Breast, Lung, Leukemia, and Colon Cancer Survival Analysis for Nation, Kentucky, and Purchase Area Development District: 1996-2000

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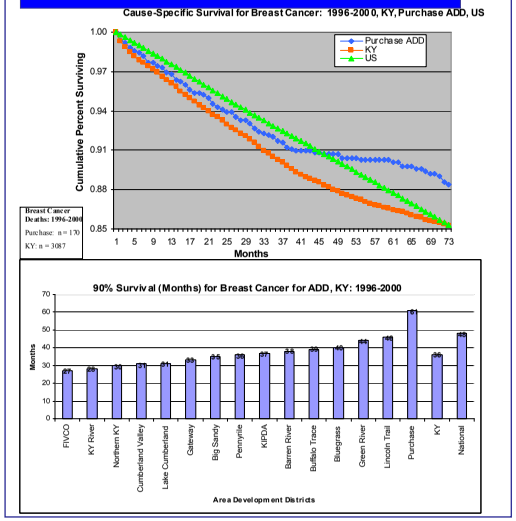
Abstract

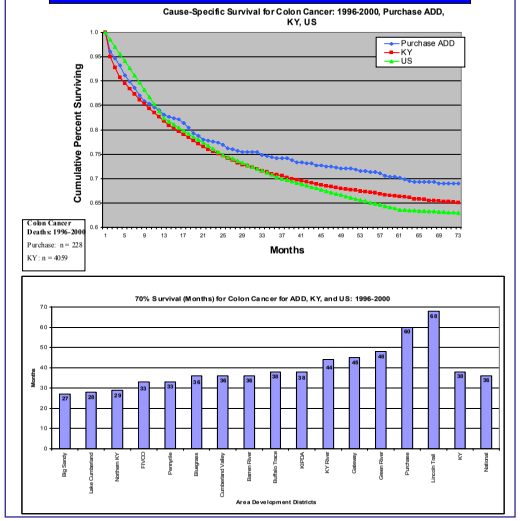
This study is an outgrowth of development for analysis of the Paducah Gaseous Diffusion Plant (PGDP) Worker's Study for the time period 1953-2003. PGDP was a DOE facility until 1998. The cohort being analyzed is 6,858 workers. PGDP's main function has been to produce enriched uranium for commercial reactors. During the late 1990's, public concerns were growing about environmental and worker health issues at PGDP. This is the only gaseous diffusion plant in the U.S. that has not undergone a health study.

From 1953-2003, cause-specific mortality in Kentucky changed dramatically. This is largely due to two reasons: increasing longevity of the overall population and smoking-related deaths. In preparation to adjust cohort analysis for the changing patterns that occurred from 1953-2003, we will compare Purchase Area Development District (ADD; includes Paducah) survival to the state, nation, and other ADDs. To better understand with-in state variation for leukemia, survival data organized for Kentucky's fifteen ADDs was used. Cancers included in this survival comparison analysis are lung, breast, leukemia, and colon. Examined populations include all races and both sexes. We report an analysis for the aforementioned cancer survival patterns using data from the Kentucky Cancer Registry and from SEER. The analysis shows declining life expectancy as a function of cause-specific mortality, and markedly lower leukemia survival rates in the Purchase ADD as compared to the nation, KY, and other ADDs. We also report that there is more district-to-district variation with leukemia survival than what might be expected to occur solely by chance.

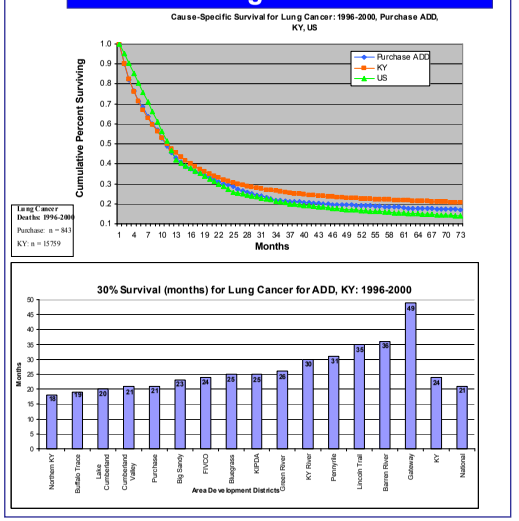
Breast Cancer



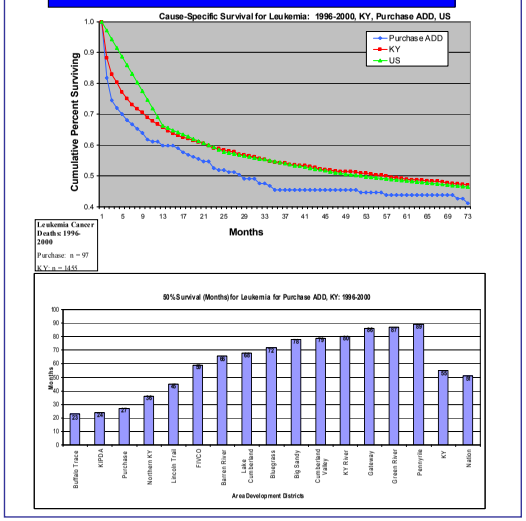
Colon Cancer



Lung Cancer



Leukemia



Results & Conclusion

Cancer Incidence Rates by ADD in Kentucky[1]
Acute Myeloid Leukemia, 1996-2000

ADD	Risk Population	Cases	Crude Rate	Age-Adjusted Rate
Purchase	**962724**	**56**	**5.82**	**4.79**
Lake Cumberland	954981	45	4.71	4.29
Green River	1032327	45	4.36	4.15
KIPDA	4280263	170	3.97	3.97
Kentucky River	608979	24	3.94	3.92
Lincoln Trail	1188397	43	3.62	3.9
FIVCO	679653	27	3.97	3.63
Big Sandy	813604	29	3.56	3.59
Cumberland Valley	1180407	37	3.13	3.13
Barren River	1251208	39	3.12	3.06
Northern Kentucky	1904697	51	2.68	3
Bluegrass	3344532	88	2.63	2.87
Buffalo Trace	273632	7	2.56	2.40***
Pennyrile	1077815	23	2.13	2.06
Gateway	371499	5	1.35	1.32***
STATE	**19924718**	**689**	**3.46**	**3.49**

1. Kentucky Cancer Registry, both sexes, all races.
***Counts < 15 are too few to calculate a stable age-adjusted rate.**
Note: All rates are per 100,000. Rates are age-adjusted to the 2000 U.S. Standard Million Population.

Our conclusion is that the Purchase ADD has markedly lower survival rates than the US and KY in regard to leukemia. Additionally, leukemia survival has the most district-to-district variation with the lowest survival being 23 months (Buffalo Trace) and highest being 89 months (Pennyrile).

The Cancer Incidence table may help explain why leukemia survival in the Purchase ADD is lower than KY and the US. AML was examined because it is the most common leukemia in adults and related to exposure levels. Purchase ADD has the highest rate of AML even after age-adjusting for the older population in the Purchase ADD. This suggests that Purchase ADD is a unique region that requires further examination.

Survival Rates After 72 Months

	Purchase	KY	Nation
Lung	0.1697	0.2058	0.14
Breast	0.8839	0.8528	0.853
Colon	0.6898	0.6505	0.63
Leukemia	0.4121	0.4715	0.464

Discussion

LUNG CANCER: This graph shows that lung cancer survival in the Purchase ADD is similar to that of the US and KY. However, after 72 months, the graph shows that Purchase ADD survival is 0.1697 while KY survival is 0.2058 and U.S. survival is 0.14.

BREAST CANCER: Breast cancer survival rates are very similar between Purchase ADD, KY, and US. What is interesting to note is that 90% survival is much lower in Purchase ADD than KY or U.S—there is a difference of 28 months of survival between Purchase and KY and 24 months of survival between Purchase and U.S.

COLON CANCER: The difference between colon cancer survival rates in Purchase ADD, KY, and US is dramatic. After 72 months, colon cancer survival in Purchase ADD is 0.6898, while in KY it is 0.6505 and 0.63 in U.S.

LEUKEMIA: Leukemia survival rates are dramatically different in Purchase ADD and other districts. After 72 months, leukemia survival in Purchase ADD is 0.4121, in KY it is 0.4715 and it is 0.464 in US. As survival for KY and US appear to stabilize, Purchase ADD survival continues to plummet. One must note that 50% survival for Purchase ADD is at a mere 27 months, while it is at 55 months for KY and 51 months for U.S. The results of leukemia survival rates in Purchase ADD are striking.

**Since leukemia is strongly linked to exposure, any extreme variation in incidence and survival may point to over-exposure.

Future Work

•This data should be used to adjust cohort analysis for the PGDP Worker's Health Initiative. When doing the cohort worker study, though the survival rates may appear small, they must be compared to the Purchase ADD, KY, and nation.

•An analysis should be done comparing survival rates between different counties and Area Development Districts so as to rule out the case that the Purchase ADD is an outlier weighing down the KY survival curve.

•Additionally, with such a striking difference with leukemia survival rates in the Purchase ADD compared to KY and the nation, more research needs to be done understanding why leukemia survival is so low in this district. Certain factors could be inadequate access to health care, low density of health care providers, higher exposure of carcinogenic materials, etc.

Acknowledgements

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References

1) National cancer survival data. http://seer.cancer.gov/csr/1975_2002.
2) Kentucky Cancer Registry. Life tables for KY survival data and Purchase ADD data; Incidence Data http://www.kcr.uky.edu