leading causes of cancer deaths ranking third among males and second among females during the period of 2004-2008. Up to date, the exact causes of colorectal cancer are not known. Nevertheless, studies have demonstrated that some risk factors increase the chance of developing colorectal cancer. Some of the risk factors for colorectal cancer are: personal or familiar history of polyps, ulcerative colitis and Crohn's disease, a diet high in fat and calories and low in fruits and vegetables, cigarette smoking, and physical inactivity (17).

For 2005-2009, the median age at diagnosis for cancer of the colon and rectum was 68 years. The incidence rate among males increased by an average of 1.8% ($p<0.05$) each year, while in females it increased by an average of 1.5% ($p<0.05$) annually during 1987-2009 (Figure 15).

For 2004-2008, the median age at death for colon and rectum cancer was 73 years. Cancer mortality rate in males increased by an average of 1.7% ($p<0.05$) each year, while in females it increased by an average of 0.2% ($p>0.05$) annually during 1987-2008 (Figure 16).

Key Points

- **Colorectal cancer accounted for 13.2% of all male cancers and 13.9% of all female cancers between 2005-2009.**
- **It was also accountable for 12.7% of all male cancer deaths and 13.4% of female cancer deaths between 2004-2008.**
- **An average of, approximately 892 males and 789 females were diagnosed with colorectal cancer between 2005-2009.**
- **Approximately 350 males and 287 females die from colorectal cancer each year for the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 45.4 per 100,000 males per year and 32.1 per 100,000 females per year.**
- **Colorectal cancer incidence was 1.4 times (Confidence Interval (CI) 95%: 1.3, 1.5) higher among men than among women, during 2005-2009.**
- **Between 2004-2008, the age-adjusted mortality rate was 18.4 per 100,000 males per year and 11.6 per 100,000 females per year.**
- **Colorectal cancer mortality was 1.6 times (CI 95%: 1.5, 1.7) higher among males than among females, during 2004-2008.**

FIGURE 15: AGE-ADJUSTED INCIDENCE RATES FOR COLON AND RECTUM CANCER BY SEX, PUERTO RICO 1987-2009

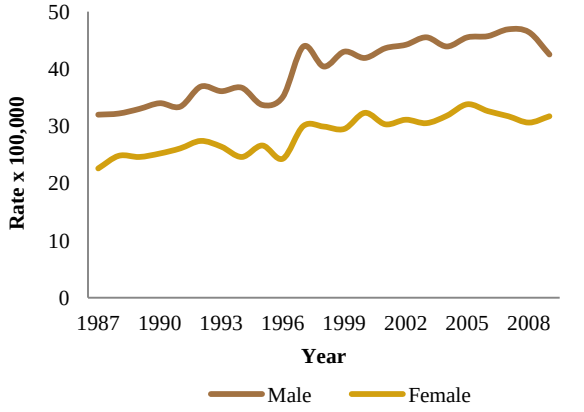


FIGURE 16: AGE-ADJUSTED MORTALITY RATES FOR COLON AND RECTUM CANCER BY SEX, PUERTO RICO 1987-2008

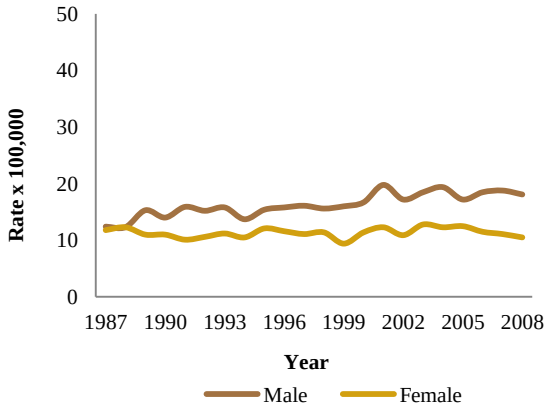


FIGURE 17: INCIDENCE AGE DISTRIBUTION FOR COLON AND RECTUM CANCER, PUERTO RICO 2005-2009

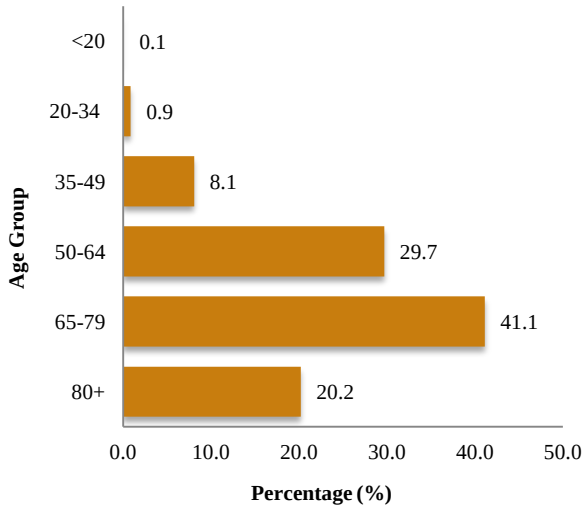


FIGURE 18: MORTALITY AGE DISTRIBUTION FOR COLON AND RECTUM CANCER, PUERTO RICO 2004-2008

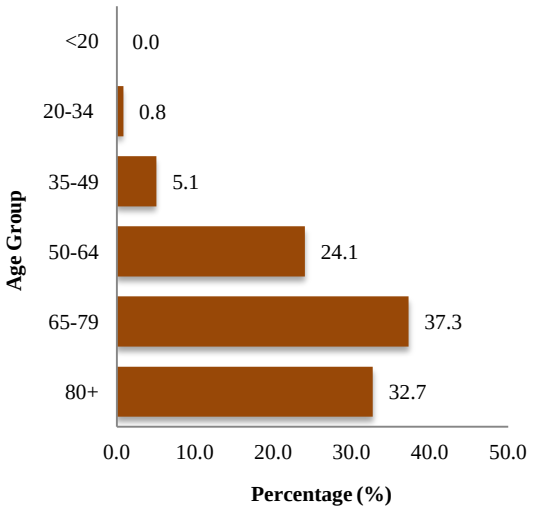


FIGURE 19: AGE-ADJUSTED COLON AND RECTUM CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

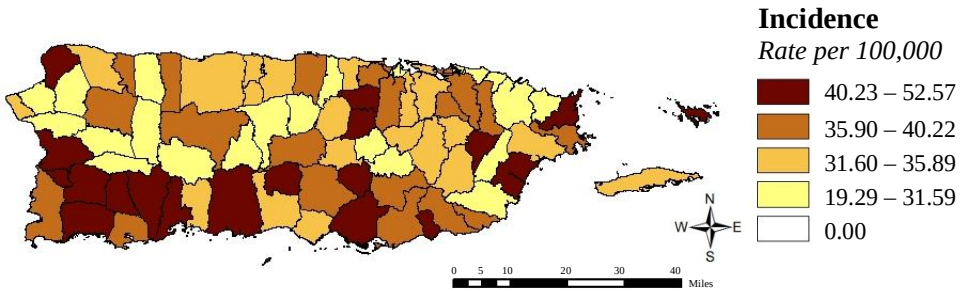
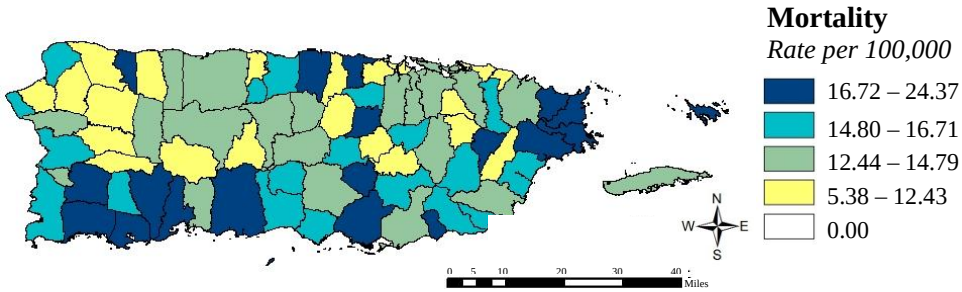


FIGURE 20: AGE-ADJUSTED COLON AND RECTUM CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Liver and Intrahepatic Bile Duct

Liver and intrahepatic bile duct cancer was the eighth and thirteenth most commonly diagnosed cancer among males and females respectively, in Puerto Rico during 2005-2009. Liver and intrahepatic bile duct cancer was also one of the leading causes of cancer deaths in Puerto Rico. During 2004-2008, 166 men and 104 women die from this type of cancer. People with certain risk factors may be more likely than others to develop liver cancer. Studies have found the following risk factors for liver cancer: infection with hepatitis B virus (HBV) or hepatitis C virus (HCV); heavy alcohol use; aflatoxin (a harmful substance made by certain types of mold); iron storage disease; cirrhosis; obesity and diabetes. There are two main types of primary liver cancer: hepatocellular carcinoma and cholangio-carcinoma; but hepatocellular carcinoma is the most common (17).

For 2005-2009, the median age at diagnosis for cancer of the liver and intrahepatic bile duct was 69 years. The incidence rate among males increased by an average of 2.0% ($p<0.05$) each year, while in females it increased by an average of 1.4% ($p<0.05$) annually from 1987-2009 (Figure 21).

Key Points

- **Liver and intrahepatic bile duct cancer accounts for 2.8% of all male cancers and 1.8% of all female cancers between 2005-2009.**
- **It accounts for 6.0% of all male cancer deaths and 4.9% of female cancer deaths between 2004-2008.**
- **An average of, approximately 190 males and 100 females were diagnosed with liver and intrahepatic bile duct cancer between 2005-2009.**
- **Approximately 166 males and 104 females die from liver and intrahepatic bile duct cancer each year during the period of 2004-2009.**
- **Between 2005-2009, the age-adjusted incidence rate was 9.7 per 100,000 males per year and 4.0 per 100,000 females per year.**
- **Liver and intrahepatic bile duct cancer incidence was 2.4 times (Confidence Interval (CI) 95%: 2.3, 2.5) higher among men than among women, during 2005-2009.**
- **Between 2004-2008, the age-adjusted mortality rate was 8.6 per 100,000 males per year and x4.2 per 100,000 females per year.**
- **Liver and intrahepatic bile duct cancer mortality was 2.1 times (CI 95%: 1.8, 2.3) higher among males than among females.**

For 2004-2008, the median age at death for liver and intrahepatic bile duct cancer was 71 years. The cancer mortality rate in males decreased by an average of 0.6% ($p<0.05$) each year, while in females it decreased by an average of 1.8% ($p<0.05$) annually from 1987-2008 (Figure 22).

FIGURE 21: AGE-ADJUSTED INCIDENCE RATES FOR LIVER AND INTRAHEPATIC BILE DUCT CANCER BY SEX, PUERTO RICO 1987-2009

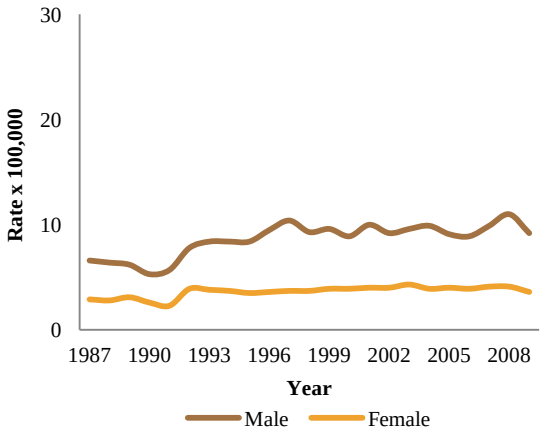


FIGURE 22: AGE-ADJUSTED MORTALITY RATES FOR LIVER AND INTRAHEPATIC BILE DUCT CANCER BY SEX, PUERTO RICO 1987-2008

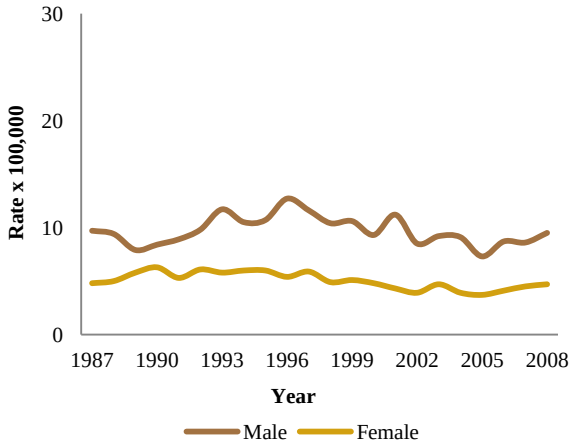


FIGURE 23: INCIDENCE AGE DISTRIBUTION FOR LIVER AND INTRAHEPATIC BILE DUCT CANCER, PUERTO RICO 2005-2009

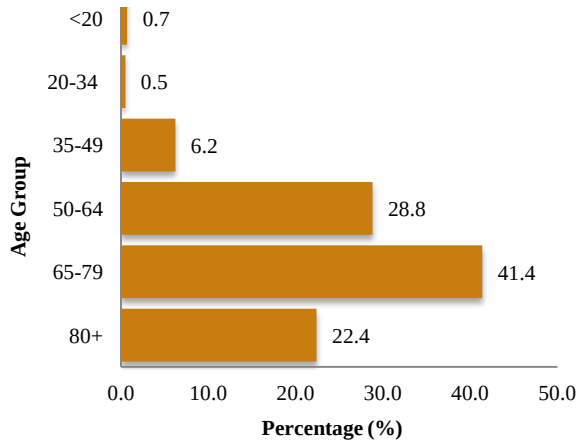


FIGURE 24: MORTALITY AGE DISTRIBUTION FOR LIVER AND INTRAHEPATIC BILE DUCT CANCER, PUERTO RICO 2004-2008

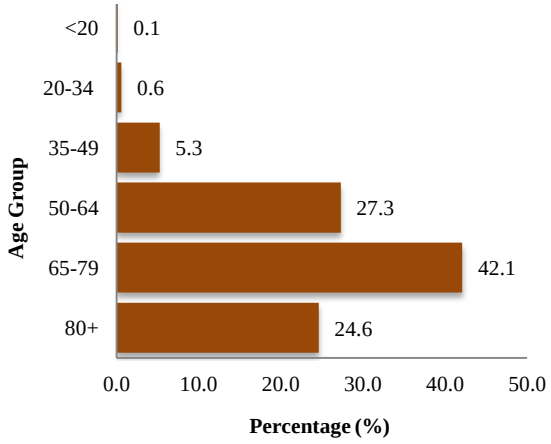


FIGURE 25: AGE-ADJUSTED LIVER AND INTRAHEPATIC BILE CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

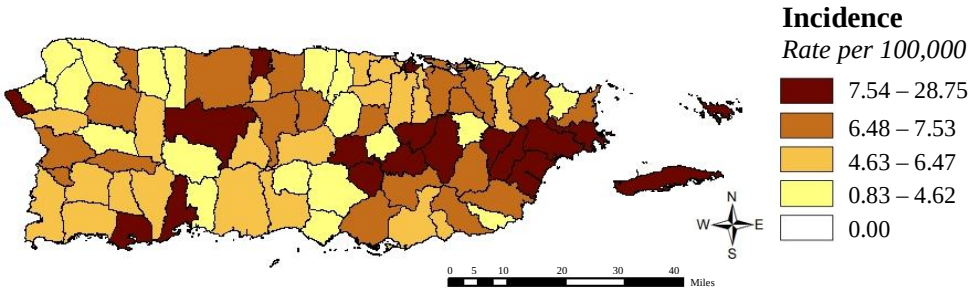
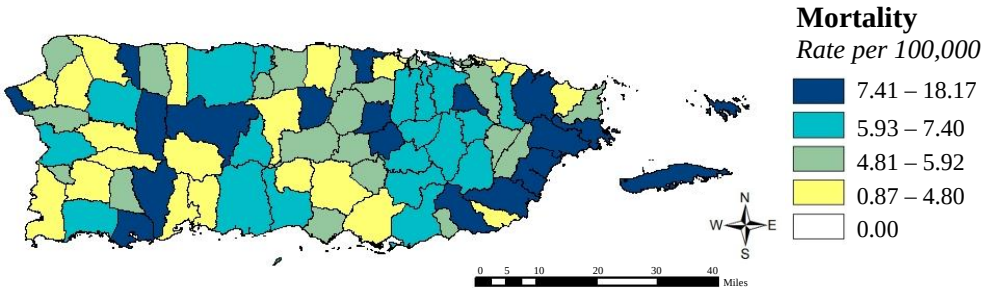


FIGURE 26: AGE-ADJUSTED LIVER AND INTRAHEPATIC BILE CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Lung and Bronchus

For the period of 2005-2009, among both males and females, lung and bronchus cancer was the second leading cause of cancer death in Puerto Rico. Lung and bronchus cancer was the third and fifth most commonly diagnosed cancer among males and females respectively, in Puerto Rico. Cigarette smoking is the major cause of lung and bronchus cancer. The likelihood that a smoker will develop lung cancer is affected by the age at which smoking began, how long the person has smoked, the number of cigarettes smoked per day, and how deeply the smoker inhales. Stopping smoking greatly reduces a person's risk for developing lung cancer. Additional risk for lung and bronchus cancer includes smoking cigars and pipes; environmental tobacco smoke (second hand smoke); exposure to radon gas, asbestos, and pollution; lung diseases such as tuberculosis, and having a personal history of lung cancer (17).

For 2005-2009, the median age at diagnosis for cancer of the lung and bronchus was 71 years. Between 1987-2009, the incidence rate among males decreased by an average of 1.3% ($p<0.05$) each year, while in females remained constant for that period (0.0%) (Figure 27).

For 2004-2008, the median age at death for lung and bronchus cancer was 72 years. Cancer mortality rate in males decreased by an average of 1.7% ($p<0.05$) each year, while in females it decreased by an average of 0.9% ($p<0.05$) annually, from 1987-2008 (Figure 28).

Key Points

- **Lung and bronchus cancer accounted for 6.4% of all male cancers and 4.3% of all female cancers between 2005-2009.**
- **It accounts for 13.3% of all male cancer deaths and 10.1% of female cancer deaths between 2004-2008.**
- **An average of approximately 430 males and 243 females were diagnosed with lung and bronchus cancer between 2005-2009.**
- **Approximately 368 males and 215 females die from lung and bronchus cancer each year, during the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 21.8 per 100,000 males per year and 9.8 per 100,000 females per year.**
- **Lung and bronchus cancer incidence was 2.5 times (Confidence Interval (CI) 95%: 2.4, 2.6) higher among men than among women, during 2005-2009.**
- **Between 2004-2008, the age-adjusted mortality rate was 19.1 per 100,000 males per year and 8.7 per 100,000 females per year.**
- **Lung and bronchus cancer mortality was 2.2 times (CI 95%: 2.0, 2.4) higher among males than among females, during 2004-2008.**

FIGURE 27: AGE-ADJUSTED INCIDENCE RATES FOR LUNG AND BRONCHUS CANCER BY SEX, PUERTO RICO 1987-2009

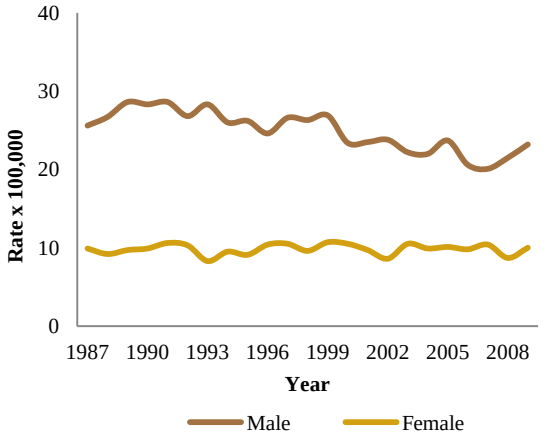


FIGURE 28: AGE-ADJUSTED MORTALITY RATES FOR LUNG AND BRONCHUS CANCER BY SEX, PUERTO RICO 1987-2008

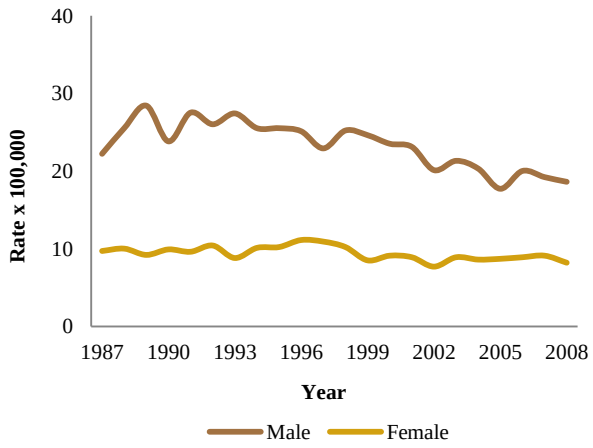


FIGURE 29: INCIDENCE AGE DISTRIBUTION FOR LUNG AND BRONCHUS CANCER, PUERTO RICO 2005-2009

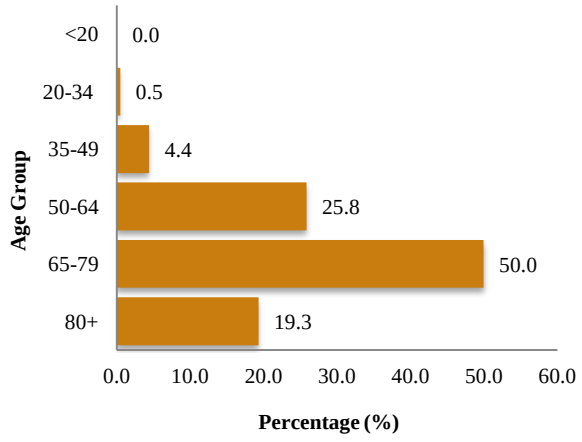


FIGURE 30: MORTALITY AGE DISTRIBUTION FOR LUNG AND BRONCHUS CANCER, PUERTO RICO 2004-2008

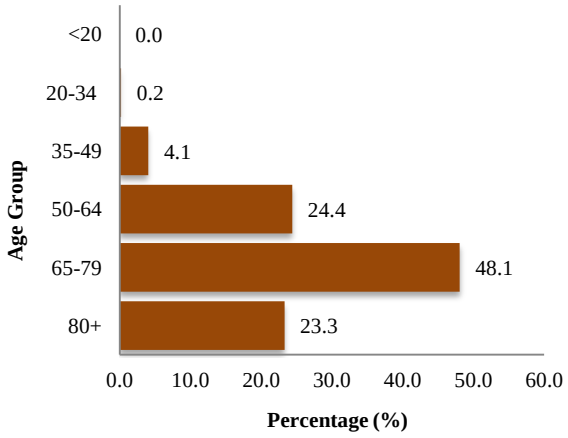


FIGURE 31: AGE-ADJUSTED LUNG AND BRONCHUS CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

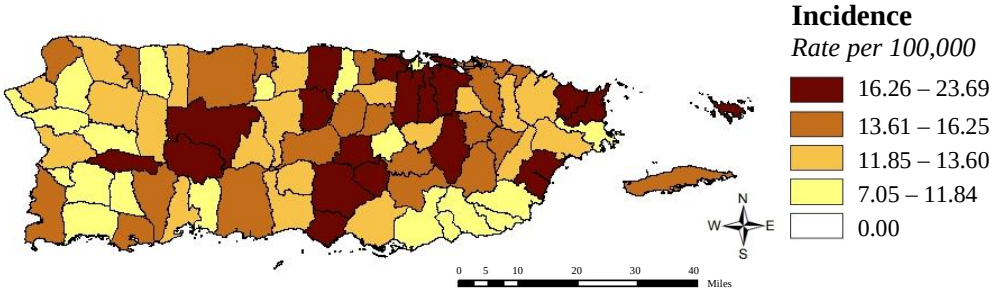
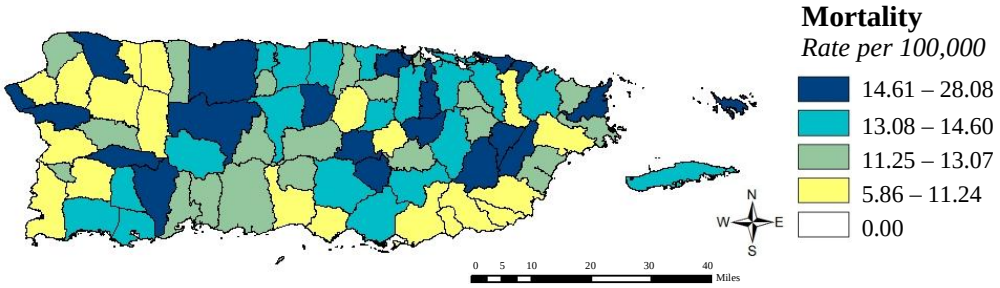


FIGURE 32: AGE-ADJUSTED LUNG AND BRONCHUS CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Thyroid

Thyroid gland is an organ at the base of the throat that makes hormones that help control heart rate, blood pressure, body temperature, and weight. In Puerto Rico, for the period of 2005-2009, thyroid cancer was the fifteenth and third most commonly diagnosed cancer among males and females, respectively. In mortality, for the period of 2004-2008, thyroid ranked above the twentieth position for both males and females.

Studies have found the following risk factors for thyroid cancer: radiation, family history of medullary thyroid cancer, family history of goiters or colon growths, personal history, having a goiter or benign thyroid nodules, being female and age over 45. Also scientists are studying exposure to iodine as a possible risk factor for thyroid cancer (17).

For 2005-2009, the median age at diagnosis for cancer of the thyroid was 50 years. The incidence rate among males increased by an average of 8.9% ($p<0.05$) each year, while in females it increased by an average of 10.8% ($p<0.05$) annually for the period of 1987-2009 (Figure 33).

Key Points

- **Thyroid cancer accounts for 1.4% of all male cancers and 8.0% of all female cancers between 2005-2009.**
- **It accounts for 0.1% of all male cancer deaths and 0.3% of female cancer deaths between 2004-2008.**
- **An average of approximately 92 males and 455 females were diagnosed with thyroid cancer between 2005-2009.**
- **Between 2005-2009, the age-adjusted incidence rate was 4.8 per 100,000 males per year and 21.1 per 100,000 females per year.**
- **Thyroid cancer incidence was 3.9 times (Confidence Interval (CI) 95%: 3.6, 4.1) higher among women than among men, during 2005-2009.**
- **Approximately four males and seven females die from thyroid cancer each year for the period of 2004-2008.**
- **Between 2004-2008, the age-adjusted mortality rate was 0.2 per 100,000 males per year and 0.3 per 100,000 females per year.**
- **Thyroid cancer mortality was 1.4 times (CI 95%: 0.8, 2.6) higher among females than among males, during 2004-2008.**

For 2004-2008, the median age at death for thyroid cancer was 74 years. Cancer mortality rate in males decreased by an average of 4.2% ($p<0.05$) each year, while in females it decreased by an average of 1.1 % ($p<0.05$) annually during the period of 1987-2008 (Figure 34).

FIGURE 33: AGE-ADJUSTED INCIDENCE RATES FOR THYROID CANCER BY SEX, PUERTO RICO 1987-2009

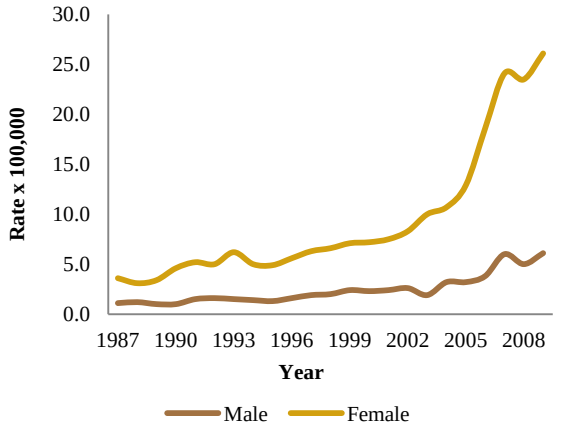


FIGURE 34: AGE-ADJUSTED MORTALITY RATES FOR THYROID CANCER BY SEX, PUERTO RICO 1987-2008

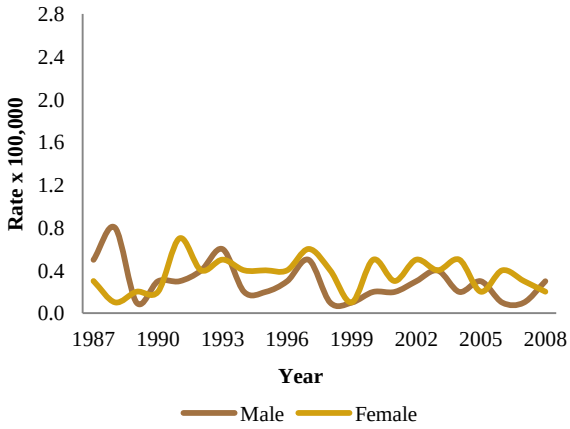


FIGURE 35: INCIDENCE AGE DISTRIBUTION FOR THYROID CANCER, PUERTO RICO 2005-2009

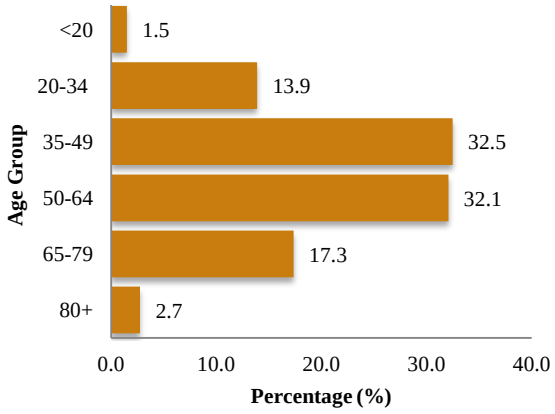


FIGURE 36: MORTALITY AGE DISTRITUTION FOR THYROID CANCER, PUERTO RICO 2004-2008

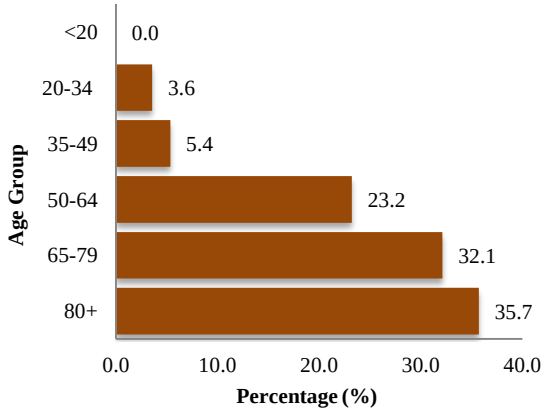
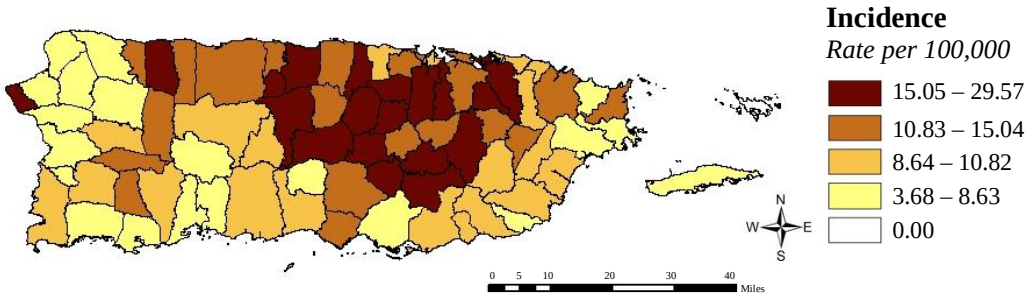


FIGURE 37: AGE-ADJUSTED THYROID CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009



Note: Detailed municipality specific rates cannot be calculated for mortality because of the small number of cases in several municipalities.

Cancer of the Prostate

During the period of 2005-2009, prostate cancer was the most commonly diagnosed cancer among males in Puerto Rico, accounting for around 40.2% of all cancer diagnosed in males. Also for the period of 2004-2008, prostate cancer was the leading cause of death by cancer in males. Prostate cancer usually occurs in older males. Research has shown that males with certain risk factors are more likely than others to develop prostate cancer. Studies have found the following risk factors: age (> 45 years), having a family history of prostate cancer, males with cells called high-grade prostatic intraepithelial neoplasia (PIN) may be at increased risk for prostate cancer, and a diet high in animal fat or meat (17).

For 2005-2009, the median age at diagnosis for cancer of the prostate was 68 years. The prostate cancer incidence rate in Puerto Rico increased by an average of 1.5% ($p<0.05$) each year for the period of 1987-2009 (Figure 38).

Key Points

- **Prostate cancer is the most commonly diagnosed cancer among males in Puerto Rico.**
- **It accounts for 41.0% of all male cancers between 2005-2009 and 18.6% of all male cancer deaths between 2004-2008.**
- **An average of approximately 2,777 males were diagnosed with invasive prostate cancer between 2005-2009.**
- **Between 2005-2009, the age-adjusted incidence rate was 138.8 per 100,000 males per year.**
- **Approximately, for the period of 2004-2008, 514 males died from prostate cancer each year between the period of 2004-2008.**
- **Between 2004-2008, the age-adjusted death rate was 28.3 per 100,000 males per year.**

On the other hand, for 2004-2008 the median age at death for prostate cancer was 82 years. For the period of 1987-2008, the mortality rates decreased by an average of 0.7% ($p<0.05$) each year (Figure 39).

FIGURE 38: AGE-ADJUSTED INCIDENCE RATES FOR PROSTATE CANCER, PUERTO RICO 1987-2009

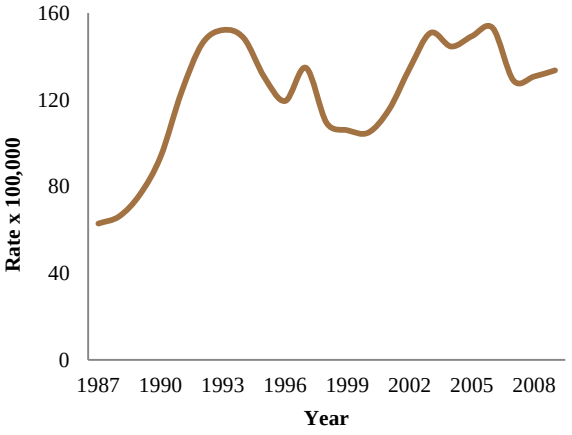


FIGURE 39: AGE-ADJUSTED MORTALITY RATES FOR PROSTATE CANCER, PUERTO RICO 1987-2008

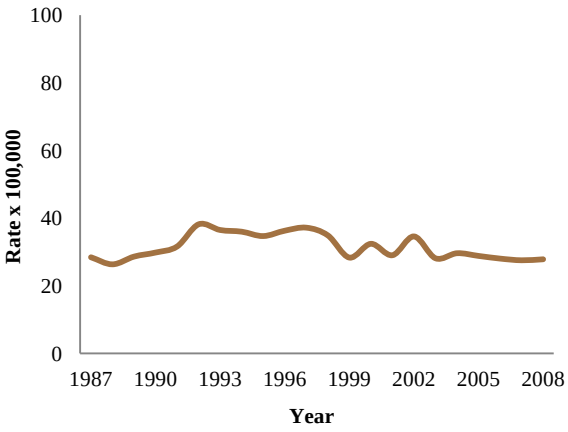


FIGURE 40: INCIDENCE AGE DISTRIBUTION FOR PROSTATE CANCER, PUERTO RICO 2005-2009

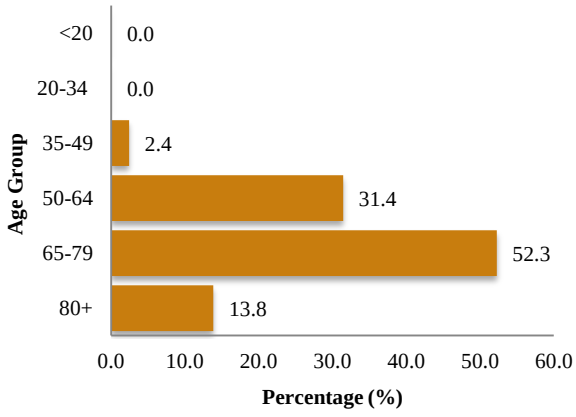


FIGURE 41: MORTALITY AGE DISTRIBUTION FOR PROSTATE CANCER, PUERTO RICO 2004-2008

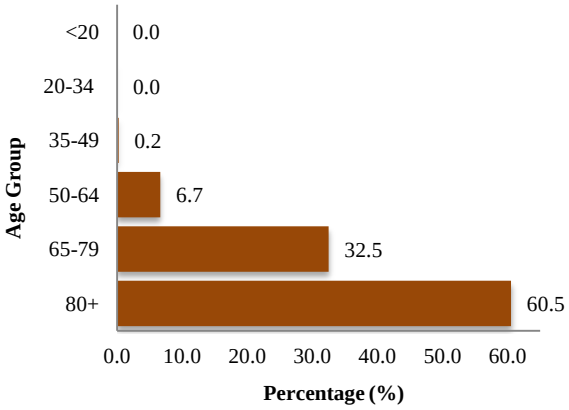


FIGURE 42: AGE-ADJUSTED PROSTATE CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

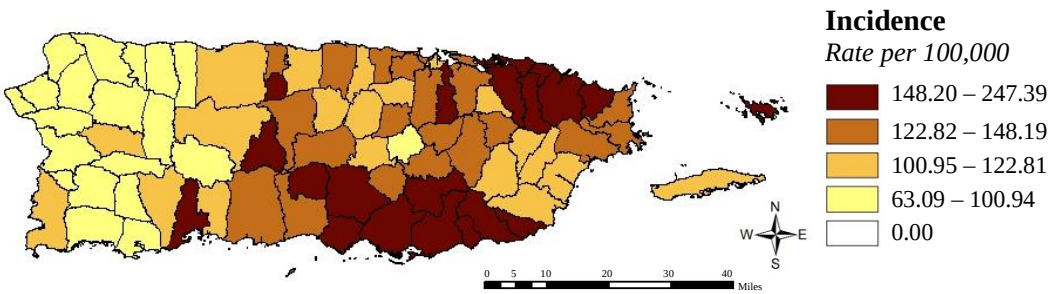
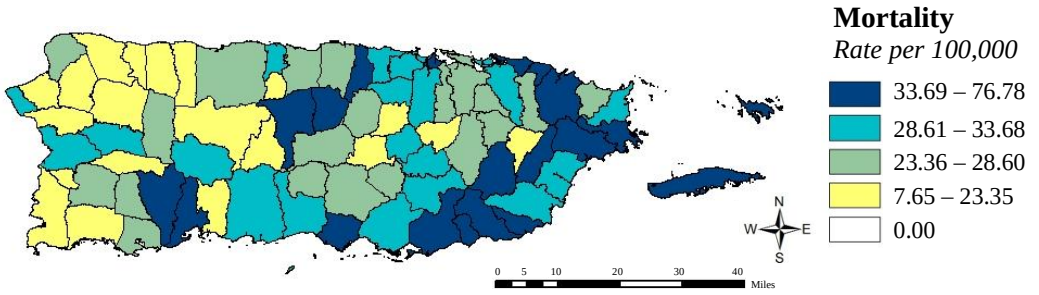


FIGURE 43: AGE-ADJUSTED PROSTATE CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Breast

Breast cancer was the most commonly diagnosed cancer and the leading cause of cancer death among females in Puerto Rico (for the period of years that goes from 2004-2009). Many factors have been associated with the risk of developing breast cancer. Both genetic and environmental factors are believed to play a role in the development of breast cancer. Breast cancer is a disease predominantly influenced by risk factors related to lifestyle, approximately only 15% of all breast cancer cases can be attributed to familial and genetic influences. Most of these factors can be linked to hazardous effects of hormonal exposures (17).

For 2005-2009, the median age at diagnosis for cancer of breast was 61 years. For 2004-2008, the median age at death for breast cancer was 65 years. The breast cancer incidence rate among females in Puerto Rico increased by an average of 1.3% ($p<0.05$) each year during 1987-2009 (Figure 44), while the mortality rates decreased by an average of 0.1% ($p<0.05$) during 1987-2008 (Figure 45).

Key Points

- **Breast cancer was the most commonly diagnosed cancer among females in Puerto Rico.**
- **It accounts for 30.3% of all female cancers between 2005-2009 and 18.8% of all female cancer deaths between 2004-2008.**
- **An average of approximately 1,725 females were diagnosed with invasive breast cancer between 2005-2009.**
- **Between the years of 2005-2009, the age-adjusted incidence rate was 73.4 per 100,000 females per year.**
- **Approximately 401 females die from breast cancer each year between the periods of 2004-2008.**
- **Between 2004-2008, the age-adjusted death rate was 16.9 per 100,000 females per year.**

TABLE 3: AGE-ADJUSTED INCIDENCE RATES FOR IN SITU FEMALE BREAST CANCER, PUERTO RICO 2005-2009

Age Group	2005-2009		2009	
	Rate	Count	Rate	Count
All	14.5	1,699	15.3	363
<40	1.3	75	2.1	23
40-59	30.0	785	30.9	162
60-79	47.2	755	47.5	160
80+	23.0	84	22.8	18

FIGURE 44: AGE-ADJUSTED INCIDENCE RATES FOR INVASIVE BREAST CANCER IN FEMALES, PUERTO RICO 1987-2009

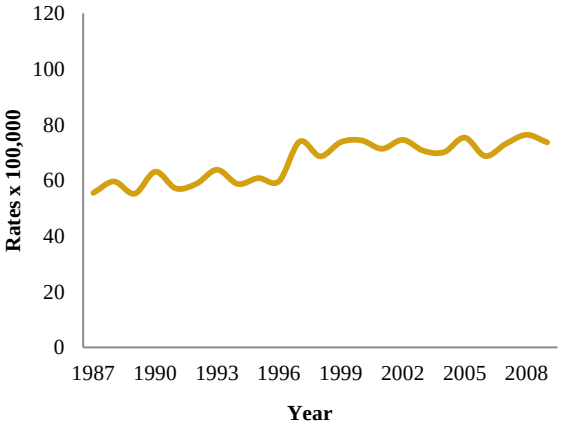


FIGURE 45: AGE-ADJUSTED MORTALITY RATES FOR INVASIVE BREAST CANCER IN FEMALES, PUERTO RICO 1987-2008

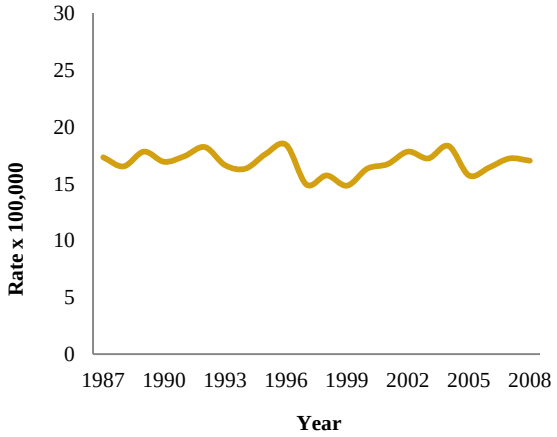


FIGURE 46: INCIDENCE DISTRIBUTION FOR INVASIVE BREAST CANCER, PUERTO RICO 2005-2009

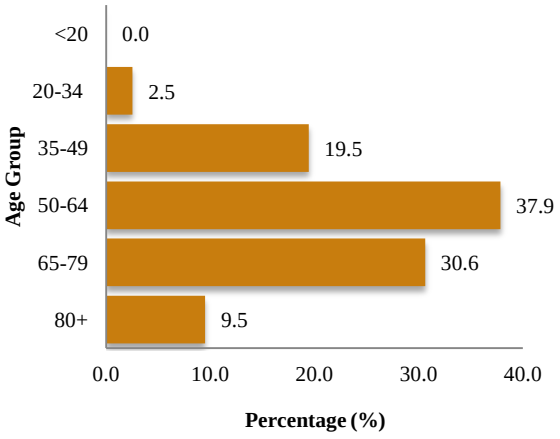


FIGURE 47: MORTALITY AGE DISTRIBUTION FOR INVASIVE BREAST CANCER, PUERTO RICO 2004-2008

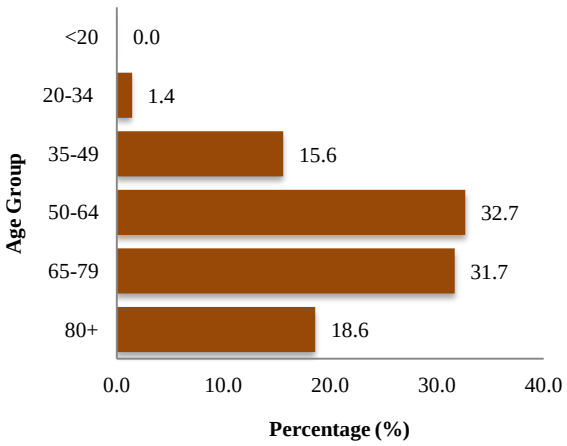


FIGURE 48: AGE-ADJUSTED FEMALE BREAST CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

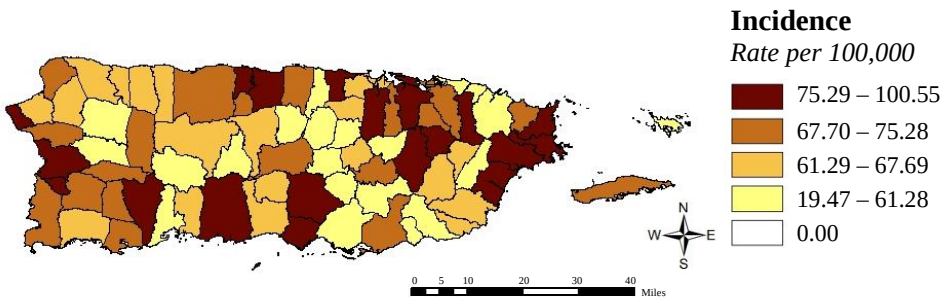
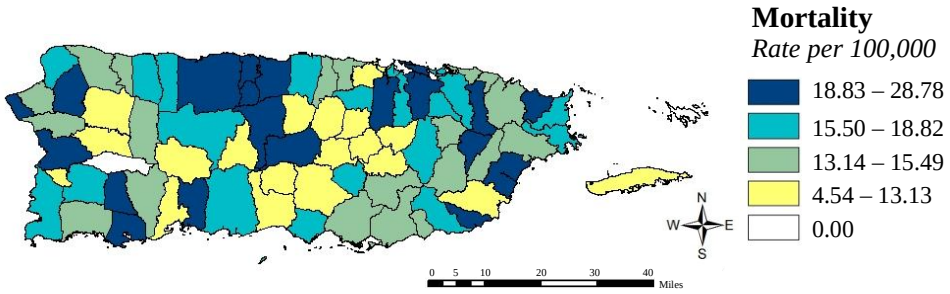


FIGURE 49: AGE-ADJUSTED FEMALE BREAST CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Cervix Uteri

For the period of 2005-2009, cervical cancer was the sixth most commonly diagnosed cancer among females in Puerto Rico representing approximately 3.7% of all female cancers. Cervical cancer is a disease in which malignant (cancer) cells form in the tissues of the cervix. Infection of the cervix with human papillomavirus (HPV) is the major risk factor for development of cervical cancer. Certain types of sexual behavior increase the risk factors to infect with HPV and develop cervical cancer like first sexual intercourse at a young age, numerous lifetime sexual partners, history of sexual transmission diseases, non use protection in any age and high parity. Other risk factors are: use long term oral contraceptive, history of smoking cigarettes, low socioeconomic status and dietetic factors (17).

For 2005-2009, the median age at diagnosis for cancer of the cervix uteri was 50 years. For 2004-2008, the median age at death for cervix uteri cancer was 60 years.

Key Points

- **Cervix Uteri cancer was the sixth commonly diagnosed cancer among females in Puerto Rico.**
- **It accounts for 3.8% of all female cancers between the years of 2005-2009 and 2.2% of all female cancer deaths between the years of 2004-2008.**
- **An average of 218 females were diagnosed with invasive cervix uteri cancer each year, between 2005-2009.**
- **Approximately 47 females die from cervix uteri cancer each year for the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 10.1 per 100,000 females per year.**
- **Between 2004-2008, the age-adjusted death rate was 2.1 per 100,000 females per year.**

The cervix uteri cancer incidence rate among females in Puerto Rico decreased by an average of 1.2% ($p<0.05$) each year for the period of 1987-2009 (Figure 50), while the mortality rates decreased by an average of 2.3% ($p<0.05$) during 1987-2008 (Figure 51).

FIGURE 50: AGE-ADJUSTED INCIDENCE RATES FOR CERVIX UTERI CANCER, PUERTO RICO 1987-2009

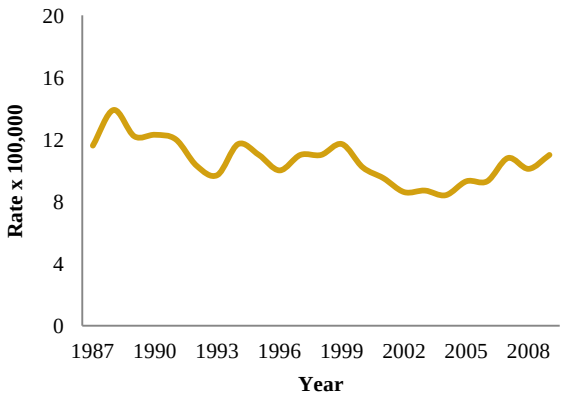


FIGURE 51: AGE-ADJUSTED MORTALITY RATES FOR CERVIX UTERI CANCER, PUERTO RICO 1987-2008

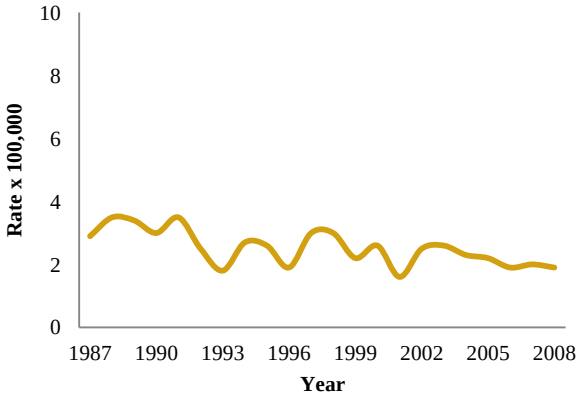


FIGURE 52: INCIDENCE AGE DISTRIBUTION FOR CERVIX UTERI CANCER, PUERTO RICO 2005-2009

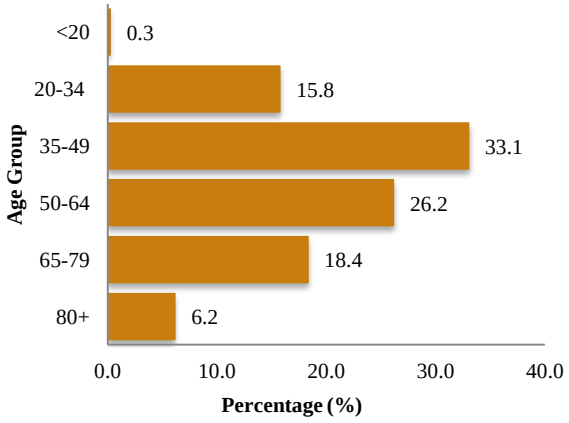


FIGURE 53: MORTALITY AGE DISTRIBUTION FOR CERVIX UTERI CANCER, PUERTO RICO 2004-2008

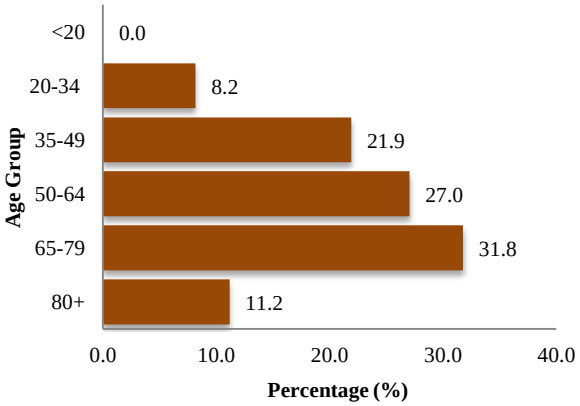


FIGURE 54: AGE-ADJUSTED CERVIX UTERI CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

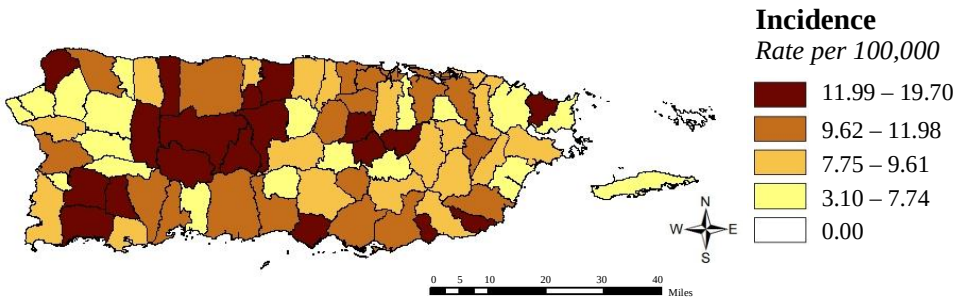
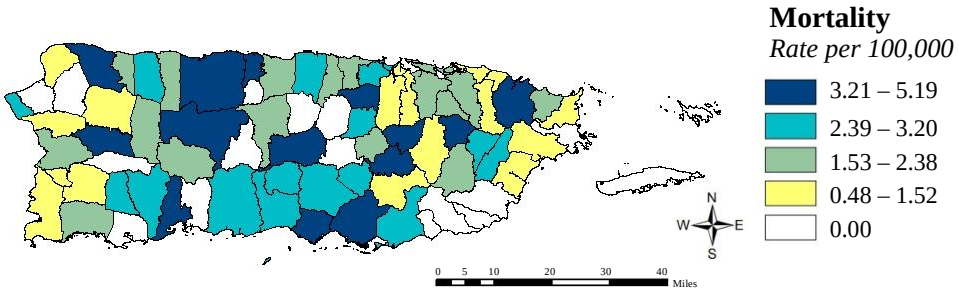


FIGURE 55: AGE-ADJUSTED CERVIX UTERI CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Cancer of the Corpus Uterus

Corpus and Uterus, Not Other Specified (NOS) cancer was the fourth most commonly diagnosed cancer among females in Puerto Rico and the most common malignancy of the female genital tract. In Puerto Rico, nearly 87% of female with corpus and uterus (NOS) cancer are classified as endometrial.

Studies have found the following risk factors: age; endometrial hyperplasia; hormone replacement therapy; obesity and related conditions; tamoxifen use and colorectal cancer. Other risk factors are related to how long a woman's body is exposed to estrogen. Females who have no children, begin menstruation at a very young age, or enter menopause late in life are exposed to estrogen longer and have a higher risk (17).

For 2005-2009, the median age at diagnosis for cancer of the corpus uterus was 62 years. For the period of 2004-2008, the median age at death for corpus uterus cancer was 70 years.

Key Points

- **Corpus uterus cancer was the fourth most commonly diagnosed cancer among females in Puerto Rico for the period of 2005-2009.**
- **It was accountable for 7.1% of all female cancers between 2005-2009 and 4.4% of all female cancer deaths between 2004-2008.**
- **An average of approximately 402 females were diagnosed with invasive corpus uterus cancer between 2005-2009.**
- **Approximately 94 females died from corpus uterus cancer each year during the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 17.0 per 100,000 females per year.**
- **Between 2004-2008, the age-adjusted death rate was 3.9 per 100,000 females per year.**

The corpus uterus cancer incidence rate among females in Puerto Rico increased by an average of 2.1% ($p<0.05$) each year for the period of 1987-2009 (Figure 56), while the mortality rates decreased by an average of 0.8% ($p<0.05$) during 1987-2008 (Figure 57).

FIGURE 56: AGE-ADJUSTED INCIDENCE RATES FOR CORPUS UTERUS CANCER, PUERTO RICO 1987-2009

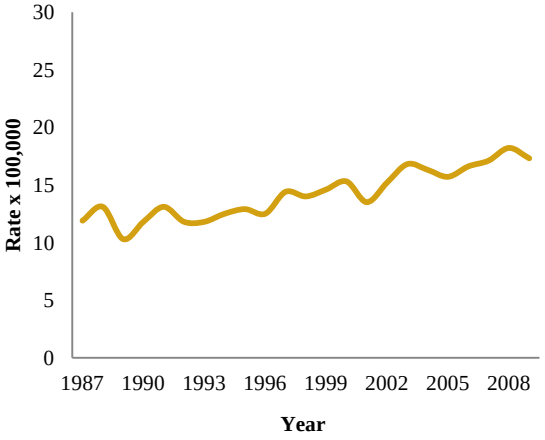


FIGURE 57: AGE-ADJUSTED MORTALITY RATES FOR CORPUS UTERUS CANCER, PUERTO RICO 1987-2008

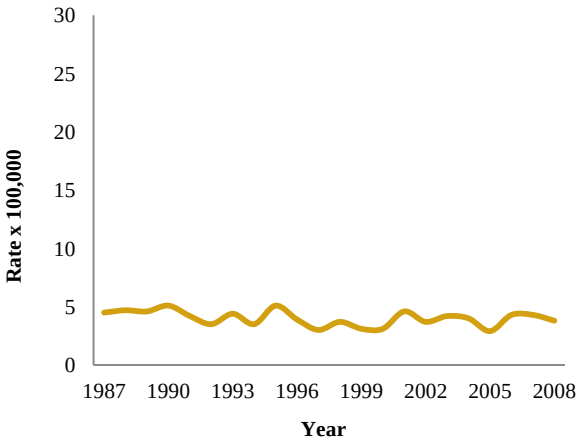


FIGURE 58: INCIDENCE AGE DISTRIBUTION FOR CORPUS UTERUS CANCER, PUERTO RICO 2005-2009

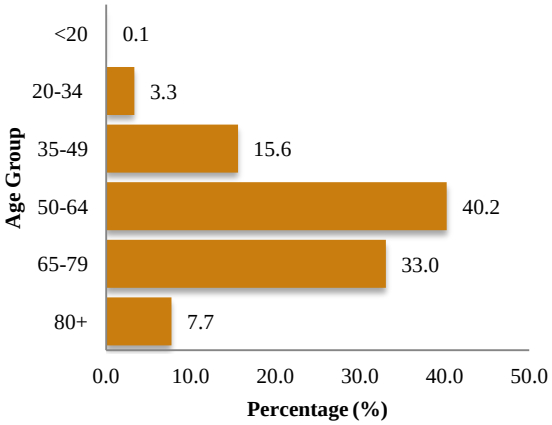


FIGURE 59: MORTALITY AGE DISTRIBUTION FOR CORPUS UTERUS CANCER, PUERTO RICO 2004-2008

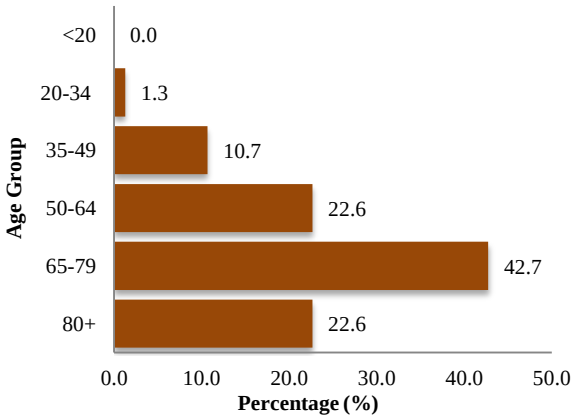


FIGURE 60: AGE-ADJUSTED CORPUS UTERUS CANCER INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

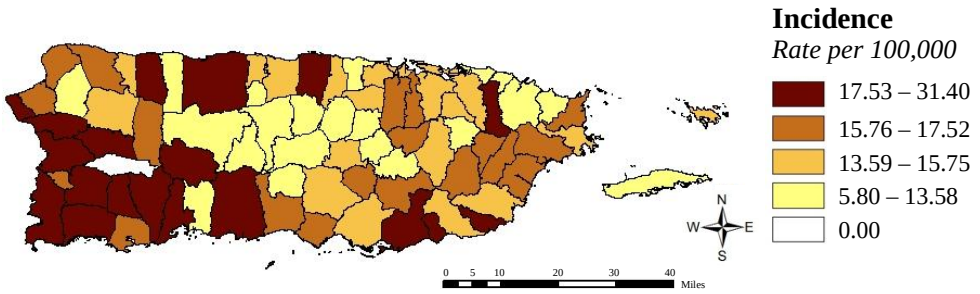
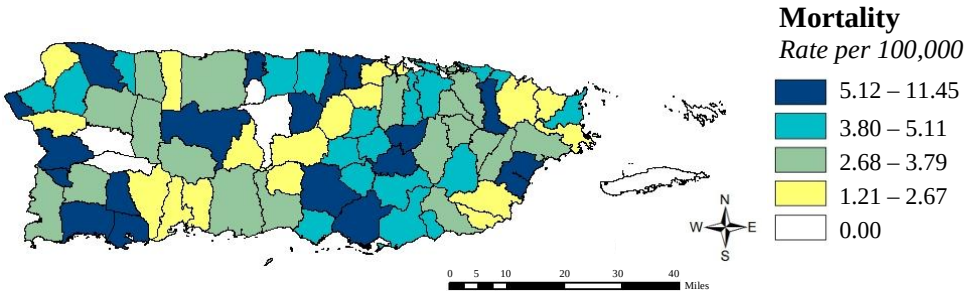


FIGURE 61: AGE-ADJUSTED CORPUS UTERUS CANCER MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Non-Hodgkin Lymphoma

Lymphomas are cancers that affect the white blood cells of the immune system, and are usually classified as either Hodgking lymphoma or non-Hodgking lymphoma. Non-Hodgking lymphoma is by far the most common of the two. In Puerto Rico, non-Hodgkin lymphoma is the sixth most commonly diagnosed cancer among males and the seventh most common diagnosed cancer in females for the period of 2005-2009. Non-Hodgkin lymphoma is the tenth and ninth cause of death by cancer among male and female respectively, for the period of 2004-2008. The cause of non-Hodgkin lymphoma is unknown, although there is evidence that viral exposures and immune systems that have been suppressed by drugs, in those who have received organ transplants. People that have congenital disorder and acquired immunologic disorders are at risk also. The increased incidence of the disease among this group of people suggests that hereditary influence may also be a risk factor. Some studies have found that occupational exposure to certain herbicides is a risk factor as well (17).

For the period of 2005-2009, the median age at diagnosis for cancer of the non-Hodgkin lymphoma was 64.5 years. For the period of 2004-2008, the median age at death for non-Hodgkin lymphoma was 69 years.

Key Points

- **Non-Hodgking lymphoma accounts for 3.4% of all male cancers and 3.8% of all female cancers between 2005-2009.**
- **It accounts for 3.4% of all male cancer deaths and 3.5% of female cancer deaths between 2004-2008.**
- **An average of approximately 227 males and 215 females were diagnosed with non-Hodgkin lymphoma between 2005-2009.**
- **Approximately 94 males and 76 females die from non-Hodgking lymphoma cancer each year between the period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence rate was 11.8 per 100,000 males per year and 9.0 per 100,000 females per year.**
- **Non-Hodgking lymphoma incidence are 1.3 times (Confidence Interval (CI) 95%: 1.2, 1.4) higher among men than among women, during 2005-2009.**
- **Between 2004-2008, the age-adjusted mortality rate was 4.9 per 100,000 males per year and 3.2 per 100,000 females per year.**
- **Non-Hodgking lymphoma mortality are 1.6 times (CI 95%: 1.4, 1.8) higher among males than among females, during 2004-2008.**

The incidence rate among males increased by an average of 0.9% ($p<0.05$) each year, while in females it increased by an average of 1.2% ($p<0.05$) annually for the period of 1987-

2009 (Figure 62). Cancer mortality rate in males increased by an average of 0.5% ($p<0.05$) each year, while in females it decreased by an average of 0.6% ($p<0.05$) annually for the period of 1987-2008 (Figure 63). Only the mortality trend for females was statistically significant.

FIGURE 62: AGE-ADJUSTED INCIDENCE RATES FOR NON-HODGKIN LYMPHOMA BY SEX, PUERTO RICO 1987-2009

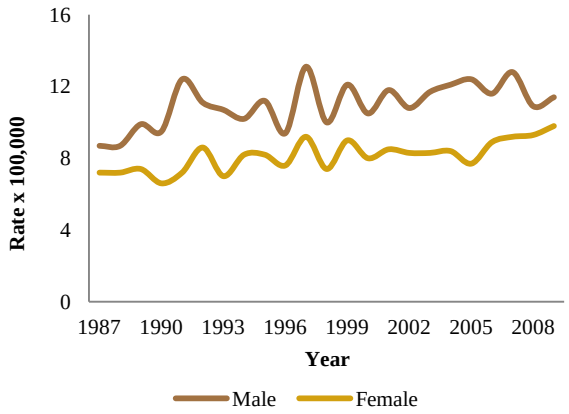


FIGURE 63: AGE-ADJUSTED MORTALITY RATES FOR NON-HODGKIN LYMPHOMA, PUERTO RICO 1987-2008

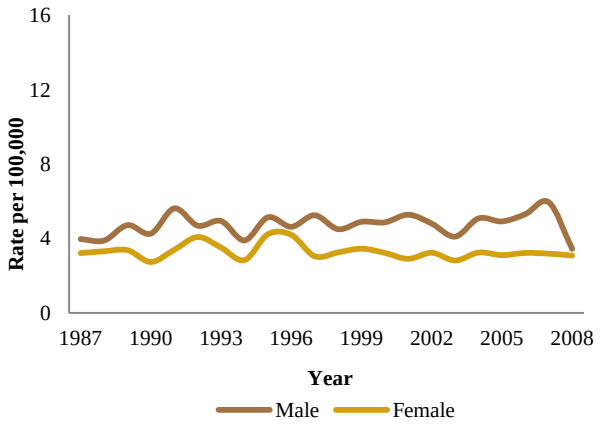


FIGURE 64: INCIDENCE AGE DISTRIBUTION FOR NON-HODGKIN LYMPHOMA, PUERTO RICO 2005-2009

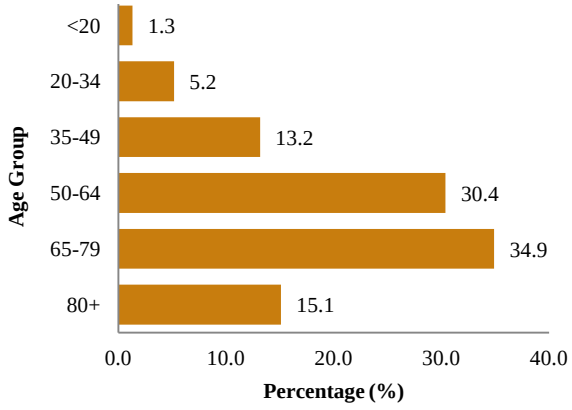


FIGURE 65: MORTALITY AGE DISTRIBUTION FOR NON-HODGKIN LYMPHOMA, PUERTO RICO 2004-2008

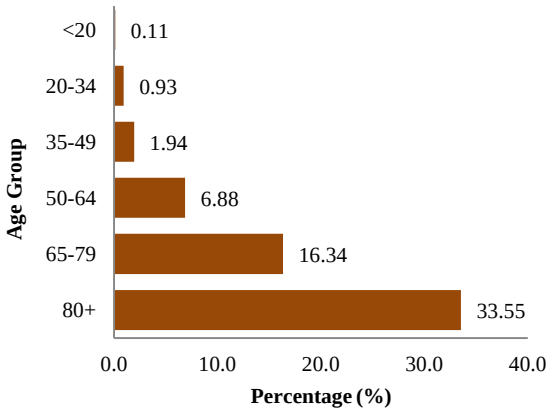


FIGURE 66: AGE-ADJUSTED NON-HODGKIN LYMPHOMA INCIDENCE RATES BY MUNICIPALITY IN PUERTO RICO, 2005-2009

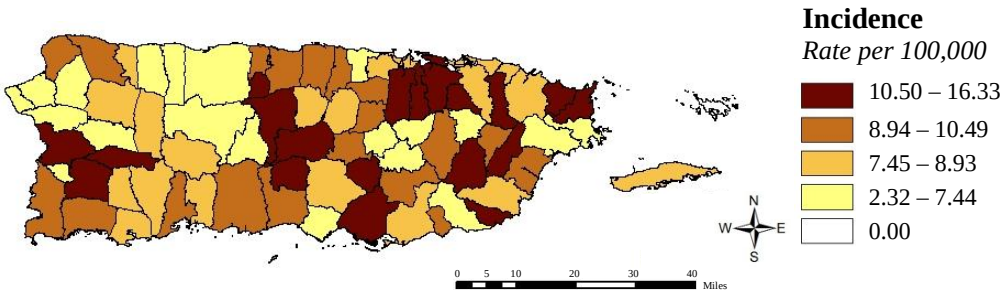
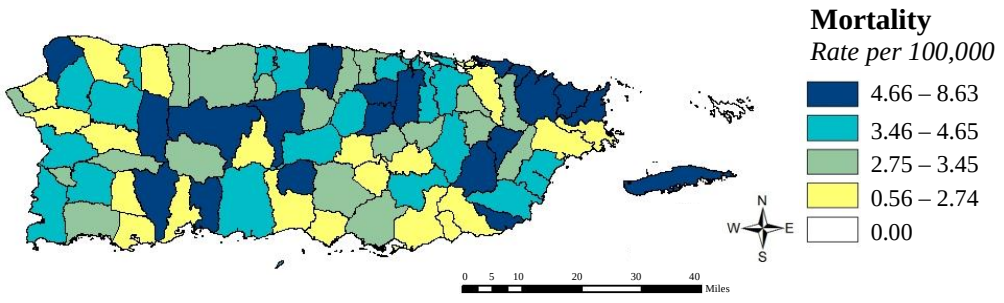


FIGURE 67: AGE-ADJUSTED NON-HODGKIN LYMPHOMA MORTALITY RATES BY MUNICIPALITY IN PUERTO RICO, 2004-2008



Childhood Cancer

Key Points

- **Childhood cancer is less common than cancer in adults, representing 1.1% of all cancers in Puerto Rico.**
- **An average of 671 children under the age of 20 were diagnosed with cancer during the period of 2005-2009 and about 107 deaths from the disease were reported during period of 2004-2008.**
- **Between 2005-2009, the age-adjusted incidence cancer rate for children cancers was 123.5 per million and the age-adjusted mortality rates was 19.0 per million for all cancers combined.**
- **Leukemia (24.3%), lymphomas (13.4%) and cancers of the central nervous system (19.1%), are the three most frequently diagnosed cancers in children.**
- **Incidence rates for childhood incidence cancer remained stable during the period of 1987-2009; being similar for male and females.**
- **Mortality rates of childhood cancer decreased by 3.4% ($p<0.05$) annually during the period of 1987-2008; it decreased for both males (APC= -2.3%, $p>0.05$) and females (APC= -4.7%, $p<0.05$).**

Childhood cancer is a diverse spectrum of different rare malignancies, varying widely in histology and anatomical site. Childhood cancers are different from adult cancers with respect to diagnosis, risk factors, cancer sites, treatments, and prognosis. The causes of childhood cancers are largely unknown. Only a small percentage of cases can be explained by a few conditions such as specific chromosomal/genetic abnormalities (e.g., Down's syndrome) and ionizing radiation exposure. Environmental exposures have long been suspected of increasing the risk of certain childhood cancers. Researchers continue to examine environmental influences on childhood cancer (18). Cancer in children is much less common than cancers in adults, representing less than 1.1% of all cancers diagnosed in Puerto Rico. From 2005 to 2009, a total of 671 new cancer cases were diagnosed among Puerto Rican children. These corresponds an average of 134 cases per year of invasive cancer among children; approximately 72 were males and 63 were female new cancers diagnosed from 2005 to 2009. For the period of 2004-2008, a total of 107 deaths due to cancer occurred in children less than 20 years, corresponding to an average of 21 deaths annually. Cancer is the fifth leading cause of death among Puerto Rican children. Leukemia, lymphomas and cancers of the central nervous system, are the three most frequently diagnosed cancers, accounting 56.8% of all childhood cancers (Table 4). Children in the youngest age group (<5 years) have much higher incidence rates for all cancers combined than the older age groups (Figure 70). Meanwhile,

mortality rates were higher in the age group of 15-19 years (Figure 71). This pattern is seen for both males and females. Trends for childhood incidence cancer remained stable during the period 1987-2009; been similar for male and females (Figure 68). During 2004-2009, mortality childhood cancer trends decrease 3.4% ($p<0.05$) annually during period 1987-2008; 4.7% ($p<0.05$) among females and 2.3% ($p>0.05$) among males (Figure 69).

TABLE 4: COUNTS AND AGE-ADJUSTED INCIDENCE RATES FOR CHILDHOOD CANCERS (0-19 YEARS) BY ICCC CATEGORIES AND SEX, PUERTO RICO 2005-2009*

Cancer Types	Total			Male			Female		
	Rate	Count‡	%	Rate	Count‡	%	Rate	Count‡	%
All Cancer Combined	123.5	671	100.0	129.3	358	100.0	117.3	313	100.0
I Leukemias	30.4	163	24.3	33.7	92	25.7	27.0	71	22.7
II Lymphomas	16.2	90	13.4	20.9	59	16.5	11.2	31	9.9
III CNS Neoplasms	23.7	128	19.1	28.1	77	21.5	18.7	51	16.3
IV SNS Tumors	6.6	34	5.1	5.7	15	4.2	7.6	19	6.1
V Retinoblastoma	1.6	8	1.2	0.8	< 6	0.6	2.4	6	1.9
VI Renal tumors	5.6	29	4.3	4.6	12	3.4	6.7	17	5.4
VII Hepatic tumors	1.7	9	1.3	2.3	6	1.7	1.2	< 6	1.0
VIII Bone Tumors	8.1	45	6.7	8.0	23	6.4	8.1	22	7.0
IX Soft tissue Sarcomas	8.1	44	6.6	7.5	21	5.9	8.4	23	7.3
X Germ Cell Neoplasm	7.1	40	6.0	8.4	24	6.7	5.9	16	5.1
XI Carcinomas	12.9	73	10.9	8.3	24	6.7	17.9	49	15.7
XII Other and unspecified	1.3	7	1.0	1.1	< 6	0.8	1.5	< 6	1.3

*Rates are per 1,000,000 and age-adjusted to the PR 2000 population.
Age-specific/site specific counts less than six (< 6) are not presented to avoid potential identification of cancer patients.
‡ Counts < 15 are too few to calculate a stable age-adjusted rate.

FIGURE 68: CHILDHOOD AGE-ADJUSTED INCIDENCE RATES FOR ALL SITES CANCER BY SEX, ALL AGES, PUERTO RICO 1987-2009

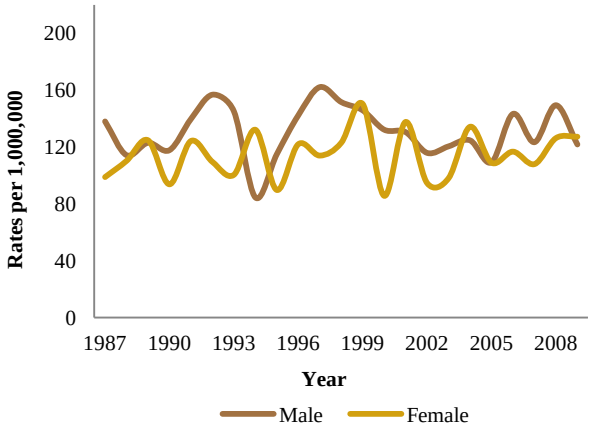


FIGURE 69: CHILDHOOD AGE-ADJUSTED MORTALITY RATES FOR ALL SITES CANCER BY SEX, ALL AGES, PUERTO RICO 1987-2008

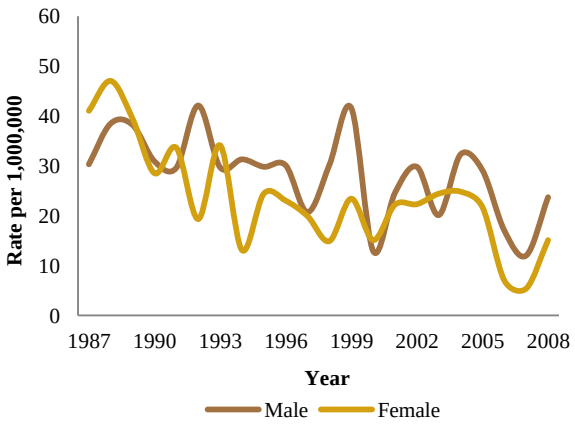


FIGURE 70: CHILDHOOD AGE SPECIFIC INCIDENCE RATES FOR ALL SITES OF CANCER BY AGE GROUP, PUERTO RICO 2005-2009

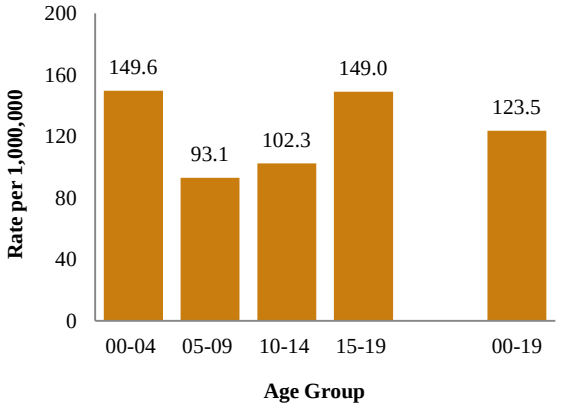


FIGURE 71: CHILDHOOD AGE SPECIFIC MORTALITY RATES FOR ALL SITES OF CANCER BY AGE GROUP, PUERTO RICO 2004-2008

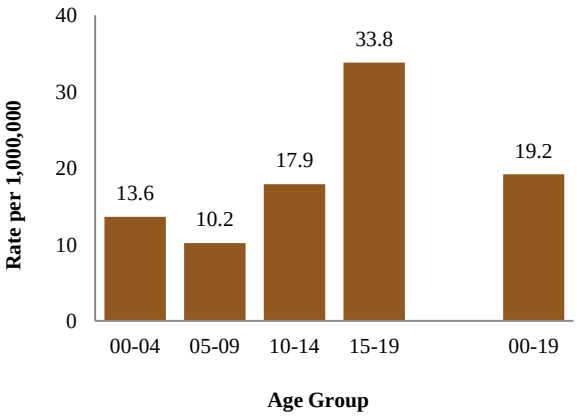


FIGURE 72: INCIDENCE DISTRIBUTION FOR CHILDHOOD CANCER, PUERTO RICO 2005-2009

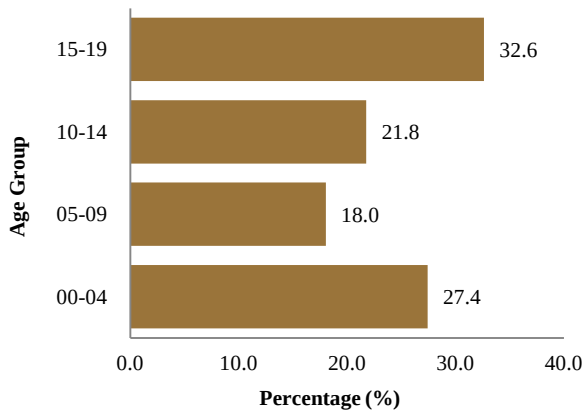
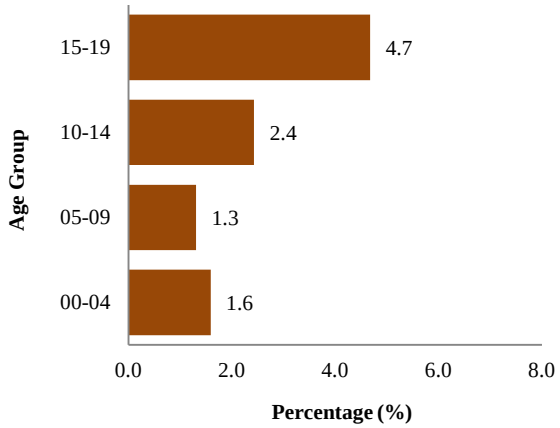


FIGURE 73: MORTALITY DISTRIBUTION FOR CHILDHOOD CANCER, PUERTO RICO 2004-2008



Selected List of Publications

1. Ho GY, Figueroa-Vallés NR, De La Torre-Feliciano T, Tucker KL, Tortolero-Luna G, Rivera WT, Jiménez-Velázquez IZ, Ortiz-Martínez AP, Rohan TE. **Cancer Disparities Between Mainland and Island Puerto Ricans**. *Rev Panam Salud Publica*. 2009 May; 25(5):394-400.

2. Morse D, Psoter W, De la Torre Feliciano T, Cruz G, Figueroa N. **A Deficit in the Detection of Very Early Oral Cancers in Puerto Rico**. *Am J Public Health*. 2008 Jul; 98(7):1200-2.

3. Morse DE, Psoter WJ, Cuadrado L, Jean YA, Phelan J, Mittal K, Buxó CJ, Cruz GD, Elias A. **A Deficit in Biopsying Potentially Premalignant Oral Lesions in Puerto Rico**. *Cancer Detect Prev*. 2009; 32(5-6):424-30.

4. Murray G, Jiménez L, Báez F, Colón-Castillo LE, Brau RH. **Descriptive Profile of Surgically-Confirmed Adult Central Nervous System Tumors in Puerto Rico.** *PR Health Sci J*. 2009 Dec; 28(4):317-28.

5. Ortiz AP, Frías O, González-Keelan C, Suárez E, Capo-Ramos D, Pérez J, Cabanillas F, Mora E. **Prevalence and Correlates of HER2/neu Over Expression Among Invasive Breast Cancer Cases in Two Hospitals in Puerto Rico.** *PR Health Sci J*. 2010; 3:265-271.

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8. Ortiz AP, Soto-Salgado M, Calo W, Nogueras G, Tortolero-Luna G, Hebl S, Figueroa-Vallés N, Suárez E**. Disparities in Breast Cancer in Puerto Rico and Among Hispanics, Non-Hispanic Whites and Non-Hispanics Blacks in the United States, 1992-2002**. Accepted for publication at *The Breast Journal*. 2009 Feb. (MS No. TBJ-00565-2008.R1).

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10. Ortiz-Ortiz KJ, Pérez-Irizarry J, Marín-Centeno H, Ortiz AP, Torres-Berríos N, Torres-Cintrón M, De la Torre-Feliciano T, Laborde-Rivera J, Calo WA, Figueroa-Vallés, NR. **Productivity Loss in Puerto Rico's Labor Market due to Cancer Mortality**. *PR Health Sci J*. 2010; 3:241-249.

11. Pérez-Irizarry J, Nazario CM, Figueroa-Valles NR, Torre-Feliciano T, Ortiz-Ortiz KJ, Torres-Cintrón M. **Incidence Trends of Cervical Cancer in Puerto Rico, 1987-2004.** *PR Health Sci J*. 2010; 4:364-371.

12. Ramírez-Marrero FA, Smith E, Torre-Feliciano T, Pérez-Irizarry J, Miranda S, Cruz M, Figueroa-Valles NR, Crespo CJ, Nazario CM. **Risk of Cancer Among Hispanics with AIDS Compared with the General Population in Puerto Rico: 1987-2003.** *PR Health Sci J*. 2010;3:256-264

13. Ramírez-Vick M, Nieves-Rodríguez M, Lúgaro-Gómez A, Pérez-Irizarry J. **Increasing Incidence of Thyroid Cancer in Puerto Rico, 1985-2004.** *PR Health Sci J*. 2011 Sep;30(3):109-15.

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15. Romero Marrero C, Ortiz AP, Pérez CM, Pérez J, Torres EA. **Survival of Hepatocellular Carcinoma in Puerto Rico**. *PR Health Sci J*. 2009 Jun; 28(2):105-13.

16. Smit E, Garcia-Palmieri MR, Figueroa NR, McGee DL, Messina M, Freudenheim JL, Crespo CJ. **Protein and Legume Intake and Prostate Cancer Mortality in Puerto Rican Men**. *Nutr Cancer*. 2007; 58(2):146-52.

17. Soto-Salgado M, Suárez E, Calo W, Cruz-Correa M, Figueroa-Vallés N, Ortiz AP. **Incidence and Mortality Rates for Colorectal Cancer in Puerto Rico and among Hispanics, Non-Hispanic Whites and Non-Hispanics Blacks in the United States, 1998-2002**. *Cancer*. 2009; 115:3016-23.

18. Suarez E, Calo WA, Hernandez EY, Diaz EC, Figueroa NR, Ortiz AP. **Age-Standardized Incidence and Mortality Rates of Oral and Pharyngeal Cancer in Puerto Rico and among Non-Hispanics Whites, Non-Hispanic Blacks, and Hispanics in the USA**. *BMC Cancer*. 2009 Apr 28; 9:129.

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Other Information

Law No. 113 of July 30, 2010 (Law of the Puerto Rico Central Cancer Registry)

As of July 2008, the PRCCR administration was transferred to the Comprehensive Cancer Center of the University of Puerto Rico, Medical Sciences Campus. To improve cancer reporting timeliness and completeness, the Puerto Rico Legislature passed Law No. 113 of July 30, 2010 (Law of the Puerto Rico Central Cancer Registry), derogating Law No. 28 of 1951. The new law enforces cancer reporting to the PRCCR and facilitates obtaining accurate and complete information from the reporting facilities. This development is a huge step for the PRCCR toward achieving Gold Certification from the North American Association of Central Cancer Registries (NAACCR). For more information visit the following site:
http://www.lexjuris.com/lexlex/Leyes2010/lexl2010113.htm

Link to PRCCR Web Page

http://www.salud.gov.pr/RCancer/Pages/default.aspx

Requests for cancer data are welcome and should be sent to nprios@rcpr.org. Interest in potential research collaborations must also be sent to nprios@rcpr.org. .

Contact Information

Puerto Rico Central Cancer Registry of Puerto Rico
Comprehensive Cancer Center at the University of Puerto Rico, Medical Sciences Campus
PMB #315 PO BOX 70344
San Juan, PR 00936-8344
Tel: 787-772-8300 x. 1110
Fax: 787-522-3282

Comprehensive Cancer Center
University of Puerto Rico,
Medical Sciences Campus
PMB #711
89 Ave De Diego Suite 105
San Juan, PR 00927-6346
Tel: 787-772-8300

Department of Health of Puerto Rico
PO Box 70184
San Juan, PR 00936-8184
Tel: 787-765-2929