

# Leading Causes of Premature Mortality in San Luis Obispo County

Ann McDowell, MPH  
Christopher Li

*County of San Luis Obispo Public Health Department  
P.O. Box 1489/2191 Johnson Avenue  
San Luis Obispo, CA 93406-1489  
Phone: (805) 781-5500  
Facsimile: (805) 781-5543*

## Abstract

**Introduction:** This study aims to carry out a comprehensive study of premature mortality in San Luis Obispo County between the years 2000-2010, by reviewing the ten leading causes of death: heart disease, cancer, cerebrovascular disease, chronic lower respiratory disease, accidents, alzheimers, diabetes, influenza/pneumonia, liver disease, and suicide using years of potential life lost (YPLL) and age-standardized years of potential life lost rate (ASYR) calculations.

**Methods:** For the years 2000-2010 (excluding 2001 due to a lack of records), using the Death Statistical Master Files for San Luis Obispo County, total numbers of deaths for the ten leading causes of death were calculated, along with years of potential life lost (YPLL) and age-standardized YPLL rates (ASYR). The results were stratified by sex, underlying causes of death, and age groups. Total YPLL was used to rank the leading causes of death overall and for individual groups. ASYR was used to compare the effects of the different causes of death on premature mortality between age groups.

**Results:** The leading causes of premature mortality were accidents (30% of overall YPLL), cancer (30%), heart disease (18%), and suicides (8%). When compared across ages, accidents were the most prevalent cause of premature death in the 0-49 age range with a peak in the 20-39 age group. Both cancer and heart disease peaked in the 50-69 age group, while suicides were highest in the 0-39 age group. For both genders, accidents, suicides, and liver disease were found on average to cause the greatest years of potential life lost per individual death. Statistically significant differences ( $\alpha=.10$ ) were seen between the years of potential life lost per death between males and females for heart disease, cancer, and chronic lower respiratory disease

**Conclusion:** The leading causes of premature death in San Luis Obispo County are accidents, cancer, heart disease, and suicides. The preventable causes of accidents and suicides are the greatest causes of premature death in the youth. Males lose statistically more years of potential life per death than females due to heart disease, cancer, and chronic lower respiratory disease.

**Introduction:**

The impact of communicable and chronic diseases on public health are often measured using mortality statistics such as crude and age-adjusted death rates in a population. “Since most deaths occur among persons in older age groups, crude and age-adjusted mortality data are dominated by the underlying disease processes of the elderly” [1]. Although these studies are important in analyzing public health issues and allowing priorities to be set, they by nature ignore the effects of premature mortality. Thus, alternative measurements were created in an effort to study the effects of disease in causing premature mortality by weighting the deaths among the young more heavily than those of the elderly. Years of potential life lost (YPLL) was developed to determine the burden of premature mortality in populations by setting a standard life expectancy value (in this report, the age of 75 is used) and calculating the potential years of life remaining when an individual dies prematurely [2]. For example, a person who dies at the age of 50 has lost 25 potential years of life ( $75 - 50 = 25$  YPLL). Using YPLL as well as age-standardized years of potential life lost rate (ASYR) measurements allows public health programs to investigate the effects of various diseases in causing premature mortality in their populations and rank them, as well as compare them to other regions.

This study aims to carry out a comprehensive study of premature mortality in San Luis Obispo County between the years 2000-2010 caused by the ten leading causes of death: heart disease, cancer, cerebrovascular disease, chronic lower respiratory disease, accidents, alzheimer’s, diabetes, influenza/pneumonia, liver disease, and suicide. Results of this study highlight areas where targeted interventions could reduce premature mortality, which can often represent preventable loss of life [3].

**Methods:**

For the years 2000-2010 (excluding 2001 due to a lack of records), the Death Statistical Master Files for San Luis Obispo County were obtained from the State of California Department of Public Health, Center for Health Statistics. These files are records of all deaths occurring during the study period, and have been reviewed by nosologists (researchers who classify deaths according to cause and mechanism of disease) to accurately record cause of death. In this study, total numbers of deaths for the ten leading causes of death were calculated, along with years of potential life lost (YPLL) and age-standardized YPLL rates (ASYR). Standard life expectancy was set at 75 years for both men and women, so as to be in accordance with other state and national studies that follow the Center for Health Statistics Information for Local Health Officers guidelines [4]. In calculating age-standardized YLL rates, San Luis Obispo County population estimates for the 2000-2005 period were based off of the California Department of Finance population estimates [5] and the 2006-2010 period was based off of 2010 US Census estimates [6], while the United States population estimates utilized for age standardization were based off of the 2010 US Census estimates [7].

In this study the number of deaths, YPLLs, % YPLL, and ASYR were calculated. Because results based on fewer than 20 deaths may not be reliable, they were reported in red and italicized in tables. The results were stratified by sex, underlying causes of death, and age groups. Total YPLL was used to rank the leading causes of death overall and for

individual groups, error bars are the standard error of the mean. Student t-tests were used to test for differences for gender comparisons if the results were based on data from groups of more than 20 deaths. % YPLL was calculated for each individual cause of death vs. the overall YPLL for all cause of death. All calculations, tables, graphs, and statistical tests were performed using Microsoft Excel 2003. Additional details regarding calculation details can be found in the Appendix.

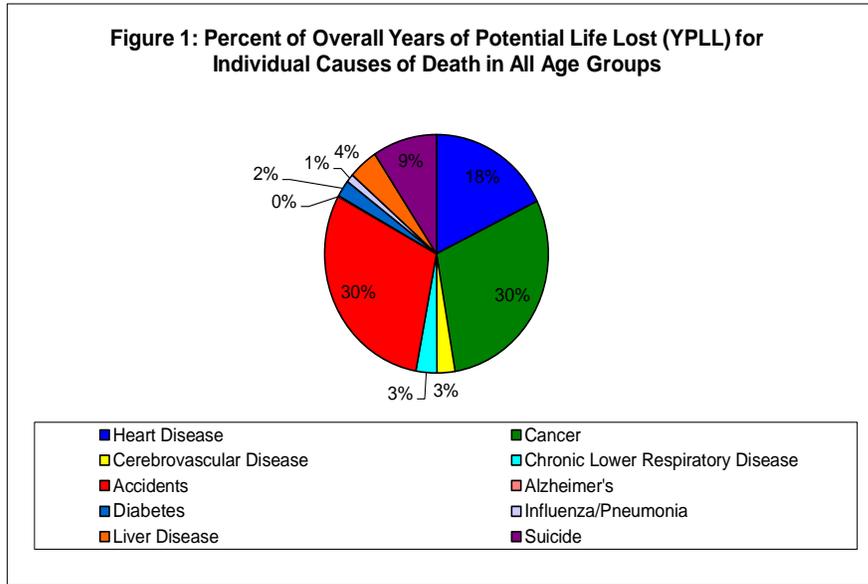
### Results:

Between the years 2000 and 2010 (with the exclusion of the year 2001), the total years of potential life lost (YPLL) were calculated for each of the top ten leading causes of death for each age group (Table 1). The leading cause of years of potential life lost in San Luis Obispo County during this time was accidents, accounting for just over 33,000 years of potential life lost, 30% of the overall total (Figure 1). Following accidents was cancer, which accounted for just less than 33,000 years of potential life lost, and another 30% of the overall total. Heart disease ranked third with just under 20,000 years of potential life lost, representing 18% of the overall total. Suicides came in fourth with over 10,000 years of potential life lost, 9.3% of the overall total. Liver disease, chronic lower respiratory disease, cerebrovascular disease, diabetes, influenza/pneumonia, and Alzheimer's followed respectively, accounting from between 0%-4% of the overall total of years of potential life lost.

**Table 1: Total Years of Potential Life Lost (YPLL) for Individual Causes of Death in Each Age Group and YPLL% for Individual Causes of Death**

Total Years of Potential Life Lost (YPLL)								
	0-19 yrs	20-39 yrs	40-49 yrs	50-59 yrs	60-69 yrs	70-74 yrs	Total YPLL	YPLL%
Heart Disease	<i>188</i>	1439	3874	7700	5449	1113	19763	17.8%
Cancer	<i>1041</i>	2252	6002	12032	9910	1698	32935	29.6%
Cerebrovascular Disease	<i>0</i>	<i>261</i>	<i>532</i>	943	922	232	2890	2.6%
Chronic Lower Respiratory Disease	<i>71</i>	<i>107</i>	<i>445</i>	967	1379	407	3376	3.0%
Accidents	7512	15453	5858	3328	1093	128	33372	30.0%
Alzheimer's	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>92</i>	60	152	0.1%
Diabetes	<i>0</i>	<i>183</i>	<i>596</i>	1001	627	133	2540	2.3%
Influenza /Pneumonia	<i>140</i>	<i>252</i>	<i>274</i>	<i>270</i>	207	91	1234	1.1%
Liver Disease	<i>0</i>	<i>418</i>	1535	1916	827	<i>31</i>	4727	4.2%
Suicide	<i>746</i>	3977	2991	1938	643	<i>46</i>	10341	9.3%
							Total:	100%

Results that are in red and italicized are based on small numbers and may be unreliable



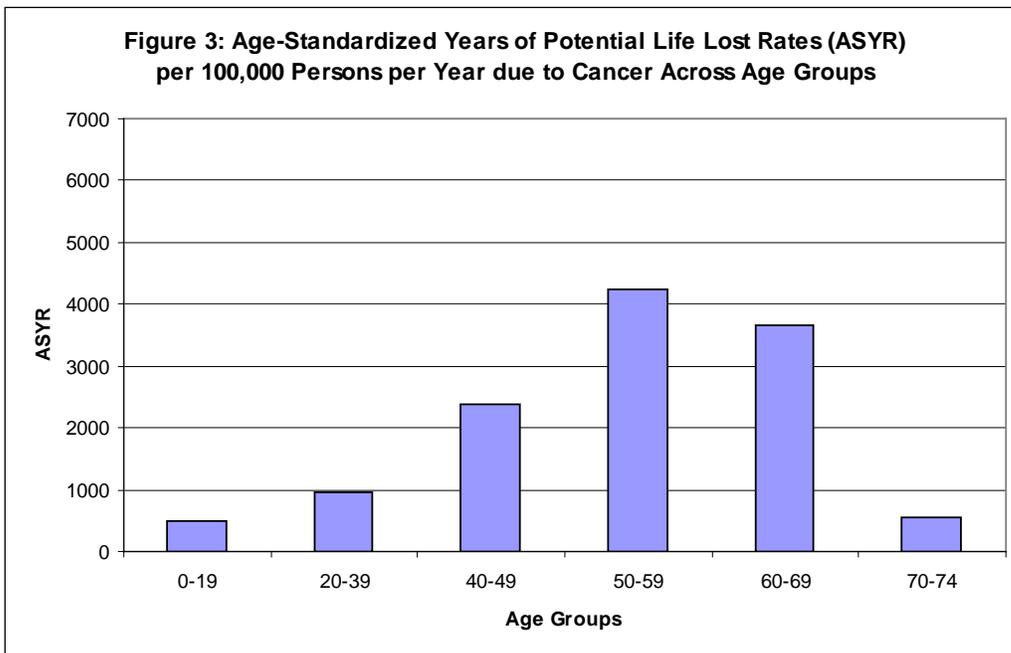
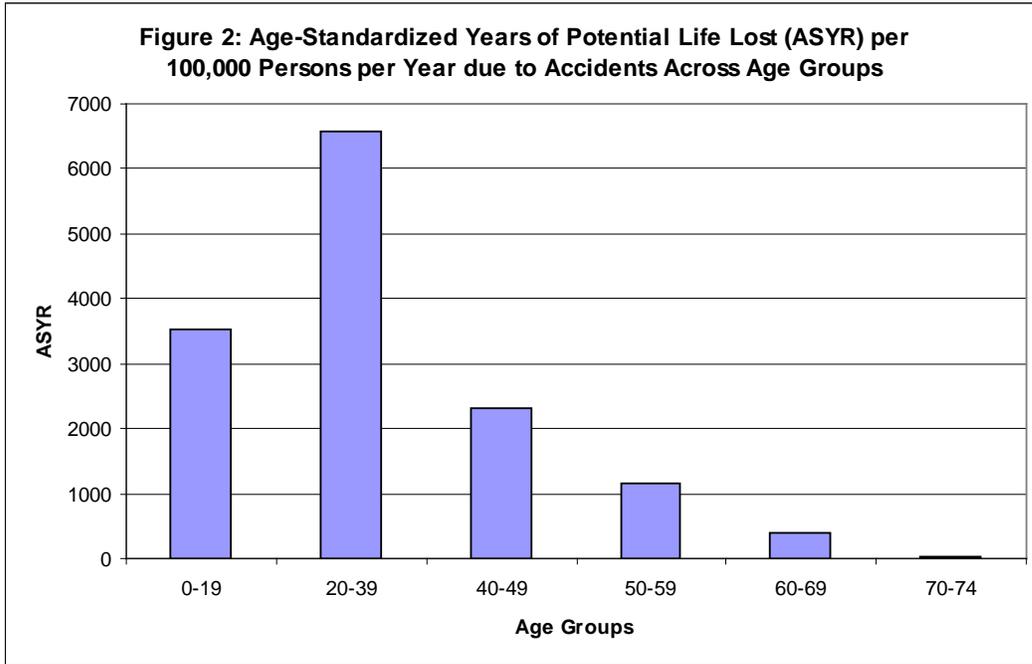
Age-Standardized Years of Potential Life Lost Rates (ASYR) per 100,000 People per Year calculations allows the comparison between different age groups by cause of death (Table 2).

**Table 2: Age-Standardized Years of Potential Life Lost Rates (ASYR) per 100,000 Person per Year for Individual Causes of Death in Each Age Group.**

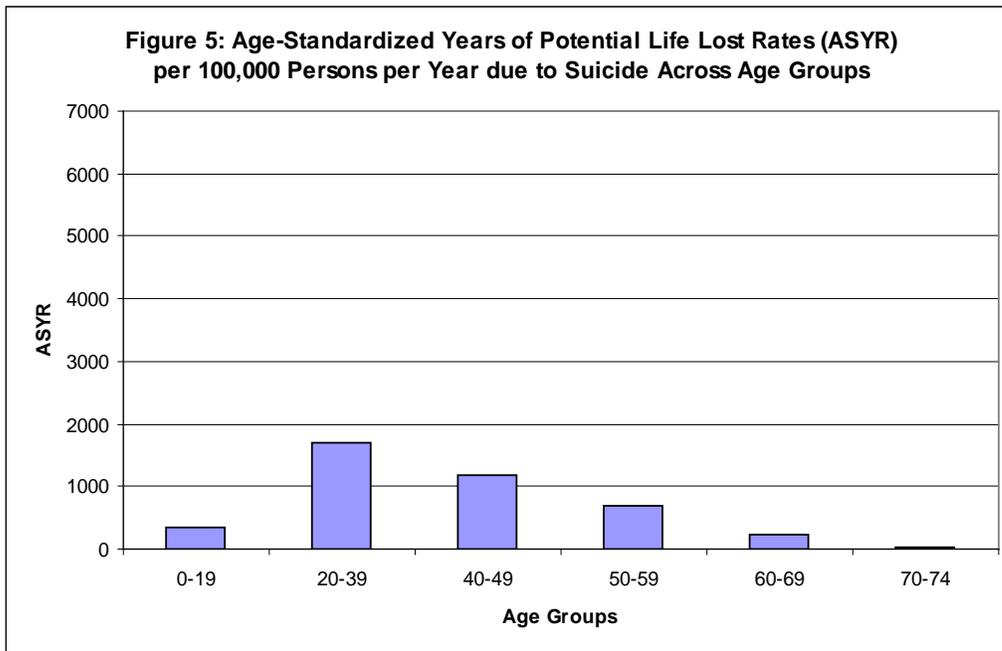
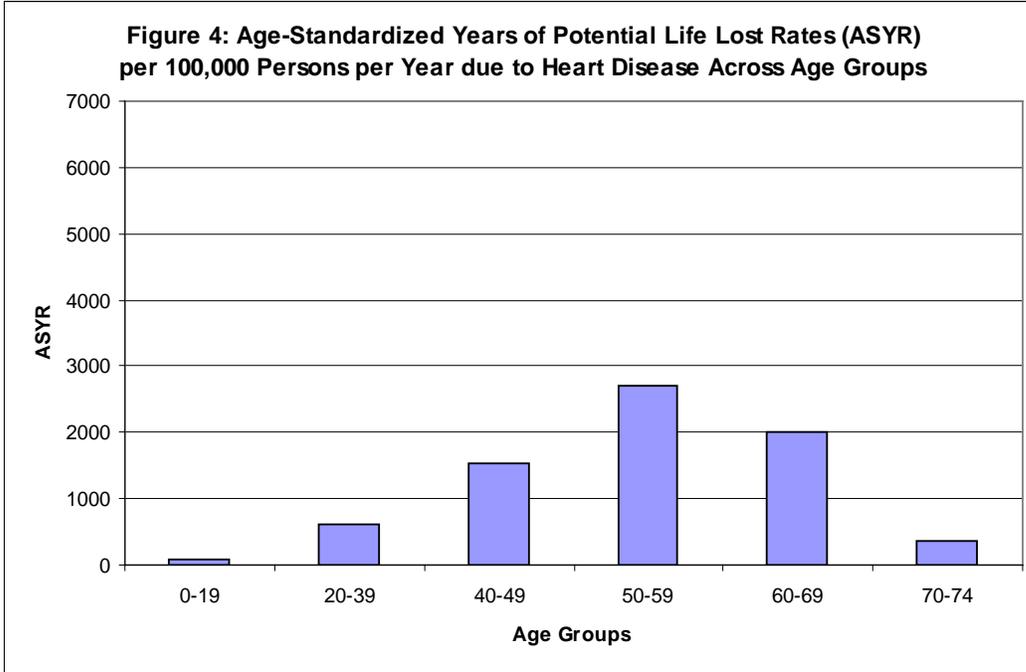
Age-Standardized Years of Potential Life Lost Rates (ASYR) per 100,000 Persons per Year						
	0-19 Years	20-39 years	40-49 years	50-59 years	60-69 years	70-74 years
Heart Disease	<i>89</i>	612	1533	2709	2012	367
Cancer	<i>490</i>	958	2375	4233	3659	560
Cerebrovascular Disease	<i>0</i>	<i>111</i>	<i>211</i>	332	340	77
Chronic Lower Respiratory Disease	<i>33</i>	<i>46</i>	<i>176</i>	340	509	134
Accidents	3539	6577	2318	1171	404	42
Alzheimer's	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>34</i>	20
Diabetes	<i>0</i>	<i>78</i>	<i>236</i>	352	232	44
Influenza/Pneumonia	<i>66</i>	<i>107</i>	<i>108</i>	<i>95</i>	76	30
Liver Disease	<i>0</i>	<i>178</i>	607	674	305	<i>10</i>
Suicide	<i>351</i>	1693	1184	682	237	<i>15</i>

Results that are italicized and in red are based on less than 20 deaths and may be unreliable.

Accidents were the leading cause of YPLL, with the greatest impact between the ages of 20-39, followed by the age groups 0-19 and 40-49 years with rates tapering off after the age of 49 years (Figure 2). Cancer’s impact on premature mortality is most significant between the ages of 50-59, lessening slightly between 60-69, and declining in the 70-74 and 40-49 years age groups (Figure3).

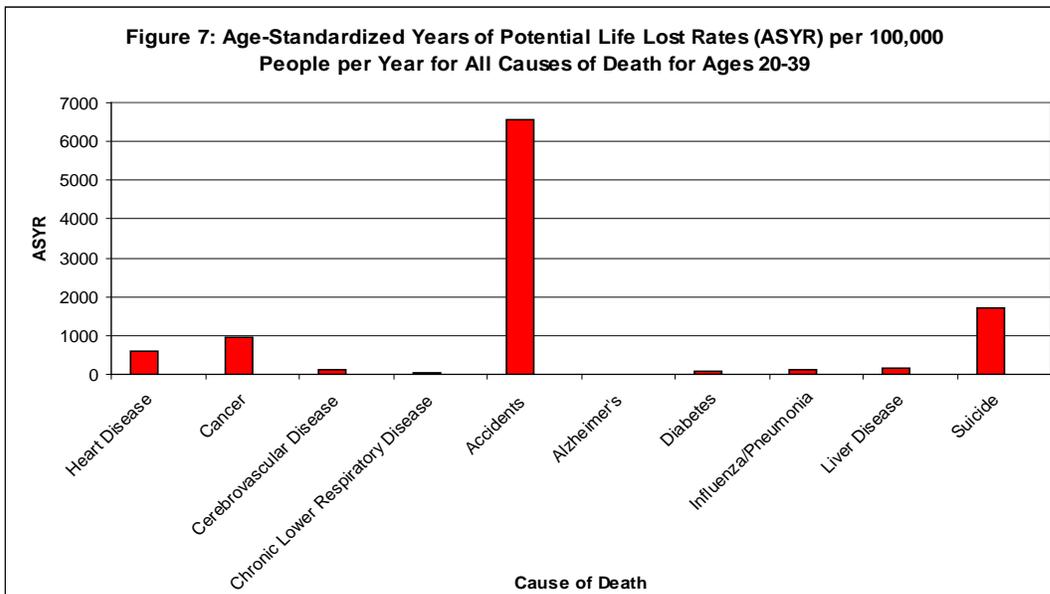
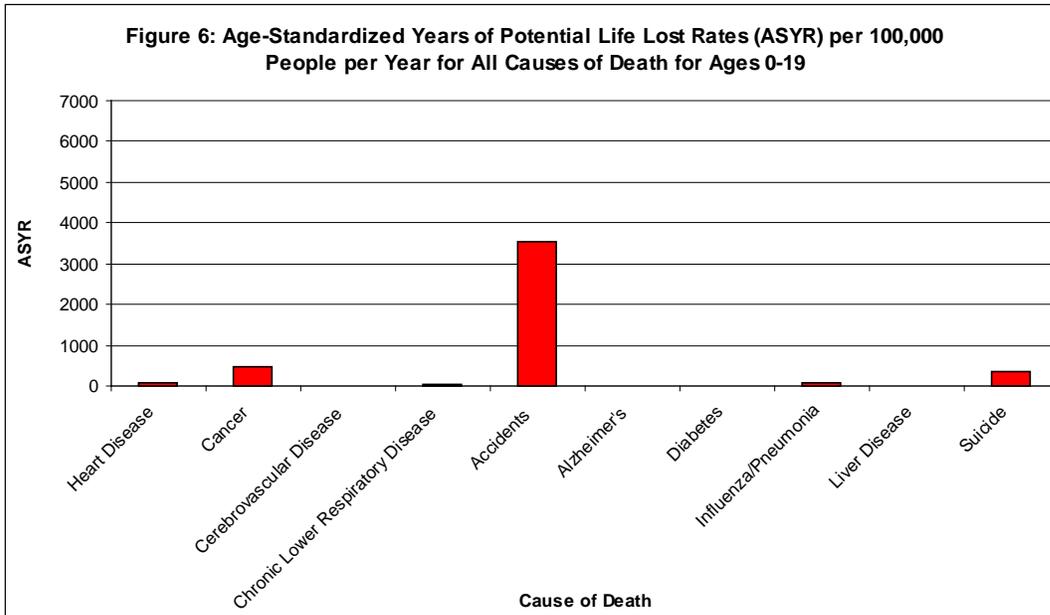


Heart disease’s effect largely begins between the ages of 40-69 with the peak in the 50-59 age range and a drastic decline by the 70-74 age group (Figure 4). Suicides are highest between the 0-19 and 20-39 age groups and then steadily decline through the subsequent age groups (Figure 5).

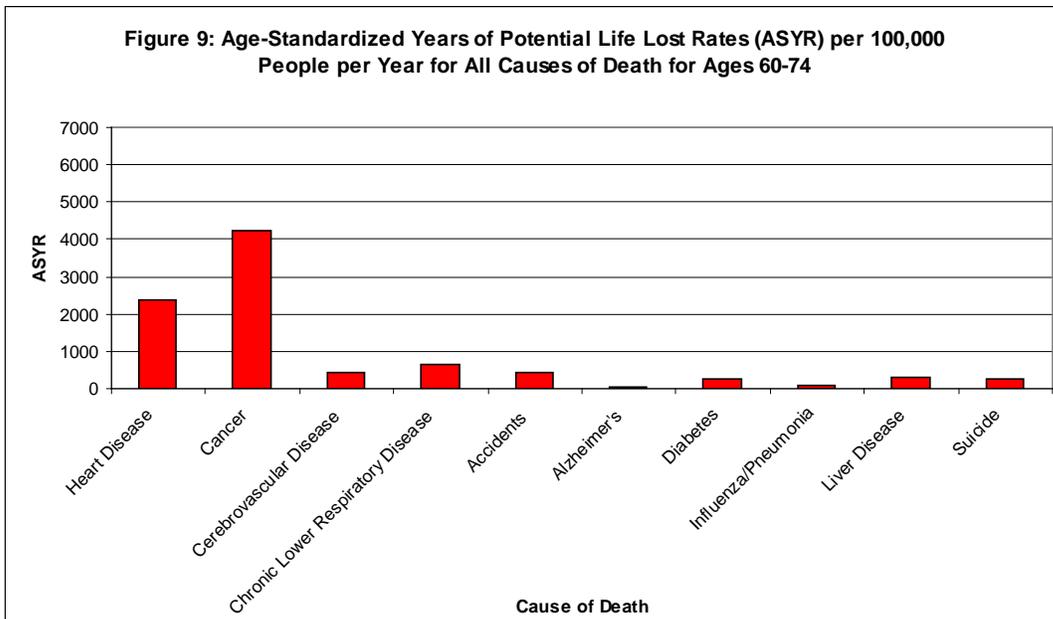
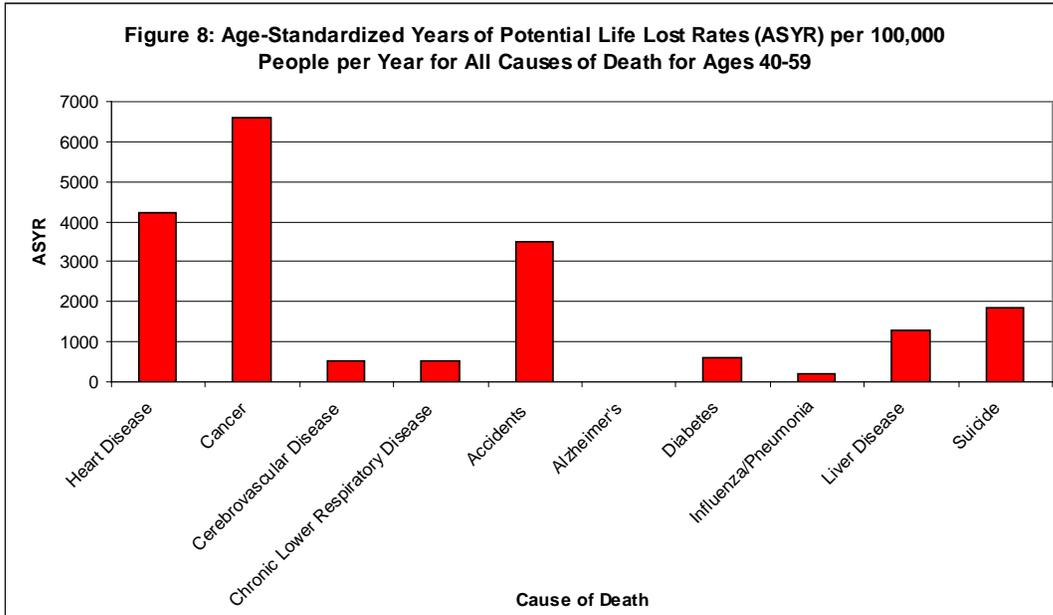


Results by Age Group:

In the 0-19 age group, accidents were by far the largest cause of years of potential life lost with its ASYR over seven times higher than the next leading cause, cancer, and over ten times higher than third ranked suicides (Figure 6). A similar trend is seen in the 20-39 age group, where accidents still ranked the highest, but a nearly five times increase in suicides ASYR is seen (Figure 7).



By the 40-59 age group a shift in trends is seen as cancer and heart disease both surpass accidents in ASYR. Cancer’s ASYR is nearly double that of accidents and heart disease is slightly higher than that of accidents. The impact of liver disease also begins to be seen in this age group (Figure 8). In the 60-74 age group, cancer and heart disease are the predominant cause of years of potential life lost, while many of the other causes of death, such as accidents, have greatly tapered off (Figure 9).

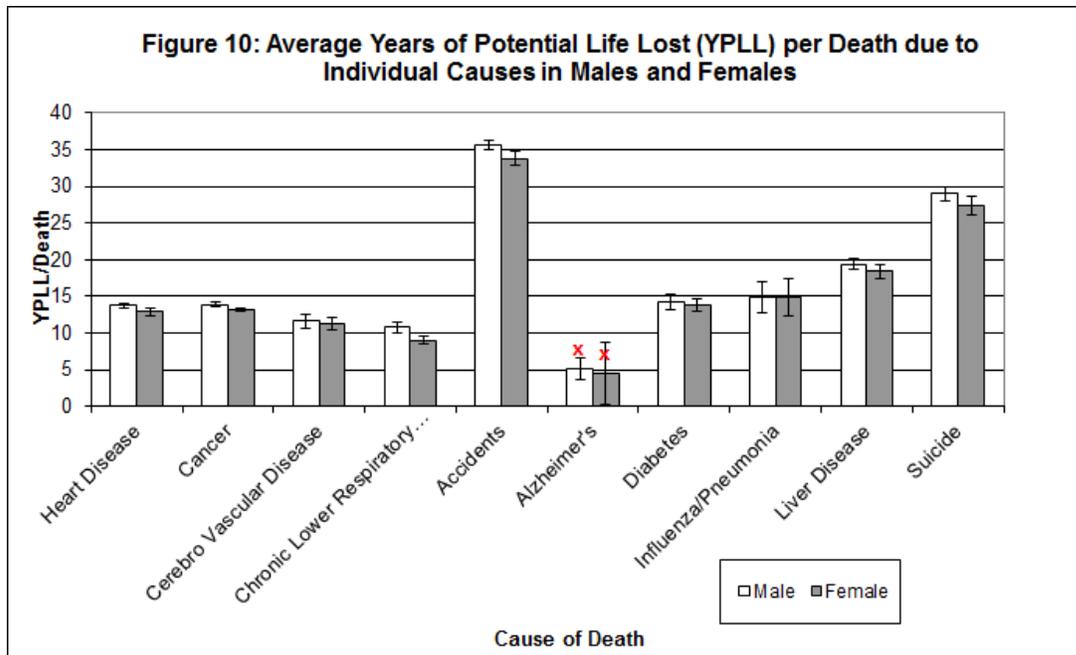


Comparisons of the years of YPLL by cause of death between genders are shown below in Table 3 and Figure 10. For both males and females, the three leading causes of YPLL/death were accidents, suicides, and liver disease respectively. Table 3 and Figure 10 show the average number of years of life lost per each death by cause of disease. No statistically significant differences in YPLL/death between men and women were seen at the 0.05 significance threshold, although significance at the 0.10 threshold was seen for heart disease (p=0.093), cancer (p=0.098), and chronic lower respiratory disease (p=0.075).

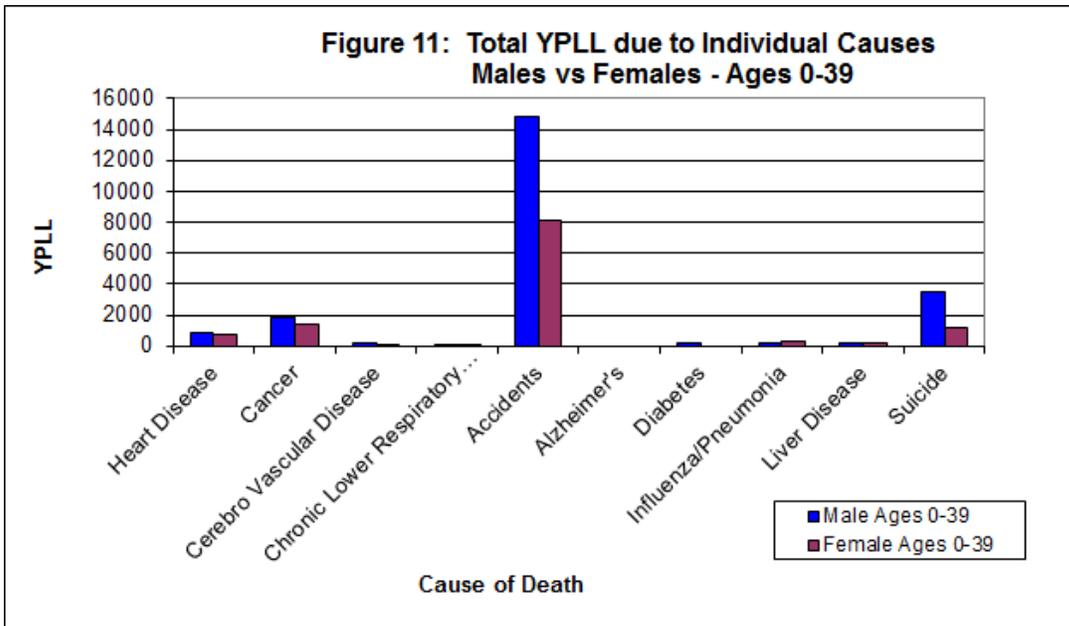
**Table 3: Average Years of Potential Life Lost (YPLL) per Death for Individual Causes of Death in Males and Females**

	Male	Female	ttest
Accidents	35.6	33.8	0.14
Suicide	29.0	27.3	0.28
Liver Disease	19.4	18.4	0.44
Influenza / Pneumonia	14.8	14.9	0.98
Diabetes	14.2	13.8	0.79
Cancer	13.9	13.2	0.10
Heart Disease	13.8	12.9	0.09
Cerebro Vascular Disease	11.7	11.3	0.78
Chronic Lower Respiratory Disease	10.8	9.0	0.07
Alzheimer's	<i>5.2</i>	<i>4.5</i>	N/A

Results that are italicized and in red are based on less than 20 deaths and may be unreliable.



Dramatic differences in the total YPLL by gender can be seen in the 0-39 year age group in Figure 11, with many more YPLL by males due to accidents and suicide.



**Discussion:**

This study is one of the first of its kind for San Luis Obispo County, and helps identify the effects of the top 10 leading causes of death across the different population ages in terms of years of potential life lost and age-standardized years of potential life lost rates. In the study of years of potential life lost, accidents, cancer, heart disease, and suicides were identified to be the leading causes of premature deaths in the population (Figure 1). Accidents generally happen in younger age groups, thus causing the most YPLL, and contributing to the category ranking highest in this study. In the study of years of potential life lost per death for males and females, accidents, suicides, and liver disease were found on average to cause the greatest years of potential life lost per individual death. Furthermore, statistically significant differences ( $\alpha=.10$ ) were seen between the years of potential life lost per death between males and females for heart disease, cancer, and chronic lower respiratory disease (Figure 10). In regards to the age-standardized years of potential life lost rates, it was found that the leading causes for those between the ages of 0-39 were predominantly accidents and suicides. But, by the 40-59 years age group the causes shifted to cancer and heart disease more than accidents or suicides. By the ages of 60-74, the causes of the age-standardized years of potential life lost were almost solely due to cancer and heart disease on average (Figures 2-9).

Years of potential life lost (YPLL) and age-standardized years of potential life lost rates (ASYR) studies allow for a robust analysis of the effect of particular diseases on reducing the average lifespan of a population as well as investigation into the

particular effects in different age groups and demographical groups, such as gender. Benefits of these analyses include being able to obtain standardized cause of death information readily from registry death data, the ability to repeat this study over time and observe changes, the use of international ICD-10 codes making this study comparable to intrastate, interstate, national, and international studies, as well as the ability to use these findings to make evidence-based, targeted public health intervention programs to reduce premature mortality [3].

Although these types of studies can be very informative, they do have a few key limitations that must be considered. One key limitation is that this study focused on the ten leading causes of death overall as ranked nationally, which are ranked based primarily on deaths in the elderly population and thus may not include all important contributing causes of premature mortality in the young. Another limitation is that although the studies do provide key information about premature mortality, they do not measure any factors related to loss of quality of life, nor any disease or illness that does not result in mortality. Another key limitation for the County of San Luis Obispo is that due to such a small population with a proportionally large elderly population, a lack of enough data to make statistically reliable comparisons between many diseases across age groups occurred. Furthermore, although future comparisons have the potential to provide insight into the changing effects of disease on premature mortality and the effectiveness of targeted programs, the requirement to compile many years of data for significant comparisons for San Luis Obispo County prevents future studies from making any near future comparisons. Also, the accuracy of all information used in calculations and conclusions is dependent on the accuracy of the death registry and death certificates, which can vary by region and underlying cause [8]. While these limitations are important to consider, the implications of the identification of the causes of premature mortality can allow for specific, targeted public health intervention can have very profound effects.

Future work may include taking steps to further investigate particular causes of death, such as the amount of premature mortality caused by cancer due to smoking. In addition, future studies may seek to include diseases that are more specific to young people, unlike alzheimer's which exclusively affects the adults. Further, the development of specific, public health intervention plans to reduce particular causes of premature mortality, perhaps targeting specific age groups, is an important next step. Finally, the continuation of evaluation of these and other causes of premature mortality in the County of San Luis Obispo is crucial to continually develop programming to reduce premature mortality.

**References:**

1. Centers for Disease Control. Premature mortality in the United States: public health issues in the use of years of potential life lost. Center for Disease Control, MMWR 35:1S-11S; 1986. Available from:  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm>
2. Dranger E, Remington P. Department of Population Health Sciences, Univ. of Wisconsin Medical School. *YPLL: A Summary Measurement of Premature Mortality Used in Measuring the Health of Communities*. Wisconsin Public Health & Health Policy Institute Issue Brief 5:7; Oct 2004. Available from:  
<http://uwphi.pophealth.wisc.edu/publications/issue-briefs/issueBriefv05n07.pdf>
3. Aragón TJ, Lichtensztajn DY, Katcher BS, Reiter R, Katz MH. *Calculating Expected Years of Life Lost to Rank the Leading Causes of Premature Death in San Francisco*. San Francisco Department of Public Health; 2007. Available from:  
[http://www.sfdph.org/dph/files/reports/StudiesData/CHE\\_Rpt07242007C.pdf](http://www.sfdph.org/dph/files/reports/StudiesData/CHE_Rpt07242007C.pdf)
4. Center for Health Statistics Information for Local Health Officers. National Center for Health Statistics; May 2012. Available from: <http://www.cdc.gov/nchs/hus.htm>
5. State of California, Department of Finance. *Race/Ethnic Population with Age and Sex Detail, 2000–2050*. Sacramento, CA; May 2004. Available from:  
<http://www.dof.ca.gov/HTML/DEMOGRAP/Data/DRUdatafiles.asp>
6. United States Census Bureau, Population Estimates Branch. *Population Estimates: Age, Sex, Race, and Hispanic Origin: Annual Estimates of the Resident Population by Age, Sex, Race, and Hispanic Origin for Counties: April 1, 2000 to July 1, 2009*. United States Census Bureau; Dec 2011. Available from:  
<http://www.census.gov/popest/data/counties/asrh/2009/CC-EST2009-alldata.html>
7. United States Census Bureau, Population Estimates Branch. *Population Estimates: Current Estimates Data*. United States Census Bureau; May 2012. Available from:  
<http://www.census.gov/popest/data/index.html>
8. Maudsley G, Williams EM. "Inaccuracy" in death certification—where are we now? *Journal of Public Health Medicine* 18:1:59-66; 1996. Available from:  
<http://jpubhealth.oxfordjournals.org/content/18/1/59.long>
9. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. *ICD-10 Cause-of-Death Lists for Tabulating Mortality Statistics (Updated October 2002 to include ICD codes for Terrorism Deaths for data year 2001 and WHO updates to ICD-10 for data year 2003)*. U.S. Department of Health and Human Services; Oct 2002. Available from:  
[http://www.cdc.gov/nchs/data/dvs/im9\\_2002.pdf.pdf](http://www.cdc.gov/nchs/data/dvs/im9_2002.pdf.pdf)

**Appendix:**

**A. ICD-10 Codes for the 10 Leading Causes of Death and Designated Excel Identification Codes [9]**

**#1 – Heart Disease**

Acute rheumatic fever and chronic rheumatic heart diseases.....	I00-I09
Hypertensive heart disease.....	I11
Hypertensive heart and renal disease.....	I13
Ischemic heart diseases.....	I20-I25
Other heart diseases.....	I26-I51

**#2 – Cancer**

Malignant neoplasms.....	C00-C97
--------------------------	---------

**#3 – Cerebrovascular Disease**

Cerebrovascular diseases.....	I60-I69
-------------------------------	---------

**#4 – Chronic Lower Respiratory Disease**

Chronic lower respiratory diseases.....	J40-J47
---	---------

**#5 – Accidents**

Accidents (unintentional injuries).....	V01-X59, Y85-Y86
---	------------------

**#6 – Alzheimer’s**

Alzheimer’s disease.....	G30
--------------------------	-----

**#7 – Diabetes**

Diabetes mellitus.....	E10-E14
------------------------	---------

**#8 – Influenza/Pneumonia**

Influenza and pneumonia.....	J09-J18
------------------------------	---------

**#9 – Liver Disease**

Chronic liver disease and cirrhosis.....	K70, K73-K74
--	--------------

**#10 – Suicide**

Intentional self-harm (suicide).....	*U03, X60-X84, Y87.0
--------------------------------------	----------------------

**B. Calculating Years of Potential Life Lost (YPLL) [3]**

To calculate the age at death of all individuals ( $A_D$ ), the year of the decedent’s birth ( $Y_B$ ) was subtracted from the year of the decedent’s death ( $Y_D$ ). The age at death ( $A_D$ ) was then subtracted from the standard life expectancy to compute the years of potential life lost for the standardized age of 75 years old ( $YPLL[75]$ ). The sum of the YPLL for each age group ( $Y_S$ ) was then calculated by summing all the individual YPLLs

for an age group (YPLL). %YPLL is equal to the YPLL for a specific cause of death divided by the sum of the YPLLs for all causes of death.

$$A_D = Y_D - Y_B$$

$$YPLL[75] = 75 - A_D$$

$$Y_S = \sum YPLL$$

$$\%YPLL = YPLL / \sum YPLL$$

#### A.2 Calculating Age-Standardized Years of potential life lost Rates (ASYR)

In calculating the ASYR, the 2010 census was used to estimate the population of individuals in each age group both in County of San Luis Obispo and in the United States. For every cause of death at each age group, the weighted 2010 US standard population ( $U_W$ ) was calculated by dividing the estimated number of individuals in the US in each age group ( $U_N$ ) by the sum of the estimated number of individuals in the US for all age groups under 75 years old.

$$U_W = U_N / \sum U_N$$

The YPLL per population at each age group for each cause of death ( $Y_P$ ) was then calculated using the 2010 County of San Luis Obispo Population Estimate ( $P_S$ ) by dividing the sum of the YPLLs for each age group ( $Y_S$ ) by the population estimates.

$$Y_P = Y_S / P_S = \sum YPLL / P_S$$

The age-specific rates of years potential life lost for each cause of death and age group ( $R_A$ ) were then calculated by multiplying the weighted 2010 US standard population ( $U_W$ ) by YPLL per population at each age group for each cause of death ( $Y_P$ ).

$$R_A = U_W * Y_P$$

The age-standardized years potential life lost rates for each cause of death (ASYR) was then calculated by summing the age-specific rates of years of potential life lost for each cause of death and age group ( $R_A$ ).

$$ASYR = \sum R_A = (U_N / \sum U_N) * (\sum YPLL / P_S)$$