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Introduction

- Rates of HPV-associated cancer (cervical, vaginal, vulvar, penile, anal, and oropharyngeal) account for 15.3/100,000 Kentuckians compared to 11.9/100,000 nationally

- Even when correcting for smoking rates, Kentucky still has the highest incidence of head and neck cancer

- Utilizing publicly available head and neck cancer data uncovered regional variations within the state itself and demonstrated geographic clustering

- Geographic cluster data regarding HPV associated tumors was used to identify areas of increased incidence of HPV-related tumors

- Knowledge of HPV-cancer clusters helps focus public health efforts in the form of education, vaccination, screening, and physician recruitment

Methods

- Spatial scan statistics derived from the Kentucky Cancer Registry (KCR) from 1995-2016 were used to examine HPV-related cancers and were adjusted for county-level gender, age, race, Appalachian residence, and smoking. All case and population data files were imported into SaTScan™ software developed specifically for implementing spatial scan statistics.
- Analyses were conducted using a discrete Poisson model using SaTScan’s default settings: a circular scan window, a maximum cluster size of 50% of the total population, and 999 Monte Carlo replications
- After completing the spatial scan statistics, maps were created using ArcGIS version 9.3.
- Clusters from SaTScan were then overlaid on county-level maps showing areas of increased relative risk (RR).

Results

- Table 1** demonstrates incidences of HPV related cancers as well as demographics from the KCR.
- There was an increased risk for HPV-related oropharyngeal cancers in 13 urban counties in north central Kentucky (RR = 1.24, p<0.001) after adjusting for age greater than 50 years old, demonstrated in **Figure 1**.
- There was one cluster of increased risk of anal and penile cancers in 47 southern/central counties (RR=1.23, p<0.001), 9 of the head and neck cancer cluster counties overlapped with these counties as demonstrated in **Figure 2**.
- There were 4 clusters of increased cervical and vulvar cancers, one of which overlapped with 2 counties of the head and neck cancer cluster, demonstrated in **Figure 3**.

Table 1. Characteristics of HPV related Cancer cases(1995-2016)

Characteristic	Oropharynx/Tonsil/Tongue Cancer Cases (N=5792)			Cervical/Vulvar Cancer Cases (N=12480)			Anal/Penile Cancer Cases (n=1573)			P-value
	N	Pct	P-value	N	Pct	P-value	N	Pct	P-value	
Gender			<0.001			/			/	
Male	4287	74.02		/	/		1573	100		
Female	1505	25.98		12480	100		/	/		
Age group			<0.001			<0.001			<0.001	<0.001
<50	1004	17.33		7212	57.79		381	24.22		
50-70	3729	64.38		3636	29.13		759	48.25		
>70	1059	18.28		1632	13.08		433	27.53		
Race			<0.001			<0.001			<0.001	<0.001
White	5428	93.72		10830	86.78		1457	92.63		
Black	309	5.33		709	5.68		100	6.36		
Other	9	0.16		13	0.1		0	0		
Unknown	46	0.79		928	7.44		16	1.02		
Appalachia			<0.001			<0.001			<0.001	<0.001
No	4277	73.84		8494	68.06		1054	67.01		
Yes	1515	26.16		3986	31.94		519	32.99		
Smoker										
No	1055	18.21	<0.001	3309	26.51	<0.001	313	19.9	<0.001	<0.001
Yes	3824	66.02		5852	46.89		917	58.3		
Unknown	913	15.76		3319	26.59		343	21.81		
Marital Status			<0.001			<0.001			<0.001	<0.001
Married	2670	46.1		3068	24.58		593	37.7		
Never married	658	11.36		1299	10.41		338	21.49		
Separated/Divorced										
/Widowed	1264	21.82		2370	18.99		257	16.34		
Unknown	1200	20.72		5743	46.02		385	24.48		

Results, cont.

Figure 1. Oropharyngeal/Tonsil Cancer Incidence Rates in Kentucky (1995-2016), with high age adjusted rate cluster

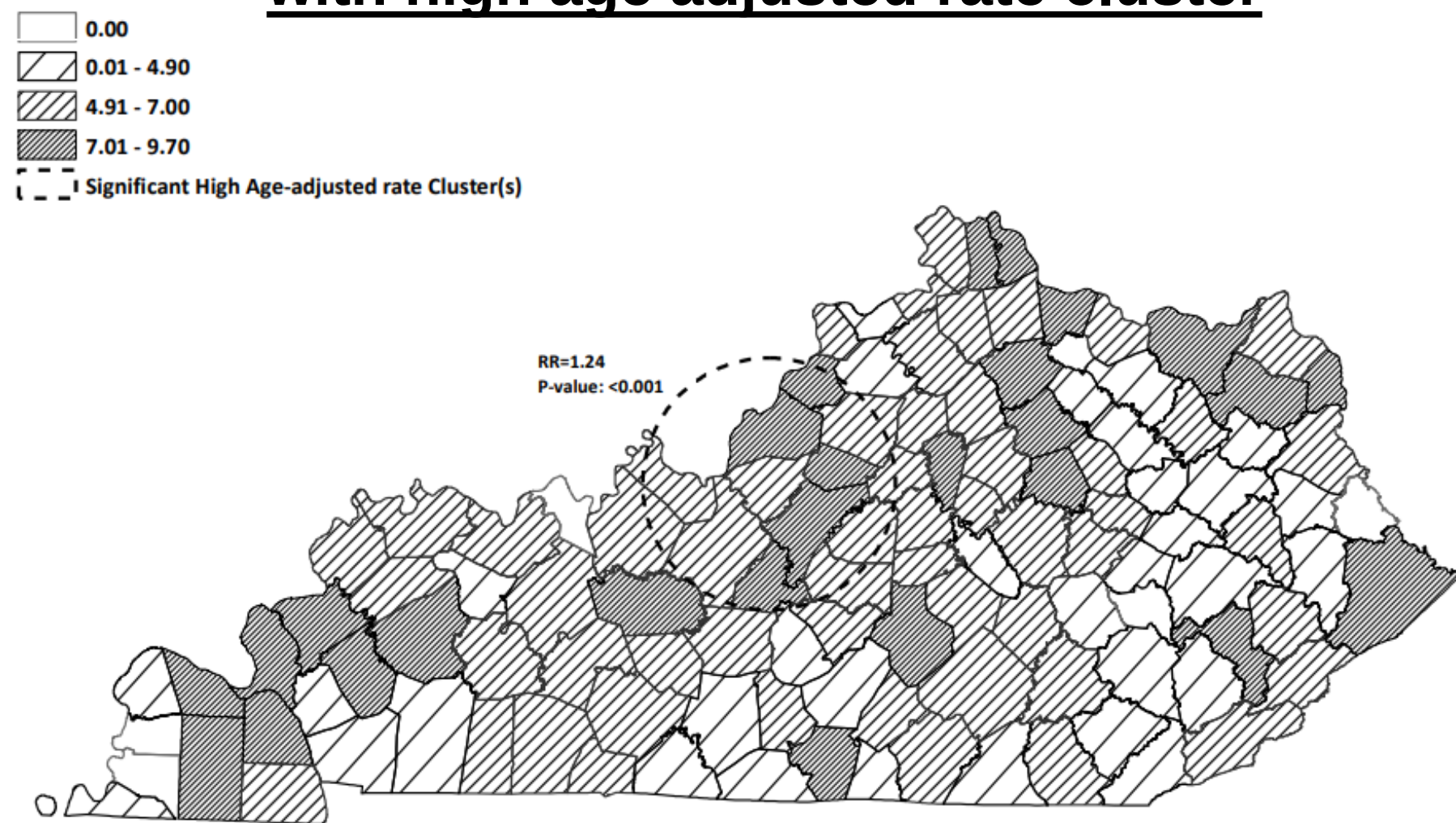


Figure 2. High Age-adjusted Rate Cluster of Male HPV-related Cancers in Kentucky (1995-2016)

--- Significant High Orophary/Tonsil/Tongue Cancer Rate Cluster(s)
□ Significant High Anal(male only) and Penile Cancer Rate Cluster(s)

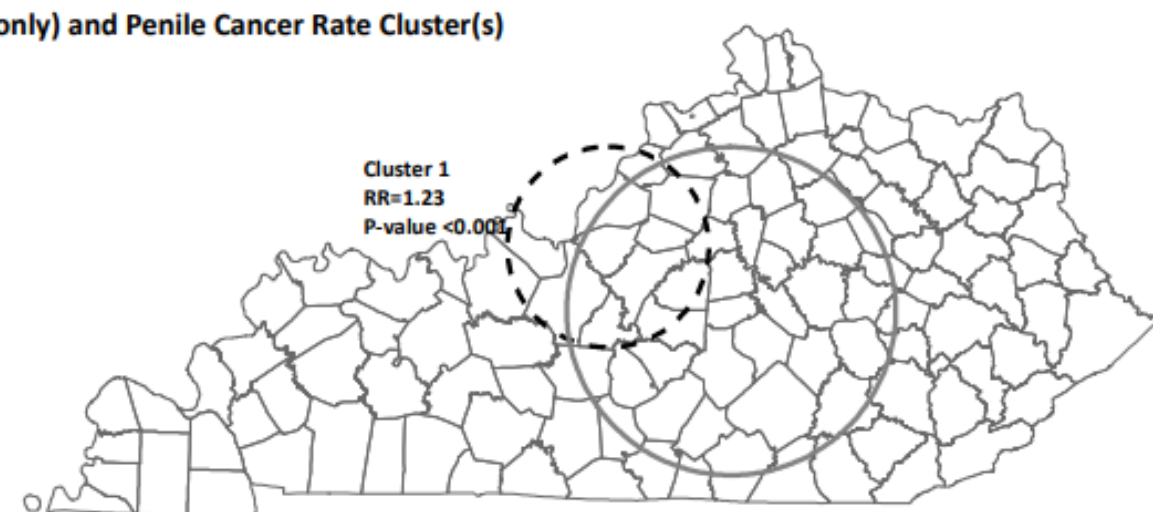
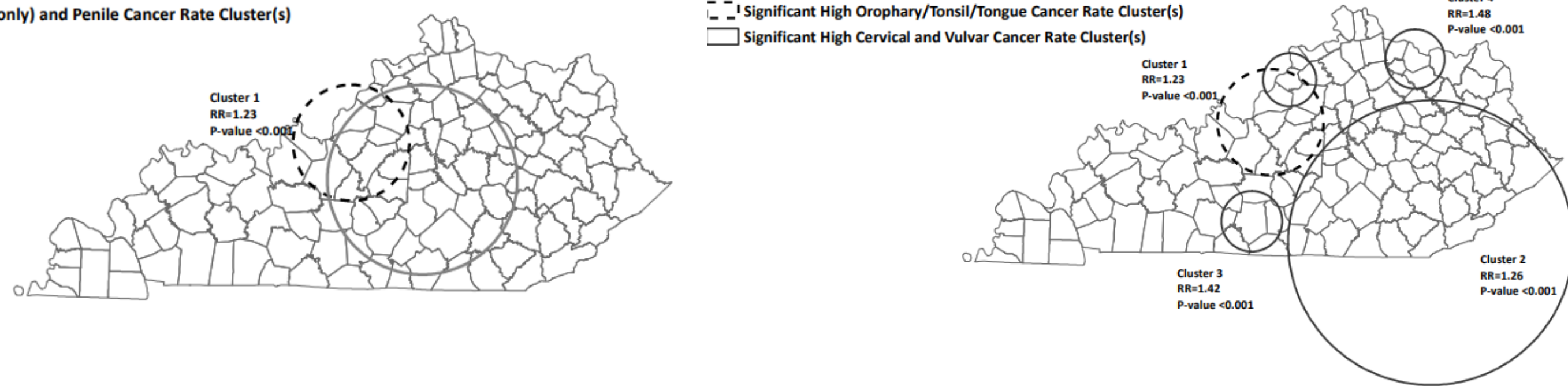


Figure 3. High Age-adjusted Rate Cluster of Female HPV-related Cancers in Kentucky (1995-2016)

--- Significant High Orophary/Tonsil/Tongue Cancer Rate Cluster(s)
□ Significant High Cervical and Vulvar Cancer Rate Cluster(s)



Conclusions

- Spatial analysis was useful in finding multiple cluster areas with higher incidence of HPV-related cancers in Kentucky.
- These clusters were primarily in urban areas within the state, particularly in men.
- These results can guide public health initiatives for increased screenings, vaccination promotion, and physician recruitment to help combat HPV related cancers in the Commonwealth.

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