Factors Associated with the Increase in Prescriptions for Opioid Analgesic Medications in Kentucky between 2001 to 2007

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October 2010

Prepared for

Kentucky Cabinet for Health and Family Services

Office of Inspector General

Drug Enforcement and Professional Practices Branch

This project supported by federal Harold Rogers Grant 2008-PM-BX-0013 awarded by the U.S. Bureau of Justice Assistance, Office of Justice Programs.

Executive summary

Between 2001 and 2007, the number of prescription dispensed (NOPD) to Kentucky residents for opioid analgesic medications (OA) from sources in Kentucky increased by 28%, from 3,698,827 to 4,760,768. Much effort has been focused on reducing the supply of these medications available for abuse and misuse by reducing diversion after the medications have been dispensed. The purpose of this study was to investigate the potential of reducing demand for OA through injury and disease prevention and health promotion.

To this end, we conducted a retrospective, ecological study using time-series regression analysis. We compared the trend in annual NOPD in Kentucky from 2001 to 2007 with the trends in injury and cancer incidence, by county, while controlling for trends in covariates including age, sex, race, ethnicity, level of urbanization, poverty level, unemployment, and others.

Counter to our expectation, the increase in NOPD from 2001 to 2007 was unrelated to trends in both injury and cancer incidence. The county characteristics that were associated in trend with NOPD were proportion of residents age 25 or older, proportion of female residents, proportion of residents in urban areas, proportion of Hispanic residents, and Appalachian county designation. With the exception of proportion of females, which was protective, each of these characteristics was associated with increasing NOPD over the study period.

The absence of a trend association between NOPD and both injury and cancer incidence suggests that the rise in NOPD in Kentucky from 2001 to 2007 was driven by factors other than an increase in the underlying need for OA for treatment of pain. While doctor shopping and diversion may have played a role, other factors such as increased attention and focus on pain management may also have contributed. Unfortunately, this finding indicates that reductions in injury and cancer incidence – whether achieved through health promotion efforts, prevention efforts, or other means – would likely not affect the trend of increasing NOPD in Kentucky.

Background

Between 2001 and 2007, the number of prescriptions dispensed in Kentucky for OA medications increased by 28%, from 3,698,827 to 4,760,768. Medical conditions for which the prescribing of OA is indicated include acute pain, such as might result from injuries or surgical procedures, and certain types of chronic pain resulting from chronic or degenerative diseases or cancer. They may also be prescribed for treatment of cough, diarrhea, anxiety due to shortness of breath, and opioid dependence. The primary purpose of this study was to determine the extent to which increases in the incidence of certain causes of acute and chronic pain were associated with the increasing trend in NOPD from 2001 to 2007. Our aim was to identify conditions that could be targeted for prevention through public health interventions, thus decreasing the need for OA. For example, if the increase in prescribing was associated with an increase in certain types and causes of nonfatal injuries, then a greater focus on preventing those injuries could reduce overall demand for medications over the long term. This type of demand-side approach would complement existing law enforcement efforts that seek to limit supply by identifying and preventing doctor shopping, fraudulent prescribing, and other forms of prescription drug diversion.

Methods

Data Sources

The data for this project came from the following sources:

1. For OA prescriptions: Kentucky All-Schedule Prescription Electronic Reporting (KASPER) system databases (2001-2007).
2. For non-fatal motor vehicle crash injuries: The Kentucky Collision Report and Analysis for Safer Highways (CRASH) system databases (2001-2007).
3. For all injury-related inpatient hospitalizations: The Kentucky inpatient hospital billing database (2001-2007).

4. For cancer rates: the Kentucky Cancer registry, a population-based central cancer registry for the Commonwealth of Kentucky (2001-2007).
5. For the socio-demographic variables, including age, racial, ethnic, and gender composition: U.S. Census Bureau County Estimates by Demographic Characteristics (2001-2007).
6. For the socio-economic variables, including median household income, percent of population living in urban area of the county, percent of a county's population in poverty, unemployment rates, health professional shortage areas: U.S. Census Bureau and U.S. Department of Health and Human Services, Health Resources and Services Administration Area Resource Files (2001-2007).
7. For other variables used as proxies for pain (e.g., percentage of a county's population having a joint pain in the last 30 days or activity limitations due to pain, and percentage of a county's population self-rating their overall health status as excellent, very good, etc.) and for alcohol and tobacco consumption (e.g., percentage of a county's currently or formerly smoking population and percentage of a county's population self-reporting heavy or binge drinking): Behavioral Risk Factor Surveillance System (BRFSS) public version data (2001-2007).
8. For the designation of a county as Appalachian: the Appalachian Regional Commission listing of counties in Appalachia.

Data Preparation

The preparation of the KASPER dataset for the analyses consisted of three stages:

1) Cleaning the original seven datasets: KASPER individual-level variables used in the analyses included the prescription recipient's date of birth, gender, date a prescription was filled, NOPD, metric quantity of OA dispensed (MQOD), and recipient's county and state names. We ran frequencies for each variable to assess the extent of invalid and missing values. We then dropped all the unnecessary variables. This was followed by dropping all the observations with

values for metric quantity exceeding 10,000 (as the highest reasonable value according to the KASPER program). Using the therapeutic codes, we dropped all prescriptions for medications other than OA's. Recipient's age at the time a prescription was filled was calculated by subtracting the date of recipient's birth from the year in which the prescription was filled. This resulted in some negative age values and some rather high values. Thus, observations with age values less than 0 or greater than 114 (which we arbitrarily chose as the maximum reasonable value) were dropped from the dataset. We also dropped those observations that had missing or incorrectly entered data (i.e., with characters other "F", "f", "M", and "m") on gender. Lastly, we dropped all those observations, for which the recipient's county information was missing or recipient's county was outside Kentucky.

2) Aggregating /collapsing the data: Since we chose counties as the unit of our analyses, we had to aggregate the individual-level variables of interest. Each of the seven KASPER datasets was collapsed into a separate dataset with the aforementioned variables of interest characterizing counties in Kentucky. More specifically, in each of the aggregated datasets, NOPD was shown as the total number of OA prescriptions filled for each of the 120 counties in Kentucky. MQOD was reported as the total metric quantity of OA dispensed for each of the 120 counties. Gender variable was reported as the percentage of females to whom a prescription was dispensed in a given county in a given year. The age breakdown of OA recipients was also calculated, but was not used in the final analysis. A variable identifying each year of observations was also created in each of the datasets. Federal Information Processing Standard (FIPS) codes were added to each of the datasets based on the county names. Considering the size of the data, the first two stages of preparing the final dataset were performed using Stata/IC version 11 (64-bit).
3) Incorporating other variables of interest from the aforementioned data sources and finalizing the dataset: additional variables of interest were merged with each of the existing datasets

using the FIPS codes as identifiers. Once all the merges were complete and finalized, all seven years were combined into one final dataset. Lastly, a dummy variable for a designation of counties as Appalachian was generated by matching the county names to the Appalachian Regional Commission listing of counties in Appalachia. We used Stata/IC version 10 for Windows (32-bit) to complete the third stage of preparing the final dataset.

The final dataset consisted of 840 observations, 120 groups (i.e., 120 counties in Kentucky), and a time-period consisting of 7 years (i.e., 2001 – 2007). The dependent variables were NOPD and MQOD for Kentucky counties in 2001-2007. The independent variables chosen fall into one of the two categories:

(1) those reflective of the socio-demographic and economic characteristics of the population living in counties of Kentucky, e.g., percentages of the population 0-24, 25-54, 55 and above, percentage of population white, black, and Hispanic, percentage of female population, median household income in the county, percentage of population living in poverty, and unemployment rate, and

(2) those used as proxies for the level of pain experienced by Kentucky residents, e.g., all-site cancer rates, rates of non-fatal injuries from motor vehicle crashes, and rates of injury-related hospitalizations for any mechanism of injury.

We had no missing data for these variables. However, data on variables such as percentage of population completing high school, percentage of insured population, health professional shortage areas, percentage of population self-reporting joint pain and activity limitations, percentage of population self-rating its health status as excellent/very good/good or poor, percentage of former and current smokers, and percentage of population self-reporting heavy or binge drinking in a county were often incomplete (i.e., we did not have these data either for each of the 120 counties or for all of the

seven years). Thus, these variables were not used in the final analyses, although we did conduct sub-analyses (since most of these variables came from the BRFSS, we used weights in our sub-analyses).

Data Analyses

Descriptive statistics were calculated for dependent and independent variables that had no missing data. We also looked at each of the dependent variables' trends for each county from 2001 to 2007 (results not presented in this report, but available upon request). To examine the overall trend we calculated the total NOPD and the total MQOD in Kentucky for each year and compared those numbers across years. We also looked at the trends by using the calculated crude rates of NOPD and MQOD. To assess the association between the trend for each independent variable and the trend in OPD and MQOD, we estimated rate ratios using time-series negative binomial regression (using total population of a county in a given year as an exposure option).

Our interest in understanding factors associated with the trend in OPD and MQOD over time led us to time-series regression analysis. Considering that each of our dependent variables represented counts, we first performed Poisson regression analysis. However, the test of the overdispersion parameter alpha, demonstrated that alpha was significantly different from zero ($p < 0.05$). Since the data did not fit the Poisson distribution, we chose negative binomial regression analysis instead. Furthermore, since we had multiple years of data for each county, it is likely data were correlated over time, which violates the assumption of the independence of observations. In addition, data were represented at the county level as rates of NOPD and MQOD per 100,000 population. Therefore, we utilized a random effects negative binomial model with a time-series panel that accounted for serial correlation of the data as well as the distribution of the data over time.

All analyses were conducted using Stata/IC version 10 for Windows.

Results

Descriptive Statistics

Our sample consisted of 120 counties and a time period of 7 years. As displayed in Table 3, on average there were 34,820 prescriptions filled (range, 1,472 – 762,677) or 1,867,834 metric quantities of prescription dispensed (range 73,029 – 45,700,000) per county in 2001 - 20007. The minimum number and amount of prescriptions were dispensed in Robertson and the maximum – in Jefferson Counties. As shown in Figures 1a, 1b, 2a, and 2b, there was a steady increase in the overall number and crude rate of OA prescriptions dispensed from 2001 to 2007.

Persons age 0-24, 25-54, and 55 or older represented 32.95%, 42.60%, and 24.45%, respectively, of the total population living in Kentucky during the 7-year period. White residents composed 94.79% (range, 72.29 – 99.38%); Blacks – 3.80% (range, 0.03 – 24.93%), and Hispanics – 1.35% (range, 0.19% - 8.56%) of all KY residents in 2001-2007. Slightly more than half of population of Kentucky was female (50.67%, range, 41.95 – 53.50%). This was only slightly lower than the percentage of females to whom OA were dispensed in Kentucky in 2001-2007 – 55.98% (range, 39.19 – 66.09%). Urban population was in the minority – 27.59% (0.00 – 98.20%). The median household income was $33,610; 18.59% (range, 5.00 – 45.40%) were considered to be living in poverty. The average unemployment rate in Kentucky in 2001-2007 was 6.52% (range 2.50 – 14.70%). With regard to variables used as proxies for the level of pain, experienced by the KY residents during the 7-year period, the lowest all-site crude incidence rate for cancer was 62.79 per 100,000 residents and the highest – 891.27 per 100,000 residents. As shown in Figure 3a, the crude rates of all-site cancer declined in 2001-2003 and increased in 2003 -2007. The lowest non-fatal crash injury rate and all injury-related hospitalizations crude rate were 77.77 and 197.16 per 1,000 residents, respectively, and the highest were 1,338.00 and 1,678.00 per 1,000 residents of Kentucky in 2001-2007, respectively.

Bivariate Results

As displayed in Table 4a, during the period 2001-2007, the only factor we examined that showed a moderately strong trend association with NOPD was Appalachian county designation. Specifically, Appalachian counties in Kentucky were 45% more likely than non-Appalachian counties in Kentucky to show an increase in OPD from 2001 to 2007. This was the difference found before controlling for other factors such as differences in population demographics and socioeconomic conditions between the two groups of counties.

Seven of the factors demonstrated a small, but significant, trend association with NOPD over the study period. Of these, four were protective against an increase in NOPD: proportion of population age 24 and younger, proportion of population age 25-54, proportion of population black and proportion of population living in urban areas of the county. The other four were risk factors for increasing NOPD: proportion of population age 55 or older, proportion of population Hispanic, and proportion of population living in poverty. Interpretations of the risk ratios (RR) for these factors are as follows.

- For each percentage point increase from 2001-2007 in a county's proportion of population age 24 or younger, its NOPD rate decreased on average by 6% (1-0.94 = 0.06 = 6%) over the same period.
- For each percentage point increase from 2001-2007 in a county's proportion of population age 25-54, its NOPD rate decreased on average by 3% over the same period.
- For each percentage point increase from 2001-2007 in a county's proportion of black, its NOPD rate decreased on average by 3% over the same period.
- For each percentage point increase from 2001-2007 in a county's proportion of population living in urban areas, its NOPD rate decreased on average by 1% over the same period.
- For each percentage point increase from 2001-2007 in a county's proportion of population age 55 or older, its NOPD rate increased on average by 6% over the same period.

- For each percentage point increase from 2001-2007 in a county's proportion of population Hispanic, its NOPD rate increased on average by 6% over the same period.
- For each percentage point increase from 2001-2007 in a county's proportion of population living in poverty, its NOPD rate increased on average by 2% over the same period.

Four factors showed a statistically significant trend association with NOPD, but the magnitude of the association was so small as to be negligible for all practical purposes. Three of our four variables of primary interest belong to this category: all-site cancer crude incidence rate, all invasive cancer crude incidence rate, and nonfatal crash injury crude rate. Interpretations of the RR's for these variables are as follows.

- For each increase of 1 per 100,000 in a county's crude rate of all-site cancer incidence from 2001-2007, its NOPD rate increased on average by 0.032% over the same period.
- For each increase of 1 per 100,000 in a county's crude rate of invasive cancer incidence from 2001-2007, its NOPD rate increased on average by 0.046% over the same period.
- For each increase of 1 per 1,000 in a county's crude rate of nonfatal crash injuries from 2001-2007, its NOPD rate decreased on average by 0.064% over the same period.
- For each increase of $1 in a county's median household income from 2001-2007, its NOPD rate increased on average by 0.002% over the same period.

Four factors were unrelated in trend to NOPD when considered without controlling for any other factors: proportion of population white, proportion of population female, unemployment rate, and crude rate of residents hospitalized due to injuries (any mechanism).

As shown in Table 4b, for the most part the bivariate results obtained by using MQOD as the dependent variable were qualitatively and quantitatively similar to those obtained using NOPD.

Multivariate Results

Next we examined combinations of variables for their simultaneous relationship with NOPD and MQOD. Out of several different regression models that we ran, of interest are the ones shown in Tables 5a, 6a, and 6b. We also chose to report the results of these models, because they had better values for their Akaike's and Schwarz's Bayesian information criteria (AIC and BIC).

As was the case for the bivariate analysis, Appalachian county designation remained the only factor to show more than a slight trend association with OPD when multiple variables were considered together. Specifically, when other factors are controlled for, Appalachian counties in Kentucky were 17% more likely than non-Appalachian counties in Kentucky to show an increase in NOPD from 2001 to 2007 (Table 5a).

Five of the factors demonstrated a small, but significant, trend association with NOPD over the study period, when other factors were controlled for. Of these, only one was protective against an increase in NOPD: proportion of population female. The other four were risk factors for increasing NOPD: proportion of population age 25-54, proportion of population age 55 or older, proportion of population Hispanic, and proportion of county population living in urban areas. Interpretations of the RR's for these factors are as follows.

- For each percentage point increase from 2001-2007 in a county's proportion of female, its NOPD rate decreased on average by 2.6% over the same period, after other factors were controlled for.
- For each percentage point increase from 2001-2007 in a county's proportion of population age 25-54, its NOPD rate increased on average by 2.6% over the same period, after other factors were controlled for.

- For each percentage point increase from 2001-2007 in a county's proportion of population age 55 or older, its NOPD rate increased on average by 5.3% over the same period, after other factors were controlled for.
- For each percentage point increase from 2001-2007 in a county's proportion of population living in urban areas, its NOPD rate increased on average by 0.3% over the same period, after other factors were controlled for.
- For each percentage point increase from 2001-2007 in a county's proportion of population Hispanic, its NOPD rate increased on average by 3.2% over the same period, after other factors were controlled for.

Six factors were unrelated in trend to OPD after controlling for other factors, including all three of our variables of primary interest that were entered into the multivariate model: proportion of population white, proportion of population in poverty, unemployment rate, and all cancers crude incidence rate, nonfatal crash injuries crude rate, and crude rate of residents hospitalized due to injuries (any mechanism).

As shown in Tables 6a and 6b, the multivariate results obtained by using MQOD as the dependent variable were quite similar to those obtained using NOPD.

Discussion

After controlling for numerous covariates, this study found no association between the increase in NOPD in Kentucky and the trends in the incidence of crash-related injuries, injury related hospitalizations, or cancer from 2001 to 2007. This suggests that something other than a change in the underlying need for OA medications drove the increase in OPD from 2001 to 2007. This trend is not particular to Kentucky. Kuhen (2007) noted that between 1999 and 2002, prescriptions for several OA medications increased nationally, including oxycodone (50%, to 29 million in 2002), fentanyl (150%, to 4.6 million), and morphine (60%, to 3.8 million). She writes that, "In addition to increased awareness of

the importance of pain control, pain experts attribute the overall increases in prescription pain medication use to a variety of factors, including support and requirements for appropriate pain control from state medical boards and advances in the science of pain control."

In this study, several factors demonstrated a very modest association in trend with NOPD, including proportion of county residents age 25-54 (IRR=1.026, 95% CI=(1.011, 1.041)), proportion of county residents age 55 or older (IRR=1.053, 95% CI=(1.041, 1.065)), proportion of county residents female (IRR=0.974, 95% CI=(0.967, 0.982)), proportion of county residents in urban areas (IRR=1.003, 95% CI=(1.001, 1.005)), and proportion of county residents Hispanic (IRR=1.032, 95% CI=(1.017,1.046)). With the exception of proportion of females, which was protective, all of these characteristics were associated in trend with increasing NOPD over the study period.

There have been a number of studies over the past couple of decades examining racial and ethnic disparities in the prescribing of OA for pain-related visits to hospital emergency departments (EDs). One such recent study (Pletcher et al., 2008) examined thirteen years of data from the National Hospital Ambulatory Medical Care Survey (NHAMCS), an annual population-based survey of visits to U.S. emergency departments. The authors found that the percentage of pain-related visits for which an OA was prescribed increased from 23% (95% confidence interval [CI] 21%-24%) in 1993 to 37% (95% CI 34%-39%) in 2005. Furthermore, white patients were significantly more likely than black, Hispanic, or Asian/other patients to receive an OA. Pletcher and colleagues concluded that opioid prescribing in ED's increased following national efforts in the 1990's, led by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the Veterans Health Administration, to focus attention on the problem of inadequate treatment of pain.

Although our study was not confined to prescriptions written or dispensed in ED's in Kentucky, the Pletcher study nevertheless provides some interesting perspective. If the bias toward prescribing OA's for white patients seen in ED's is also present in other settings (doctor's offices, etc.), then it would

be reasonable to expect counties with higher proportions of white residents to have a greater increase in NOPD trend, as we observed. Conversely, the finding that Hispanics are less likely than whites to receive an OA at an ER seems counter to our finding that counties with higher proportions of Hispanic residents had a greater increase in NOPD trend. However, given that in our study the unit of analysis was the county, we must avoid the ecological fallacy of attempting to apply our findings to individuals. The proportion of Hispanics may itself not be a causal factor for the increase in NOPD, but may simply be correlated with other (unmeasured) factors that were, in fact, causal. Finally, the finding of an increase in OA prescribing in ED's following the national quality initiatives on undertreatment of pain in the 1990's suggests another factor possibly contributing to the increase in NOPD in Kentucky.

Appalachian county designation showed a larger, but still modest association with increasing OPD trend (IRR=1.167, 95% CI=(1.032, 1.318)). In a recent report commissioned by the Appalachian Research Commission (ARC), Zhang et al. (2008) analyzed data from several large, federal data sets including the National Survey on Drug Use and Health (NSDUH), the Treatment Episode Data Set (TEDS), the Healthcare Cost and Utilization Project (HCUP), and the National Survey of Substance Abuse Treatment Services (N-SSATS). The authors concluded that hospital admission rates for primary abuse of opiates and other synthetics were higher in Appalachia than in the rest of the U.S., and furthermore that within Appalachia the rates were particularly high in coal-mining areas. Zhang and colleagues also found higher rates in Appalachia than in other areas of the U.S. for admission to treatment for primary abuse of opiates or other synthetics. These rates were found to be highest in the central part of the Appalachian region – much of which is comprised of Kentucky counties – and in the coal mining areas. It is not surprising, then, that our study found that although NOPD has been increasing statewide, the increase is somewhat greater in Appalachian counties than in the rest of the state.

Table 1a. NOPD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Adair	12,672	725	14,195	808	16,475	934	17,189	974
Allen	18,602	1,042	18,747	1,040	22,167	1,222	24,482	1,337
Anderson	15,798	812	16,952	872	17,993	915	18,630	936
Ballard	5,865	714	6,614	811	6,943	844	7,535	917
Barren	25,833	672	25,562	662	31,581	810	33,186	843
Bath	9,484	840	10,687	936	10,715	936	14,728	1,284
Bell	67,768	2,288	69,504	2,334	71,249	2,409	65,886	2,241
Boone	66,052	732	69,148	741	72,332	748	80,696	799
Bourbon	20,993	1,082	22,227	1,147	21,822	1,122	21,198	1,083
Boyd	41,736	842	40,857	826	41,666	842	43,453	883
Boyle	22,980	832	25,512	920	26,035	936	24,793	875
Bracken	5,744	687	5,499	651	7,148	847	7,962	919
Breathitt	19,973	1,255	19,338	1,226	22,766	1,451	23,615	1,500
Breckinridge	13,155	702	13,337	708	14,104	746	13,230	700
Bullitt	41,675	659	43,816	676	47,245	710	50,330	730
Butler	9,968	759	9,685	737	11,604	878	11,962	894
Caldwell	10,775	839	12,772	998	14,159	1,108	14,614	1,147
Calloway	24,973	726	29,853	868	31,633	911	30,717	875
Campbell	76,571	863	78,218	886	69,981	797	72,879	834
Carlisle	3,737	703	3,722	700	4,073	772	4,934	933
Carroll	8,728	859	11,361	1,106	10,749	1,043	10,714	1,040
Carter	22,112	822	23,681	874	25,379	932	25,700	946
Casey	13,969	894	15,400	975	15,897	1,003	16,118	1,007
Christian	39,493	528	37,888	498	39,595	513	44,684	575
Clark	36,832	1,101	39,114	1,167	39,453	1,166	40,936	1,195
Clay	42,798	1,748	47,126	1,924	51,559	2,122	54,064	2,242
Clinton	17,195	1,792	17,667	1,846	18,547	1,945	16,420	1,728
Crittenden	11,534	1,242	12,375	1,350	12,493	1,364	12,716	1,409
Cumberland	5,427	761	6,290	884	8,335	1,178	9,730	1,372
Daviess	45,105	492	49,592	541	49,567	538	49,287	534
Edmonson	8,929	760	9,328	792	10,071	854	10,535	893
Elliott	4,592	684	5,089	757	5,420	796	6,041	892
Estill	17,978	1,174	19,187	1,259	19,274	1,280	19,594	1,308
Fayette	177,173	670	187,476	702	188,577	695	183,614	669
Fleming	9,713	690	10,876	768	11,161	777	12,801	886
Floyd	92,179	2,187	91,940	2,178	91,208	2,168	87,876	2,087
Franklin	39,540	822	41,399	859	44,597	928	47,715	987
Fulton	8,368	1,079	8,338	1,102	8,191	1,102	8,015	1,102
Gallatin	6,330	793	6,621	845	6,988	875	8,003	1,003
Garrard	14,489	958	15,279	983	16,311	1,030	16,244	1,016
Grant	20,853	902	19,769	841	21,680	907	25,511	1,054

Table 1a. NOPD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Graves	34,377	929	35,645	964	36,670	987	38,191	1,028
Grayson	29,056	1,202	31,311	1,293	33,801	1,374	32,778	1,317
Green	7,434	641	8,085	698	9,214	794	9,962	869
Greenup	61,099	1,656	58,064	1,579	58,298	1,579	62,534	1,694
Hancock	3,862	458	4,028	477	5,040	597	5,167	614
Hardin	56,071	592	58,708	618	60,268	632	60,290	631
Harlan	45,677	1,409	45,270	1,400	52,043	1,636	53,217	1,702
Harrison	18,240	1,013	19,516	1,085	17,062	942	17,362	956
Hart	12,448	719	12,599	716	13,641	767	13,513	756
Henderson	42,822	956	45,015	1,002	48,284	1,074	47,818	1,062
Henry	10,493	689	11,035	723	12,093	783	13,246	852
Hickman	3,239	619	3,244	622	3,489	676	3,668	724
Hopkins	46,277	1,004	49,569	1,072	52,296	1,127	51,496	1,110
Jackson	14,106	1,037	14,337	1,060	15,451	1,149	16,173	1,207
Jefferson	570,792	821	600,851	863	623,296	892	634,365	907
Jessamine	35,177	885	37,938	933	40,470	979	40,368	960
Johnson	42,388	1,815	43,149	1,847	43,709	1,867	43,190	1,832
Kenton	97,599	642	100,644	663	101,808	668	103,497	677
Knott	25,313	1,447	24,758	1,406	26,852	1,534	25,826	1,488
Knox	41,386	1,310	45,062	1,428	49,211	1,552	50,215	1,580
Larue	7,465	558	8,453	630	10,110	762	11,038	826
Laurel	55,357	1,034	58,836	1,084	62,299	1,131	63,724	1,149
Lawrence	20,964	1,338	22,408	1,419	21,625	1,370	21,817	1,367
Lee	14,234	1,813	14,814	1,889	15,394	1,956	14,594	1,896
Leslie	17,769	1,456	19,352	1,588	19,596	1,626	19,236	1,620
Letcher	41,663	1,681	44,477	1,796	47,314	1,918	42,080	1,723
Lewis	18,601	1,330	15,402	1,124	14,146	1,036	14,590	1,061
Lincoln	19,606	824	22,284	930	23,598	973	24,864	1,015
Livingston	10,556	1,076	12,502	1,280	13,093	1,352	12,970	1,348
Logan	15,834	595	20,597	773	22,159	833	22,320	835
Lyon	8,953	1,100	9,017	1,109	9,499	1,164	9,107	1,107
McCracken	69,901	1,078	70,275	1,088	74,130	1,151	74,915	1,166
McCreary	27,183	1,600	29,149	1,709	32,761	1,929	29,098	1,591
McLean	7,470	759	8,695	875	8,886	903	8,917	908
Madison	56,227	774	62,879	852	65,873	876	66,313	862
Magoffin	25,912	1,967	25,683	1,940	24,706	1,871	24,182	1,833
Marion	13,239	722	14,880	807	15,911	858	14,383	762
Marshall	28,826	957	30,618	1,013	32,466	1,068	33,704	1,103
Martin	28,952	2,332	24,946	2,015	25,852	2,105	23,359	1,777
Mason	12,933	770	13,246	788	13,079	783	13,895	829
Meade	13,561	506	14,426	531	14,625	535	14,409	518

Table 1a. NOPD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Menifee	4,762	712	5,651	839	5,860	877	8,031	1,194
Mercer	18,423	884	19,802	941	20,206	951	21,097	986
Metcalfe	6,963	690	6,990	701	8,131	816	8,881	888
Monroe	15,288	1,297	14,705	1,254	15,584	1,331	13,952	1,199
Montgomery	21,501	942	24,111	1,041	24,263	1,036	25,356	1,071
Morgan	11,238	799	11,854	836	11,134	782	14,282	995
Muhlenberg	31,866	1,003	36,238	1,147	38,348	1,217	39,713	1,260
Nelson	34,256	897	35,191	907	38,168	967	40,352	1,004
Nicholas	7,026	1,026	5,478	788	6,574	943	7,131	1,018
Ohio	17,455	759	19,559	848	21,585	938	20,652	887
Oldham	25,407	531	27,759	567	28,601	563	31,514	604
Owen	5,113	480	6,312	581	6,989	641	8,482	764
Owsley	8,566	1,784	8,783	1,852	10,509	2,230	10,069	2,108
Pendleton	11,264	771	11,303	768	10,498	707	11,320	762
Perry	59,513	2,038	53,980	1,841	58,196	1,984	57,275	1,958
Pike	72,824	1,077	74,357	1,102	80,318	1,202	71,991	1,090
Powell	18,032	1,352	19,477	1,468	19,484	1,468	19,857	1,476
Pulaski	69,830	1,233	74,111	1,298	75,925	1,319	75,613	1,297
Robertson	1,472	656	1,485	652	1,594	697	1,706	751
Rockcastle	17,210	1,042	19,892	1,201	17,767	1,074	24,023	1,452
Rowan	15,435	693	18,177	816	18,434	829	19,536	887
Russell	7,436	454	7,813	476	7,957	482	8,397	502
Scott	30,624	888	33,330	939	33,329	912	34,327	908
Shelby	27,246	800	28,868	829	29,174	814	29,758	807
Simpson	16,596	1,001	17,003	1,025	18,908	1,137	19,301	1,153
Spencer	7,687	605	9,322	695	12,693	897	11,743	800
Taylor	16,175	704	19,740	845	22,802	974	26,430	1,122
Todd	6,059	504	6,350	532	6,683	563	7,198	611
Trigg	8,657	683	9,256	729	10,515	826	11,289	867
Trimble	4,814	572	4,931	577	5,155	597	5,435	614
Union	17,752	1,140	19,092	1,224	19,112	1,230	19,612	1,256
Warren	70,724	754	74,604	787	80,754	837	83,074	849
Washington	6,064	552	6,324	569	6,457	578	7,143	638
Wayne	23,956	1,200	30,431	1,516	27,659	1,362	26,455	1,296
Webster	13,648	977	14,941	1,067	15,993	1,149	15,578	1,114
Whitley	71,637	1,966	78,020	2,128	83,339	2,254	82,405	2,208
Wolfe	7,712	1,116	9,007	1,298	9,489	1,366	10,540	1,518
Woodford	17,843	764	18,923	807	19,238	815	19,974	840

* Per 1,000 residents

Table 1b. NOPD for KY residents, by county (2005-2007)

	2005		2006		2007	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Adair	16,324	923	18,895	1,060	19,292	1,077
Allen	25,780	1,399	29,199	1,563	28,531	1,513
Anderson	18,491	914	21,096	1,014	23,135	1,084
Ballard	7,389	897	7,602	931	8,145	1,001
Barren	37,525	938	37,916	936	43,888	1,069
Bath	13,506	1,168	12,437	1,074	14,409	1,251
Bell	63,934	2,184	65,455	2,247	69,312	2,388
Boone	87,881	832	94,293	861	103,511	918
Bourbon	22,233	1,128	22,537	1,152	23,813	1,214
Boyd	45,066	921	46,855	961	47,589	980
Boyle	28,625	1,004	28,946	1,008	31,593	1,093
Bracken	8,367	971	9,017	1,051	9,718	1,129
Breathitt	25,154	1,599	24,982	1,596	27,865	1,787
Breckinridge	15,042	790	14,960	789	16,116	845
Bullitt	53,647	754	57,901	800	65,800	892
Butler	12,950	973	15,159	1,131	16,469	1,239
Caldwell	15,045	1,178	16,044	1,256	14,941	1,166
Calloway	31,774	896	32,697	909	34,331	949
Campbell	73,607	843	78,370	899	83,407	955
Carlisle	5,030	958	5,252	999	6,281	1,218
Carroll	11,568	1,110	12,595	1,208	15,253	1,453
Carter	29,318	1,074	29,982	1,096	29,054	1,064
Casey	15,653	971	15,253	940	16,265	998
Christian	45,453	582	42,929	547	51,902	641
Clark	44,482	1,284	47,328	1,346	49,936	1,400
Clay	54,465	2,274	52,321	2,191	52,012	2,196
Clinton	18,779	1,986	20,045	2,138	22,198	2,343
Crittenden	13,532	1,502	13,909	1,527	13,026	1,432
Cumberland	11,362	1,636	12,648	1,824	12,776	1,875
Daviess	51,719	558	54,829	588	60,290	642
Edmonson	10,877	911	11,609	976	12,149	1,017
Elliott	6,083	808	5,306	662	6,472	792
Estill	22,100	1,487	20,887	1,403	23,880	1,603
Fayette	194,372	698	208,254	735	220,437	767
Fleming	13,794	952	13,102	904	13,948	951
Floyd	87,805	2,088	87,696	2,094	86,568	2,060
Franklin	48,091	994	49,020	1,012	53,763	1,108
Fulton	7,452	1,051	8,193	1,193	8,376	1,221
Gallatin	8,011	996	9,199	1,146	9,653	1,195
Garrard	16,909	1,033	17,172	1,030	18,768	1,105
Grant	26,417	1,082	30,848	1,246	33,609	1,336

Table 1b. NOPD for KY residents, by county (2005-2007)

	2005		2006		2007	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Graves	40,820	1,093	40,821	1,092	44,697	1,190
Grayson	34,576	1,379	34,891	1,386	35,391	1,398
Green	10,451	911	10,649	924	10,527	914
Greenup	66,067	1,788	66,724	1,787	68,073	1,815
Hancock	4,111	481	5,492	640	5,815	677
Hardin	64,249	663	70,451	726	72,506	739
Harlan	49,129	1,581	57,146	1,840	59,408	1,912
Harrison	18,455	1,014	20,589	1,122	21,136	1,137
Hart	15,058	832	15,353	844	15,196	831
Henderson	47,487	1,053	53,068	1,176	55,233	1,223
Henry	13,652	874	14,818	940	18,266	1,154
Hickman	3,621	721	3,970	802	4,134	844
Hopkins	54,584	1,182	56,667	1,227	60,275	1,303
Jackson	17,305	1,283	18,031	1,340	18,510	1,379
Jefferson	648,622	925	686,684	974	762,677	1,072
Jessamine	42,246	979	44,205	991	49,216	1,080
Johnson	42,262	1,779	44,396	1,860	42,144	1,763
Kenton	109,471	714	120,847	779	127,512	813
Knott	24,482	1,405	25,684	1,490	25,794	1,509
Knox	48,193	1,503	51,994	1,616	52,519	1,627
Larue	11,199	831	11,857	874	11,535	850
Laurel	63,812	1,139	71,943	1,269	76,748	1,340
Lawrence	24,535	1,522	25,706	1,586	25,076	1,536
Lee	13,788	1,835	15,119	2,021	14,980	2,016
Leslie	20,381	1,718	19,940	1,701	20,248	1,730
Letcher	37,829	1,565	38,215	1,589	36,813	1,537
Lewis	15,965	1,160	15,746	1,134	15,872	1,138
Lincoln	25,558	1,025	25,853	1,030	27,511	1,093
Livingston	13,812	1,426	14,926	1,549	16,624	1,737
Logan	22,730	846	23,279	864	24,985	921
Lyon	9,003	1,087	9,755	1,164	10,380	1,245
McCracken	74,275	1,153	79,007	1,222	81,377	1,253
McCreary	23,935	1,272	23,246	1,235	23,803	1,339
McLean	9,004	920	9,407	972	9,721	1,002
Madison	70,473	891	74,392	921	76,019	935
Magoffin	23,017	1,747	26,473	2,019	28,949	2,200
Marion	17,411	915	19,445	1,016	20,572	1,072
Marshall	35,314	1,150	35,861	1,157	38,467	1,231
Martin	20,528	1,514	20,329	1,518	19,154	1,445
Mason	14,128	838	15,797	925	15,730	915
Meade	15,432	553	16,446	598	17,753	653

Table 1b. NOPD for KY residents, by county (2005-2007)

	2005		2006		2007	
County	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*	Prescription Filled	Crude Rate*
Menifee	7,534	1,119	8,223	1,220	9,000	1,348
Mercer	21,907	1,016	22,117	1,025	23,692	1,089
Metcalfe	9,501	943	9,322	923	10,760	1,059
Monroe	15,479	1,315	17,802	1,516	15,962	1,370
Montgomery	27,883	1,152	31,191	1,261	33,123	1,315
Morgan	13,608	954	15,344	1,078	16,625	1,166
Muhlenberg	40,321	1,282	40,526	1,289	44,182	1,405
Nelson	37,995	930	43,228	1,035	48,446	1,142
Nicholas	8,950	1,284	8,945	1,287	8,997	1,300
Ohio	24,149	1,033	25,603	1,094	27,247	1,160
Oldham	32,903	617	35,208	638	39,616	700
Owen	9,328	836	9,468	846	10,196	898
Owsley	10,031	2,128	10,476	2,256	12,066	2,617
Pendleton	12,055	807	13,545	901	14,503	968
Perry	53,302	1,831	57,020	1,957	60,297	2,069
Pike	73,157	1,113	83,675	1,275	76,315	1,165
Powell	21,556	1,583	23,186	1,713	24,531	1,799
Pulaski	79,207	1,346	83,663	1,408	82,790	1,381
Robertson	1,824	822	1,963	864	1,933	877
Rockcastle	22,576	1,364	20,874	1,262	22,042	1,330
Rowan	21,935	990	22,561	1,006	23,933	1,059
Russell	8,176	485	8,341	489	8,843	518
Scott	36,699	933	41,524	1,000	45,360	1,054
Shelby	31,281	823	34,154	864	38,922	958
Simpson	19,128	1,132	18,107	1,065	19,647	1,152
Spencer	14,125	922	16,873	1,048	19,073	1,128
Taylor	25,712	1,082	26,983	1,125	29,009	1,204
Todd	7,741	653	8,360	700	9,558	796
Trigg	12,034	919	12,318	938	13,800	1,035
Trimble	6,222	706	7,049	793	8,413	938
Union	19,968	1,295	17,483	1,143	18,786	1,249
Warren	90,587	905	93,527	911	100,902	966
Washington	8,443	750	9,146	805	9,699	842
Wayne	28,915	1,415	29,663	1,451	29,192	1,419
Webster	16,599	1,185	17,073	1,230	17,383	1,252
Whitley	79,271	2,103	87,838	2,320	91,160	2,381
Wolfe	11,100	1,577	11,804	1,669	13,204	1,854
Woodford	21,271	885	21,076	869	21,734	892

* Per 1,000 residents

Figure 1a. Total OPD for Kentucky Residents during 2001-2007.

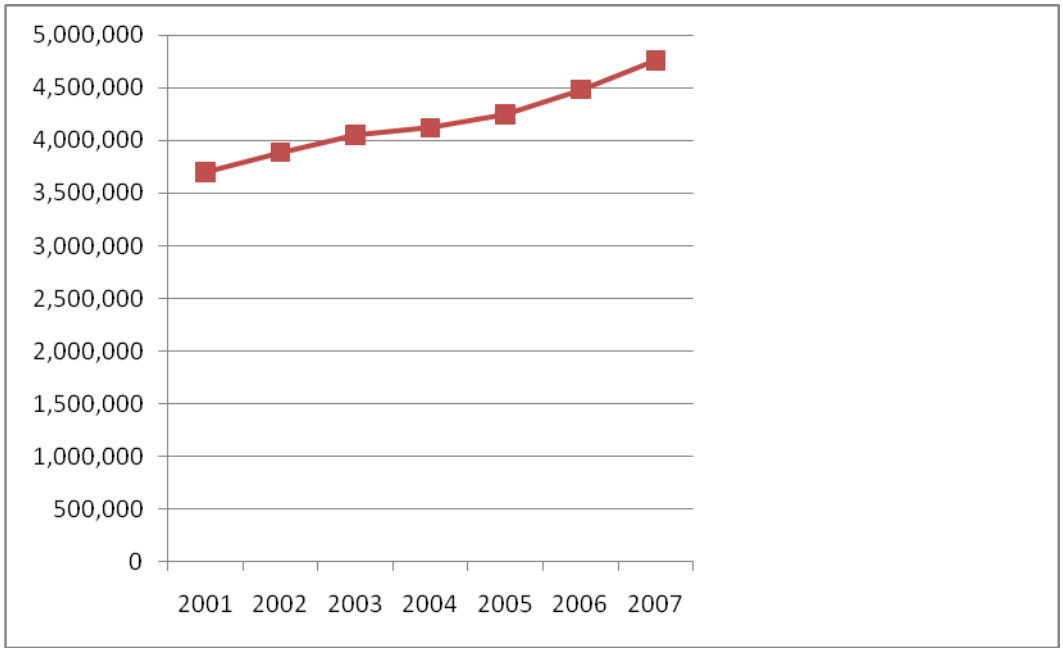

Figure 1b. Crude Rate of NOPD for Kentucky Residents during 2001-2007.

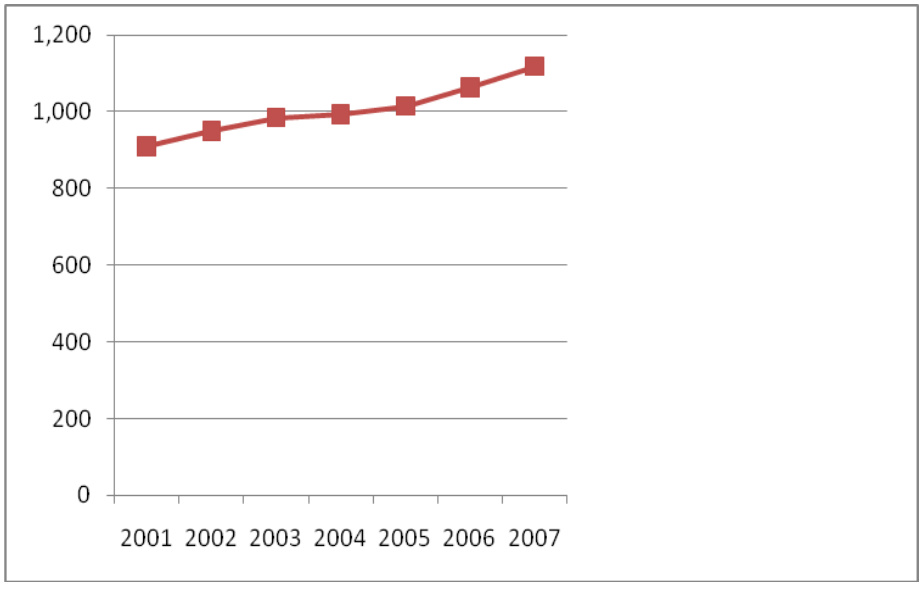

Table 2a. MQOD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*
Adair	534962	30,620	664,253	37,795	728,475	41,285	796,855	45,160
Allen	640274	35,864	709,173	39,324	860,966	47,454	966,541	52,773
Anderson	738916	37,973	803,097	41,324	914,657	46,531	962,914	48,368
Ballard	232826	28,331	284,261	34,874	360,558	43,810	427,296	52,001
Barren	982388	25,541	1,023,053	26,505	1,273,160	32,661	1,398,608	35,524
Bath	413671	36,650	505,249	44,254	532,891	46,573	717,957	62,616
Bell	3079286	103,946	3,398,409	114,102	3,639,161	123,032	3,460,360	117,691
Boone	2974052	32,953	3,351,444	35,897	3,812,073	39,415	4,414,303	43,734
Bourbon	923964	47,605	1,024,585	52,865	1,009,075	51,902	1,029,767	52,604
Boyd	2064859	41,660	2,128,558	43,053	2,320,364	46,881	2,530,778	51,446
Boyle	927571	33,575	1,118,822	40,357	1,212,976	43,621	1,186,983	41,915
Bracken	319642	38,235	302,542	35,804	371,513	44,023	424,894	49,053
Breathitt	949737	59,687	1,003,141	63,603	1,286,188	81,980	1,381,351	87,727
Breckinridge	693793	37,020	736,203	39,089	853,899	45,180	785,789	41,548
Bullitt	2028933	32,102	2,261,775	34,892	2,535,153	38,085	2,824,833	40,983
Butler	375366	28,571	433,003	32,930	516,501	39,079	603,479	45,093
Caldwell	572388	44,558	695,335	54,357	818,098	64,019	924,372	72,534
Calloway	1113088	32,361	1,491,091	43,341	1,645,203	47,388	1,739,003	49,563
Campbell	3520033	39,690	3,733,447	42,285	3,679,957	41,925	3,999,903	45,783
Carlisle	184329	34,655	198,022	37,229	218,362	41,396	259,886	49,128
Carroll	379086	37,304	491,569	47,865	486,308	47,169	518,744	50,344
Carter	1031047	38,317	1,161,091	42,854	1,352,681	49,674	1,476,209	54,336
Casey	544497	34,834	644,170	40,768	663,598	41,849	725,105	45,311
Christian	1867497	24,979	1,927,508	25,352	1,906,650	24,707	2,221,466	28,577
Clark	1762524	52,702	2,039,596	60,844	2,127,848	62,908	2,295,830	67,041
Clay	1841739	75,234	2,177,890	88,937	2,540,080	104,530	2,781,382	115,324
Clinton	710408	74,016	844,147	88,189	943,627	98,933	888,644	93,492
Crittenden	806174	86,835	934,926	101,977	1,038,973	113,462	1,169,428	129,577
Cumberland	219808	30,829	268,452	37,730	354,719	50,130	422,805	59,617
Daviess	2261017	24,682	2,644,024	28,853	2,709,129	29,401	2,953,303	31,979
Edmonson	427279	36,355	470,314	39,955	503,440	42,686	511,250	43,337
Elliott	229947	34,244	264,318	39,310	288,707	42,407	321,740	47,496
Estill	912489	59,578	1,019,635	66,932	1,065,322	70,724	1,044,181	69,705
Fayette	7840914	29,639	8,763,634	32,828	9,276,401	34,175	9,241,885	33,658
Fleming	497394	35,334	567,481	40,054	628,270	43,742	735,270	50,898
Floyd	4105993	97,418	4,365,413	103,407	4,689,219	111,444	4,614,854	109,588
Franklin	1686358	35,048	1,828,636	37,955	1,976,979	41,119	2,199,486	45,502
Fulton	357796	46,120	389,580	51,470	419,397	56,439	424,363	58,324
Gallatin	297162	37,220	348,582	44,502	389,711	48,775	456,604	57,240
Garrard	687731	45,488	875,998	56,349	1,014,539	64,086	1,046,323	65,416
Grant	937722	40,583	944,821	40,174	1,109,736	46,446	1,394,152	57,581

Table 2a. MQOD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*
Graves	1539403	41,612	1,735,381	46,928	1,903,729	51,220	2,321,446	62,499
Grayson	1416625	58,604	1,605,791	66,311	1,792,334	72,877	1,870,427	75,166
Green	345739	29,805	378,312	32,644	453,343	39,051	509,888	44,466
Greenup	3258529	88,317	3,185,888	86,620	3,530,597	95,605	3,934,531	106,581
Hancock	168868	20,015	213,267	25,269	303,552	35,966	330,836	39,320
Hardin	2619040	27,648	2,805,647	29,511	2,970,573	31,155	3,068,247	32,101
Harlan	2078682	64,131	2,230,146	68,989	2,786,709	87,613	2,886,199	92,285
Harrison	938234	52,089	988,273	54,928	814,731	44,958	862,859	47,525
Hart	550601	31,814	576,871	32,769	655,819	36,885	686,190	38,386
Henderson	1956804	43,691	2,105,421	46,850	2,415,994	53,739	2,542,327	56,452
Henry	451570	29,671	495,527	32,487	543,561	35,214	617,939	39,749
Hickman	118003	22,545	123,394	23,657	148,142	28,693	154,873	30,589
Hopkins	2074566	45,025	2,481,937	53,696	2,665,508	57,444	2,915,562	62,826
Jackson	570927	41,989	634,950	46,953	723,180	53,776	791,244	59,066
Jefferson	28700000	41,280	32,200,000	46,249	34,100,000	48,825	35,100,000	50,169
Jessamine	1623260	40,823	1,868,798	45,974	2,127,355	51,466	2,227,588	52,952
Johnson	1849788	79,220	1,940,256	83,059	2,130,515	91,009	2,004,100	84,995
Kenton	4477222	29,461	4,874,809	32,130	5,253,817	34,478	5,556,198	36,345
Knott	1039643	59,412	1,110,868	63,071	1,346,806	76,952	1,379,139	79,439
Knox	1738996	55,038	2,125,466	67,379	2,528,130	79,754	2,661,671	83,758
Larue	348505	26,047	422,104	31,453	527,423	39,740	603,117	45,106
Laurel	2537942	47,410	2,983,523	54,948	3,338,966	60,603	3,506,412	63,230
Lawrence	1007239	64,295	1,100,512	69,679	1,122,096	71,095	1,167,972	73,181
Lee	601204	76,557	703,372	89,704	811,664	103,147	796,535	103,460
Leslie	814280	66,744	942,061	77,294	1,040,970	86,402	1,053,779	88,747
Letcher	1663730	67,110	1,992,683	80,473	2,472,101	100,199	2,152,936	88,170
Lewis	994984	71,152	807,630	58,947	811,327	59,412	857,198	62,328
Lincoln	860166	36,148	1,027,730	42,876	1,173,909	48,403	1,395,219	56,969
Livingston	579034	59,031	723,510	74,100	840,084	86,768	889,219	92,434
Logan	691252	25,977	940,699	35,285	992,213	37,291	1,088,924	40,715
Lyon	483487	59,382	487,037	59,899	554,245	67,922	569,178	69,159
McCracken	3161469	48,751	3,372,387	52,191	3,915,495	60,780	4,252,637	66,179
McCreary	1378481	81,140	1,600,645	93,841	1,915,970	112,837	1,677,552	91,705
McLean	337453	34,270	416,104	41,878	437,484	44,478	468,600	47,700
Madison	2501460	34,432	2,923,796	39,617	3,271,877	43,507	3,375,876	43,862
Magoffin	1163134	88,304	1,156,008	87,332	1,198,092	90,710	1,183,668	89,699
Marion	543440	29,636	620,491	33,647	691,479	37,283	652,848	34,573
Marshall	1445783	47,991	1,679,648	55,597	1,898,194	62,443	2,100,902	68,769
Martin	1388008	111,810	1,200,293	96,962	1,246,722	101,533	1,226,505	93,292
Mason	742078	44,177	698,402	41,549	702,173	42,061	769,537	45,915
Meade	642758	23,993	736,661	27,093	776,941	28,439	792,324	28,478

Table 2a. MQOD for KY residents, by county (2001-2004)

	2001		2002		2003		2004	
County	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*
Menifee	233774	34,949	292,526	43,440	313,871	46,966	417,119	62,007
Mercer	758768	36,388	888,868	42,255	987,606	46,458	1,050,827	49,113
Metcalfe	292711	29,019	301,132	30,210	336,819	33,807	381,992	38,207
Monroe	522103	44,280	537,892	45,864	598,445	51,105	601,116	51,664
Montgomery	937780	41,105	1,138,870	49,176	1,198,512	51,155	1,251,949	52,876
Morgan	449760	31,986	491,459	34,642	460,048	32,329	662,687	46,158
Muhlenberg	1632533	51,410	1,967,671	62,272	2,164,797	68,713	2,374,548	75,327
Nelson	1451244	37,990	1,577,233	40,637	1,809,051	45,824	1,925,765	47,934
Nicholas	336720	49,192	289,937	41,724	356,453	51,119	390,651	55,752
Ohio	765732	33,306	874,009	37,879	1,063,854	46,226	1,099,343	47,237
Oldham	1158045	24,201	1,329,270	27,140	1,453,758	28,604	1,606,747	30,810
Owen	209888	19,687	294,761	27,122	344,945	31,661	431,386	38,839
Owsley	394372	82,127	460,608	97,134	597,986	126,907	579,469	121,329
Pendleton	487119	33,335	538,964	36,612	517,403	34,847	601,825	40,530
Perry	2765782	94,728	2,795,634	95,352	3,377,335	115,161	3,478,217	118,934
Pike	3750785	55,476	4,085,120	60,566	4,713,387	70,527	4,434,133	67,120
Powell	890570	66,764	1,055,235	79,508	1,112,979	83,847	1,163,347	86,449
Pulaski	3091786	54,572	3,578,037	62,654	3,829,015	66,504	3,964,500	68,020
Robertson	73029	32,544	75,854	33,313	84,476	36,954	90,886	40,003
Rockcastle	748916	45,328	942,745	56,932	905,892	54,776	1,242,476	75,115
Rowan	737242	33,082	933,737	41,941	988,306	44,468	1,057,725	48,030
Russell	301925	18,448	335,912	20,471	370,247	22,445	404,844	24,184
Scott	1209447	35,065	1,403,621	39,540	1,420,662	38,886	1,528,035	40,414
Shelby	1193872	35,046	1,339,139	38,468	1,384,572	38,644	1,455,047	39,451
Simpson	631888	38,107	718,848	43,317	769,973	46,289	842,985	50,345
Spencer	348908	27,477	468,502	34,924	667,905	47,218	624,180	42,539
Taylor	760285	33,112	993,533	42,508	1,194,594	51,031	1,440,868	61,173
Todd	260620	21,691	287,559	24,072	303,501	25,590	364,678	30,976
Trigg	436730	34,434	503,971	39,717	626,016	49,200	686,443	52,734
Trimble	216714	25,759	222,691	26,049	249,654	28,892	270,213	30,543
Union	1031936	66,294	901,531	57,805	940,855	60,536	980,552	62,816
Warren	4371788	46,622	5,815,748	61,362	3,614,407	37,460	3,667,030	37,468
Washington	244833	22,298	270,665	24,351	287,665	25,742	339,010	30,274
Wayne	914450	45,812	1,249,717	62,271	1,259,687	62,008	1,296,807	63,516
Webster	641132	45,913	767,349	54,803	867,313	62,289	921,923	65,946
Whitley	3032197	83,202	3,802,686	103,703	4,334,507	117,228	4,394,103	117,738
Wolfe	367770	53,207	464,521	66,963	530,340	76,363	607,068	87,411
Woodford	776173	33,242	873,210	37,236	921,619	39,035	993,932	41,806

* Per 1,000 residents

Table 2b. MQOD for KY residents, by county (2005-2007)

	2005		2006		2007	
County	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*	Quantity Dispensed	Crude Rate*
Adair	750,231	42,398	881,592	49,469	909,796	50,810
Allen	1,080,407	58,638	1,316,227	70,435	1,306,068	69,265
Anderson	977,969	48,366	1,152,800	55,423	1,315,655	61,669
Ballard	408,834	49,628	432,091	52,894	491,021	60,337
Barren	1,621,017	40,503	1,699,472	41,952	2,066,176	50,311
Bath	724,361	62,661	705,346	60,895	778,201	67,587
Bell	3,684,639	125,880	3,846,051	132,044	4,098,815	141,207
Boone	4,985,617	47,200	5,580,185	50,933	6,398,128	56,718
Bourbon	1,095,756	55,614	1,140,937	58,312	1,225,484	62,486
Boyd	2,672,944	54,627	2,992,769	61,394	2,966,659	61,086
Boyle	1,453,051	50,961	1,554,492	54,137	1,764,083	61,022
Bracken	456,631	53,010	533,162	62,133	570,559	66,290
Breathitt	1,429,811	90,903	1,459,975	93,253	1,665,071	106,770
Breckinridge	933,472	48,996	937,393	49,448	1,010,536	52,980
Bullitt	3,089,975	43,451	3,435,952	47,459	4,020,888	54,530
Butler	685,057	51,493	830,740	61,986	891,246	67,041
Caldwell	1,032,507	80,860	1,164,164	91,171	1,089,300	84,995
Calloway	1,767,082	49,809	1,845,690	51,286	1,929,584	53,361
Campbell	4,154,612	47,605	4,659,690	53,478	5,061,037	57,972
Carlisle	266,868	50,842	280,263	53,333	353,379	68,537
Carroll	596,457	57,242	657,697	63,088	820,978	78,203
Carter	1,779,602	65,173	1,875,820	68,543	1,770,064	64,800
Casey	722,987	44,864	745,469	45,949	817,591	50,177
Christian	2,412,640	30,892	2,439,132	31,088	3,188,051	39,386
Clark	2,569,591	74,152	3,015,214	85,735	3,067,659	86,035
Clay	2,841,937	118,636	2,920,572	122,276	2,942,321	124,227
Clinton	1,057,525	111,825	1,214,202	129,501	1,432,508	151,204
Crittenden	1,324,050	146,937	1,375,654	150,988	1,277,455	140,457
Cumberland	511,172	73,582	587,095	84,681	636,653	93,433
Daviess	2,997,639	32,367	3,162,684	33,909	3,654,210	38,885
Edmonson	532,445	44,597	576,342	48,465	623,468	52,177
Elliott	318,265	42,294	288,566	36,026	354,301	43,355
Estill	1,151,221	77,466	1,146,023	76,976	1,277,591	85,785
Fayette	9,963,419	35,799	11,200,000	39,531	12,200,000	42,470
Fleming	812,083	56,071	775,372	53,522	838,072	57,171
Floyd	4,798,894	114,137	5,108,368	121,982	5,145,520	122,428
Franklin	2,339,513	48,360	2,479,425	51,198	2,788,780	57,453
Fulton	428,747	60,481	495,599	72,171	542,937	79,122
Gallatin	470,917	58,572	564,835	70,341	648,067	80,246
Garrard	1,140,312	69,633	1,201,884	72,090	1,324,066	77,932
Grant	1,557,232	63,766	1,870,407	75,523	2,102,863	83,576

Graves	2,476,826	66,309	2,386,277	63,850	2,774,300	73,859
Grayson	2,040,002	81,356	2,121,193	84,288	2,195,897	86,753
Green	567,319	49,448	778,298	67,502	579,170	50,284
Greenup	4,183,035	113,220	4,389,060	117,537	4,452,990	118,721
Hancock	251,097	29,402	329,767	38,412	366,937	42,712
Hardin	3,422,761	35,344	3,946,413	40,646	4,224,068	43,075
Harlan	2,778,309	89,404	3,328,141	107,142	3,546,156	114,116
Harrison	934,523	51,325	1,030,132	56,132	1,105,670	59,493
Hart	753,501	41,611	806,148	44,308	843,928	46,144
Henderson	2,515,950	55,777	3,114,020	68,984	3,169,289	70,176
Henry	645,079	41,296	761,356	48,273	952,890	60,218
Hickman	171,444	34,159	216,768	43,765	218,596	44,602
Hopkins	3,190,446	69,072	3,396,720	73,535	3,861,164	83,472
Jackson	914,302	67,761	994,258	73,890	1,040,243	77,520
Jefferson	36,890,036	52,621	40,700,000	57,751	45,700,000	64,206
Jessamine	2,410,157	55,859	2,618,852	58,732	3,010,986	66,090
Johnson	2,071,067	87,199	2,392,625	100,227	2,325,614	97,298
Kenton	6,012,999	39,193	6,990,349	45,047	7,737,269	49,328
Knott	1,373,255	78,791	1,528,450	88,698	1,589,883	93,019
Knox	2,669,188	83,272	2,996,477	93,142	3,114,067	96,462
Larue	617,637	45,812	702,073	51,771	740,078	54,506
Laurel	3,588,745	64,077	4,154,798	73,281	4,493,012	78,442
Lawrence	1,368,834	84,915	1,598,844	98,676	1,518,651	93,009
Lee	763,949	101,684	867,069	115,887	892,493	120,136
Leslie	1,110,783	93,611	1,160,090	98,958	1,250,953	106,892
Letcher	2,127,883	88,013	2,397,850	99,690	2,221,119	92,736
Lewis	872,965	63,438	904,261	65,106	933,002	66,877
Lincoln	1,400,652	56,179	1,496,989	59,665	1,641,819	65,232
Livingston	1,022,427	105,525	1,156,185	119,949	1,285,967	134,333
Logan	1,169,409	43,532	1,236,765	45,898	1,360,129	50,115
Lyon	604,237	72,923	690,419	82,359	753,703	90,415
McCracken	4,393,173	68,213	4,764,948	73,695	5,160,476	79,436
McCreary	1,239,105	65,861	1,248,065	66,302	1,366,500	76,860
McLean	487,848	49,836	553,163	57,151	570,475	58,800
Madison	3,717,493	46,984	4,013,096	49,705	4,154,647	51,118
Magoffin	1,125,196	85,404	1,270,008	96,873	1,365,995	103,815
Marion	821,016	43,146	981,511	51,281	1,083,616	56,453
Marshall	2,328,169	75,824	2,394,044	77,210	2,632,609	84,273
Martin	1,071,950	79,052	1,199,156	89,536	1,005,034	75,800
Mason	772,260	45,783	844,039	49,437	850,949	49,517
Meade	867,770	31,094	945,815	34,368	1,074,871	39,507
Menifee	400,329	59,475	452,717	67,159	506,200	75,812
Mercer	1,128,161	52,310	1,176,042	54,497	1,326,758	60,989
Metcalfe	415,668	41,249	415,960	41,168	483,434	47,568
Monroe	704,904	59,880	854,209	72,730	760,264	65,253

Montgomery	1,461,856	60,402	1,669,711	67,518	1,771,436	70,343
Morgan	648,025	45,431	743,288	52,212	840,773	58,956
Muhlenberg	2,494,912	79,309	2,613,592	83,159	2,947,081	93,707
Nelson	1,902,830	46,571	2,280,034	54,591	2,615,672	61,641
Nicholas	477,339	68,504	486,274	69,967	512,776	74,111
Ohio	1,389,591	59,430	1,528,449	65,330	1,613,883	68,685
Oldham	1,681,775	31,519	1,864,557	33,786	2,143,056	37,860
Owen	521,231	46,705	530,606	47,401	592,093	52,162
Owsley	581,041	123,259	644,982	138,885	738,177	160,090
Pendleton	675,753	45,264	812,411	54,067	888,661	59,291
Perry	3,319,648	114,034	3,754,132	128,835	4,056,642	139,169
Pike	4,713,919	71,745	5,520,350	84,104	4,781,552	72,977
Powell	1,321,389	97,025	1,503,196	111,044	1,530,697	112,271
Pulaski	4,134,330	70,271	4,524,526	76,131	4,721,575	78,764
Robertson	90,871	40,951	106,044	46,654	101,510	46,036
Rockcastle	1,225,358	74,040	1,172,352	70,897	1,298,937	78,386
Rowan	1,172,690	52,948	1,323,710	59,018	1,317,856	58,315
Russell	404,873	24,007	406,436	23,845	442,794	25,937
Scott	1,696,226	43,141	2,043,647	49,231	2,320,924	53,931
Shelby	1,557,574	40,970	1,808,278	45,753	2,052,284	50,530
Simpson	871,093	51,553	901,293	53,027	1,005,837	58,976
Spencer	789,939	51,586	995,725	61,846	1,177,148	69,617
Taylor	1,414,224	59,504	1,504,810	62,753	1,673,413	69,456
Todd	429,010	36,203	502,684	42,066	614,190	51,153
Trigg	732,705	55,983	766,380	58,364	860,803	64,581
Trimble	319,578	36,287	357,889	40,244	452,164	50,431
Union	1,115,753	72,362	1,044,332	68,288	1,116,781	74,244
Warren	4,032,443	40,301	4,303,937	41,921	4,778,335	45,732
Washington	416,450	36,991	470,951	41,457	508,830	44,154
Wayne	1,345,365	65,836	1,437,123	70,278	1,503,802	73,082
Webster	1,039,848	74,227	1,132,013	81,563	1,324,256	95,380
Whitley	4,383,817	116,319	5,013,849	132,431	5,372,152	140,331
Wolfe	657,716	93,439	746,140	105,521	853,419	119,812
Woodford	1,108,828	46,143	1,182,710	48,766	1,266,711	51,985

* Per 1,000 residents

Figure 2a. Total MQOD for Kentucky Residents during 2001-2007.

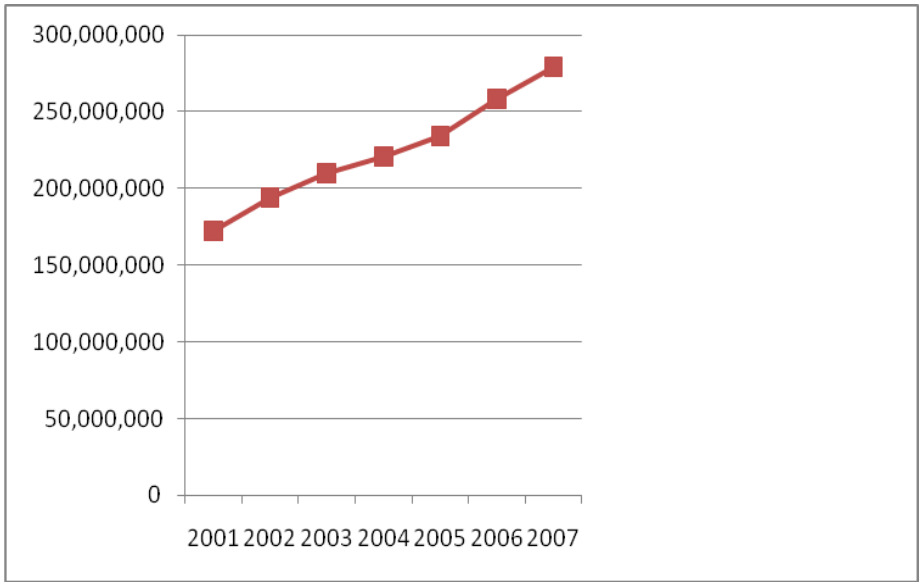

Figure 2b. Crude Rate of MQOD for Kentucky Residents during 2001-2007.

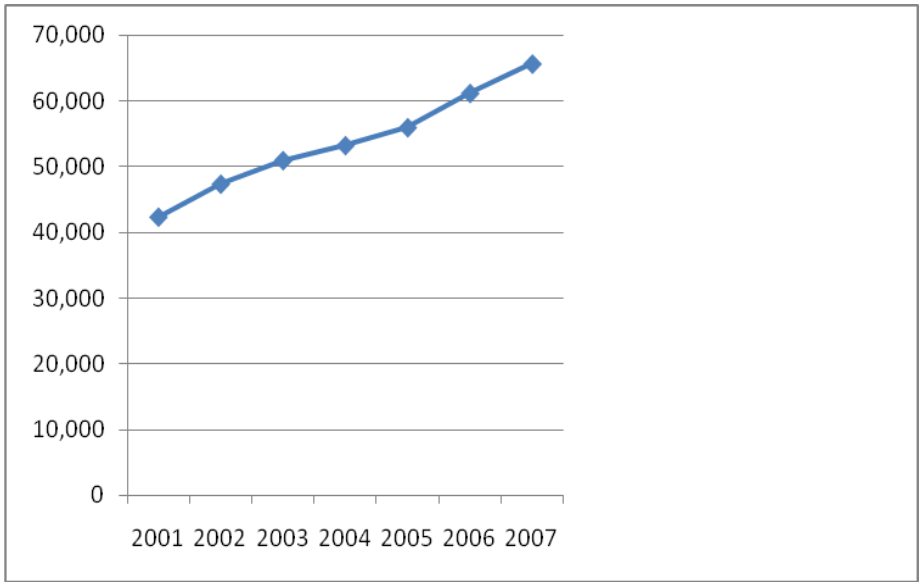

Table 3. Descriptive statistics of socio-demographic and health-related characteristics of the Kentucky counties n=120; T = 7 (2001-2007 years)

		Mean	Std. Dev.	Min.	Max
Number of prescription filled, n	overall	34,820.66	62,522.70	1,472.00	762,677.00
	between		62,416.71	1,711.00	646,755.30
	within		6,411.07	-41,142.63	150,742.40
Metric quantity of prescription dispensed, n	overall	1,867,834.00	3,503,576.00	73,029.00	45,700,000.00
	between		3,466,663.00	88,952.86	36,200,000.00
	within		585,862.50	-5,632,166.00	11,400,000.00
Total population, n	overall	34,625.07	69,520.53	2,205.00	711,766.00
	between		69,756.22	2,253.71	701,015.30
	within		1,404.63	23,553.22	46,685.36
Population 0-24 years old, %	overall	32.95	2.73	22.61	43.89
	between		2.53	23.07	43.41
	within		1.04	29.05	35.25
Population 25-54 years old, %	overall	42.60	2.03	36.55	49.25
	between		1.95	37.79	47.56
	within		0.59	40.48	45.83
Population 55 & over years old, %	overall	24.45	3.30	16.01	32.58
	between		3.17	16.97	31.63
	within		0.95	21.33	28.77
Median household income, $	overall	33,610.03	8,944.44	16,435.00	73,632.00
	between		8,691.00	18,153.86	68,302.57
	within		2,238.21	27,851.17	43,488.88
White population, %	overall	94.79	4.82	72.29	99.38
	between		4.82	73.05	99.28
	within		0.35	92.08	97.23
Black population, %	overall	3.80	4.35	0.03	24.93
	between		4.36	0.10	24.08
	within		0.31	1.44	6.51
Hispanic population, %	overall	1.35	1.06	0.19	8.56
	between		1.01	0.39	6.73
	within		0.34	-0.60	3.48
Female population, %	overall	50.67	1.40	41.95	53.50
	between		1.36	42.46	53.40
	within		0.35	47.59	53.46
Female population filled prescription, %	overall	55.98	3.94	39.19	66.09
	between		3.77	42.17	63.20
	within		1.21	51.52	62.01
Urban population, %	overall	27.59	26.55	0.00	98.20
	between		26.65	0.00	98.20
	within		0.00	27.59	27.59
Population in poverty, %	overall	18.59	6.86	5.00	45.50

	between		6.65	5.59	39.21
	within		1.81	11.58	28.70
Unemployment rate	overall	6.52	1.82	2.50	14.70
	between		1.53	3.51	12.33
	within		0.99	2.86	12.76
All cancer incidence crude rate, per 100,000	overall			62.79	891.27
Non-fatal crash injuries crude rate, per 1,000	overall			77.77	1,338.00
All injury-related hospitalizations crude rate, per 1,000	overall			197.16	1,678.91

Figure 3a. Cancer Incidence Crude Rates in Kentucky, All Sites, 2001-2007.

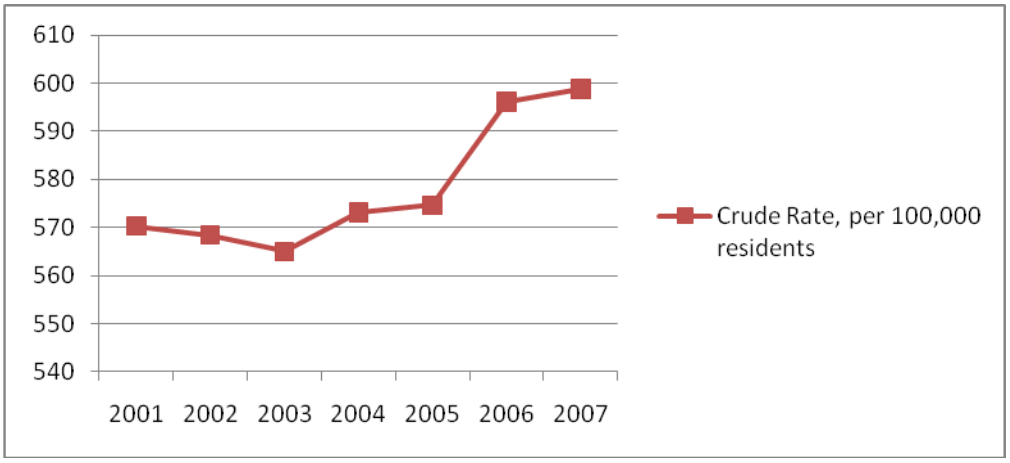

Figure 3b. Cancer Incidence Age-Adjusted Rates in Kentucky, All Sites, 2001-2007.

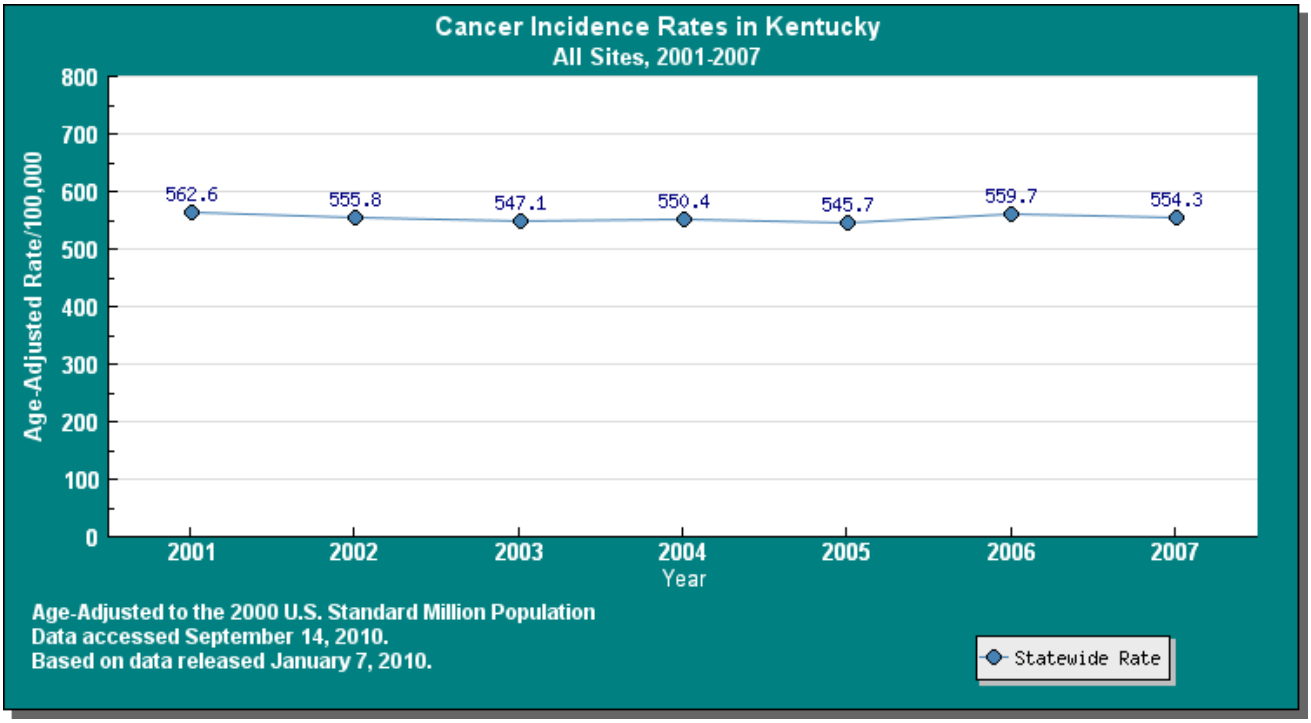

Table 4a. Bivariate relationships between OPD and socio-demographic and health-related characteristics of the counties; n=120; T = 7 (2001-2007 years)

	Est. IRR	95% Conf. Interval	
Population 0-24 years old, %	0.94	0.94	0.95
Population 25-54 years old, %	0.97	0.96	0.98
Population 55 & over years old, %	1.06	1.06	1.07
Median household income, $	1.00002	1.00002	1.00003
White population, %	1.01	0.998	1.02
Black population, %	0.97	0.96	0.98
Hispanic population, %	1.06	1.05	1.07
Female population, %	0.99	0.97	1.02
Urban population, %	0.99	0.99	0.996
Population in poverty, %	1.02	1.02	1.03
Unemployment rate	1.01	0.997	1.01
All cancer incidence crude rate, per 100,000	1.00032	1.00021	1.00042
All invasive cancer incidence crude rate, per 100,000	1.00046	1.00031	1.00061
Non-fatal crash injuries crude rate, per 1,000	0.99936	0.99928	0.99945
All injury-related hospitalization crude rate, per 1,000	1.00008	0.99996	1.00021
Appalachian counties*	1.45	1.312	1.601

* Est. IRR was calculated using Poisson due to convergency issues with negative binomial regression.

Table 4b. Bivariate relationships between MQOD and socio-demographic and health-related characteristics of the counties; n=120; T = 7 (2001-2007 years)

	Est. IRR	95% Conf. Interval	
Population 0-24 years old, %	0.89	0.88	0.90
Population 25-54 years old, %	0.94	0.93	0.95
Population 55 & over years old, %	1.14	1.13	1.15
Median household income, $	1.00004	1.000045	1.000042
White population, %	1.02	1.01	1.03
Black population, %	0.96	0.95	0.98
Hispanic population, %	1.09	1.07	1.12
Female population filled prescription, %	0.93	0.93	0.94
Urban population, %	0.99	0.989	0.994
Population in poverty, %	1.04428	1.04425	1.04431
Unemployment rate	1.02	1.01	1.03
All cancer incidence crude rate, per 100,000	1.00067	1.00048	1.00085
All invasive cancer incidence crude rate, per 100,000	1.0019	1.0007	1.0012
Non-fatal crash injuries crude rate, per 1,000	.9988	.9986	.9990
All injury-related hospitalization crude rate, per 1,000	1.0002	1.0001	1.0004
Appalachian counties**	1.42	1.26	1.59

** Est. IRR was calculated using Poisson due to convergency issues with negative binomial regression.

Table 5a. Multivariate relationships among OPD and socio-demographic and health-related characteristics of the counties; n=120; T = 7 (2001-2007 years)

Wald chi2(12) = 605.77

Log likelihood = -4560.15
Prob > chi2 < 0.001
AIC: 9150.29 BIC: 9212.90

	Est. IRR	P-value	95% Conf. Interval	
Population 0-24 years old, %	--		--	--
Population 25-54 years old, %	1.026	< 0.001	1.011	1.041
Population 55 & over years old, %	1.053	< 0.001	1.041	1.065
White population, %	1.003	0.542	0.992	1.015
Hispanic population, %	1.032	< 0.001	1.017	1.046
Female population filled prescription, %	0.974	< 0.001	0.967	0.982
Urban population, %	1.003	0.003	1.001	1.005
Population in poverty, %	1.003	0.361	0.997	1.009
Unemployment rate	0.999	0.888	0.990	1.009
All cancers crude rate, per 100,000	0.99992	0.369	0.9997	1.0001
Non-fatal crash injuries crude rate, per 1,000	0.99994	0.282	0.99984	1.00005
All injury-related hospitalizations rate, per 1,000	1.00011	0.098	0.99998	1.00024
Appalachian counties	1.167	0.014	1.032	1.318

Likelihood-ratio test vs. pooled: chibar2(01) = 542.99 Prob>=chibar2 < 0.001

Table 6a. Multivariate relationships among MQOD and socio-demographic and health-related characteristics of the counties; n=120; T = 7 (2001-2007 years)

Wald chi2(12) = 1094.29
Log likelihood = -6603.25 Prob > chi2 < 0.001
AIC: 13236.50 BIC: 13299.11

	Est. IRR	P-value	95% Conf. Interval	
Population 0-24 years old, %	--	--	--	--
Population 25-54 years old, %	1.051	< 0.001	1.031	1.072
Population 55 & over years old, %	1.107	< 0.001	1.089	1.125
White population, %	1.002	0.789	0.988	1.016
Hispanic population, %	1.041	< 0.001	1.021	1.062
Female population filled prescription, %	0.958	< 0.001	0.948	0.967
Urban population, %	1.004	< 0.001	1.002	1.007
Population in poverty, %	1.011	0.004	1.003	1.019
Unemployment rate	0.997	0.640	0.984	1.010
All cancers crude rate, per 100,000	0.9998	0.127	0.9996	1.0001
Non-fatal crash injuries crude rate, per 1,000	0.99984	0.032	0.99970	0.99999
All injury-related hospitalizations rate, per 1,000	1.00004	0.676	0.99986	1.00021
Appalachian counties	1.045	0.576	0.896	1.219

Likelihood-ratio test vs. pooled: chibar2(01) = 409.38 Prob>=chibar2 < 0.001

Table 6b. Multivariate relationships among OPD and socio-demographic and health-related characteristics of the counties; n=120; T = 7 (2001-2007 years)

Wald chi2(13) = 1262.30

Log likelihood = -6578.18 Prob > chi2 < 0.001

AIC: 13188.36 BIC: 13255.14

	Est. IRR	P-value	95% Conf. Interval	
Population 0-24 years old, %	--	--	--	--
Population 25-54 years old, %	1.031	0.002	1.012	1.052
Population 55 & over years old, %	1.0824	< 0.001	1.0652	1.0998
White population, %	1.005	0.467	0.991	1.019
Hispanic population, %	1.014	0.193	0.993	1.035
Female population filled prescription, %	0.965	< 0.001	0.955	0.974
Urban population, %	1.0020	0.114	0.9995	1.0044
Population in poverty, %	1.018	< 0.001	1.010	1.026
Unemployment rate	0.9995	0.940	0.9871	1.0121
Median household income, $	1.00002	< 0.001	1.00002	1.00003
All cancers crude rate, per 100,000	0.9998	0.134	0.9996	1.0001
Non-fatal crash injuries crude rate, per 1,000	1.00004	0.625	0.99989	1.00019
All injury-related hospitalizations rate, per 1,000	1.00013	0.132	0.99996	1.00030
Appalachian counties	1.197	0.018	1.031	1.388

Likelihood-ratio test vs. pooled: chibar2(01) = 397.31 Prob>=chibar2 < 0.001

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