CANCER INCIDENCE AND AGE AT NORTHERN MIGRATION OF AFRICAN AMERICANS IN ILLINOIS, 1986-1991

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ABSTRACT

We compared the proportional cancer incidence of Illinois-born African Americans with those who migrated to Illinois from southern U.S. states as children and adults, and with African-American residents of the South. Adult Illinois residents, born between 1913 and 1966, who were diagnosed with cancer from 1986 through 1991 were classified by both birthplace and the state and year their social security number was assigned to determine their migration status: native, early (as child) migrant, or late (as adult) migrant. African Americans of Atlanta, Georgia, were used to represent southern homeland ratios. Only lung cancer in African-American females showed a statistically significant trend among the four groups, with Illinois natives having the highest ratio. Although no trend was identified, Illinois natives had statistically significantly different ratios than both migrant groups and the southern homeland for cancers of the oral cavity (males), colon (females), and leukemias (females). The data also suggested that U.S. regional differences in cancer ratios among African Americans exist (cancers of the prostate and testis, and in females, cancers of the oral cavity, esophagus, and kidney) and, among those African Americans who migrate to the North from the South, some cancer ratios also change (in males, cancers of the stomach, colon, and bladder, and myeloma and in females, rectal cancer). Further, evidence was found in some cancer sites for the effect of the timing of northern migration on cancer risk (cancer of the rectum in males, liver cancer in both sexes, and cancer of the breast, stomach, and nervous system in females).

INTRODUCTION

The study of international migration of race/ethnic groups from their homelands to the United States has been a rich resource for generating hypotheses between lifestyle and cancer risk.[1-9] The diversity in cancer incidence among different populations and different regions within the United States also has been well documented.[10-12] However, the migration of populations within the continental United States is less well studied. Such comparisons could be useful in determining whether regional intra-U.S. migration could be an equally rich source for generating hypotheses between lifestyle (e.g., diet and occupation) and cancer risk, as well as the effect of changes in the regional physical environment and cancer risk.[13]

The importance of the timing of migration and changes in cancer risk has not been answered. Identifying differences in cancer risk among childhood migrants, adult migrants, and native-born residents can have important implications for interpreting the potential role of factors in the physical environment that abruptly change upon migration. The timing of migration also can point to the etiologic importance of childhood or adult exposure in the stage of carcinogenesis within a specific cancer site.[14]

Using social security number and place of birth, we were able to categorize cancer incidence among current Illinois residents by their birthplace and time of intra-U.S. migration. This study compares the cancer incidence of Illinois-born African Americans with those who migrated to Illinois from southern U.S. states during childhood, those who migrated from the South as an adult, and with African-American residents of the South.

METHOD AND MATERIALS

Study population. The Illinois State Cancer Registry (ISCR) is a population-based registry covering all newly diagnosed cancers in the state since 1985. Case reports are classified using the

International Classification of Diseases - Oncology (ICD-0), second edition,[15] and include the following information in addition to medical, diagnostic, and facility-identifying information: name, address, birthplace, social security number (SSN), date of birth, sex, race, employment, and tobacco and alcohol usage. More than 50,000 newly diagnosed cancer cases are reported annually to ISCR. Reporting is estimated to be 93 percent complete.[10]

This study used cases among Illinois residents who were diagnosed from 1986 through 1991. Date of birth was available for all cases. Birthplace was available for approximately 60 percent of the reports; SSN for 96 percent; and race was known for more than 99 percent of the cases. All cases identified as black[a] with complete data for birthplace and SSN were selected.

Adult cases, between the birth years of 1913 and 1966, were retained for the analysis. Cases born prior to 1913 were omitted, since social security numbers were not assigned before 1933 and thus older persons could not reasonably be expected to have been assigned a SSN at an early age.

Migration Status. Cases were classified by both birthplace and the state and year their SSNs were assigned. The first three digits of the SSN represent the geographic area in which the number was assigned, with Illinois numbers ranging between 318 and 361. Only SSNs assigned by the Railroad Retirement Board do not follow this geographic connotation, and thus they were excluded (first three digits between 700 and 728).[2,3,16] Thus, by combining birthplace information and the first five-digit SSN assignment, the cases were classified into three groups for analysis:

1. Illinois natives were born in Illinois and assigned an Illinois SSN (first three digits from 318 through 361).
2. Early migrants were born in a state other than Illinois and assigned an Illinois SSN.

[a]Race is reported as black on the cancer report form. The term, African American is used throughout the text and may include persons who are black but not American.

3. Late migrants were born in a state other than Illinois and assigned a non-Illinois SSN.

Birthplaces were grouped by state (excluding Illinois) into four U.S. regions: the Northeast, the South, West and the Midwest. The majority of African-American migrants came from southern states, and thus the analysis was limited to this group. The southern region included Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, .South Carolina, Tennessee, Texas, Virginia, and West Virginia,

Southern African Americans of the Metropolitan Atlanta (Georgia) Surveillance, Epidemiology and End Results (SEER) program were used to produce ratios for African-American residents of the South (southern homeland) for the purposes of this study. Data for 1986 to 1988 were extracted from the SEER public use tape. The same definitions were used to group cancer sites and to define date of birth for the Atlanta and the Illinois data. Race identification was available for 98 percent of the Atlanta cases and information on birthplace was available for 72 percent.

Data Analysis. The sex-specific, age-standardized, proportional incidence ratios (PIRs) for the three migrant groups were calculated, by dividing the observed number of cases in the category of interest (O_i) by the expected number (E_i). The expected number of cases for a specific cancer site was obtained by using the number of all African-American cases in age-specific groups (C_i), multiplied by the ratio of cancer cases in the site of interest (T), to all patients in that age category in the referent group (R_i). The age-specific numbers then were summed to form the expected number for the referent group, using the equation below:

$$\frac{\mathrm{O}_i}{\mathrm{E}_i} = PIR$$

where,

$$\mathrm{E}_i = \sum_{j=0}^{n} C_j \left\{ \frac{T}{R_j} \right\}$$

and where $_{\mathrm{I}}$ = the cancer group and $_{\mathrm{j}}$ = the age group. The 95 percent confidence interval was calculated for all PIRs using standard techniques.[17]

A chi-square test for trend was computed to identify statistically significant trends across the four groups: Illinois native, early migrant, late migrant, and southern homeland. Sex- and site-specific cancer ratios of Illinois African-American natives also were compared with the ratios for early migrants, late migrants, and the southern homeland. A Poisson test was used to determine statistically significant differences between Illinois natives and each group. Trends and group differences were interpreted as statistically significant when the p value was 0.05 or less.

RESULTS

Males

Table 1 reports the numbers of cases and age-standardized proportional incidence ratios by cancer site and migration group for African-American males. No statistically significant trends were identified; however, significant differences between Illinois natives and the migrant and homeland groups were found. The PIRs for oral cancer in early (PIR = 81) and late migrants (PIR = 77) and the southern homeland (PIR = 74) were all significantly lower than the ratio for Illinois natives.

Early and late migrants had significantly higher PIRs for stomach and colon cancers than Illinois natives (stomach PIR = 162 and 137; colon PIR = 127 and 117 early and late migrants, respectively). Early and late migrants had a significantly lower ratio for bladder cancer and myeloma than Illinois natives (bladder PIR 57 and 67; myeloma PIR 42 and 62, early and late migrants, respectively).

In two cancer sites, the Illinois ratio was significantly different from only one of the migrant groups. Late migrants had a lower ratio of liver cancer (PIR = 71) and a higher ratio of rectal cancer (PIR = 125) than Illinois natives. Testicular cancer in late migrants (PIR = 15) and the southern homeland (PIR = 28) was lower than in Illinois natives. Prostate cancer was significantly higher in the southern homeland (PIR = 118) than in Illinois African-American natives.

Illustrations of the PIRs with 95 percent confidence intervals for all sites with at least one ratio significantly different than the Illinois natives, are shown in Figure 1. In each graph, the PIR for Illinois natives is indicated by a thick line for ease in comparison.

The numbers of cases for bone cancer and melanoma were small in all migrant groups, thus the ratios and trends may be unstable and misleading.

Females

Table 2 presents similar data for African-American females. A statistically significant trend was identified for lung cancer, with the Illinois native ratio being the highest.

In addition, significant differences were found among some of the migrant groups, although no linear trend was identified. The PIRs for colon cancer in early (PIR = 150) and late migrants (PIR = 139) and in the southern homeland (PIR = 135) were all significantly higher than for female African-American natives of Illinois, as were the ratios for leukemias (PIR = 249, 181, and 263, early migrants, late migrants, and homeland, respectively). For rectal cancer, early (PIR = 126) and late

migrants (PIR = 130) had significantly higher PIRs than Illinois natives, and for cancers of the esophagus, pancreas, and kidney, the PIRs in early migrants and homeland groups were significantly higher than for Illinois natives.

In five cancer sites among African-American females, the Illinois ratio was significantly different from only one of the migrant groups. African-American early migrants had a lower ratio of breast cancer compared with natives (PIR = 91). Late African-American migrants had lower ratios of cancers of the liver (PIR = 45) and nervous system (PIR = 64) than Illinois African-American natives. Late migrants also had a higher ratio of stomach cancer (PIR = 145) than natives and the southern homeland had a lower ratio of oral cancer (PIR = 80) than Illinois natives.

Illustrations of PIRs with 95 percent confidence intervals for all sites with at least one ratio significantly different from the Illinois female natives are shown in Figure 2. As for the males, the PIR for female natives is indicated by a thick line for ease in comparison.

The numbers of female cases for bone cancer and melanoma and for Hodgkin's disease in early and late migrants were small, thus the ratios may be unstable and misleading.

DISCUSSION

Only one statistically significant trend was found among the four groups and that was lung cancer in African-American females, with Illinois natives having the highest ratio. Since this same pattern was not found in males, it is more suggestive of the effect of lifestyle choices (e.g., smoking and occupation) differing between African-American male and female migrants, than an effect of changes in the physical environment (e.g., exposures to radon or air pollution). Geophysical changes would be expected to affect both sexes similarly. This finding only partially supports the earlier work of Mancuso and Sterling, where lung cancer mortality was highest in both sexes of native Ohio residents compared with migrants coming from the southern U.S.[13]

Differences, other than trends, were also found among the four groups. These data may suggest the role of genetics, the importance of childhood exposures, or the impact of lifestyle risks that may change more gradually with migration. Female breast cancer in migrants was lower than in Illinois natives, supporting reports that suggest the importance of genetics and exposures early in life.[4] Leukemia PIRs were the opposite, with ratios higher in migrants than in Illinois natives, also suggesting the importance of genetics or exposures early in life.[4] Several other sites (e.g., cancers of the colon, oral cavity, female kidney, and male bladder) where the Illinois natives were different from both migrant groups and the homeland suggest an important role for genetics or that persistence of lifestyle choices in known risk factors, such as diet, smoking, or alcohol use, may be important factors.

Several issues need to be considered in the interpretation of these ratios. If there is a *healthy migrant effect*, then persons diagnosed with cancer at a young age may be less likely to move. Testicular cancer ratios were much lower in migrants than Illinois natives; however, the ratio was also lower in the southern homeland. No differences were seen among the four groups for cervical cancer (including *in situ*), Hodgkin's disease, or non-Hodgkin's lymphomas—all cancer types that occur in younger persons.

A substantial proportion of cancer cases reported to the state cancer registry do not have information on birthplace, a limiting factor in the method used to assign migration status. Whether this introduced a selection bias is not directly known. Birthplace information is more available for Atlanta cases (72 percent) than for Illinois cases (60 percent). However, the proportion of unknown birthplace was similar among all age groups and cancer types and for both sexes, and thus appears to be an unlikely source of bias that would modify the interpretation of the data presented.

Although SEER data from metropolitan Atlanta were selected to represent southern U.S. cancer patterns, they may not be representative of the rural South. Based on migration studies of African-American populations within the U.S., most Illinois African Americans migrated from Louisiana and Mississippi.[18] However, cancer data were not publicly available from these areas in the age and race detail desired. If the differences among the four migrant groups are related to urban-rural differences, then the analyses would underestimate the migration effect since the southern homeland ratios were based on an urban population. Most Illinois African Americans live in urban Cook County (including the city of Chicago) and, when stratified by migrant status, only small differences are apparent among the three migrant categories (85 percent of natives live in Cook County, while 87 percent of late migrants and 89 percent of early migrants live there).

To examine the effect of an urban bias on the homeland ratio, we compared sex-specific age-adjusted cancer incidence rates (per 100,000 population) for African Americans in Louisiana with those in Atlanta.[11] The rates for most cancer sites were similar, however, a few differences were noted. In females, Louisiana rates were higher for cancers of the stomach, lung, and uterus, and lower for cancers of the oral cavity and nervous system. In males, Louisiana rates were higher for cancers of the stomach and pancreas, and lower for cancer of the prostate. Thus the Atlanta ratios for these sites were probably not an accurate reflection of the true cancer ratios for the southern homeland of most Illinois African Americans.

Urban-rural differences in cancer incidence also have been noted among African Americans in Illinois.[18] Thus the following sites might also be inter-related with urban-rural differences, if a migration gradient is also related to the length of residence in an urban environment: cancers of the breast, stomach (early female migrants only), liver (excluding late migrant males), lung, and nervous system.

Persons who migrate may have other differences that distinguish them from natives and are also related to cancer risk. Most people migrate to be closer to family or to improve job opportunities.[19] It is assumed that employment opportunities improve socio-economic status (SES); however, several alternative theories have also been proposed.[19] While African Americans may have moved north to improve SES, many end up in low-paying jobs, accomplishing little improvement in SES. On the other hand, the jobs in the North may have provided more opportunities or greater job satisfaction.

Some have conjectured that differences in state welfare programs entice the chronically poor to migrate to places where it is easier to maintain welfare eligibility or increase welfare payments.[18] Current research suggests that if this has any effect, it is most likely a minor one and limited to the chronically poor.[19] Also, more recently, out-migration of African Americans from large urban centers in the North suggest that college-educated African Americans from Illinois are migrating south to large metropolitan areas, while poor African Americans from Illinois are drawn south to small cities or north to Minnesota and Wisconsin.[20] Atlanta, however, was one destination that attracted both college-educated and poor Illinois African Americans. If Atlanta attracts both the poor and middle class alike, then the southern homeland ratios may not introduce a SES bias as much as an urban bias into the analyses.

Another problem with using the Atlanta data as a comparison is that they contain not only data for Atlanta natives, but also in-migrants from other areas, including the Midwest. Since migrant status of the SEER patients could not be ascertained using the SSN and birthplace method (SSN is not on the public use tape), the impact of this on the interpretations is unknown.

Two studies have examined intra-U.S. migration of African Americans.[13,21] A report of Cook County African Americans did not measure the timing of migration.[21] Statistically significant

differences between the two studies were consistent for four sites: native African-American females had a higher proportional incidence of lung cancer, breast cancer, and oral cancer, and males had a higher PIR of bladder cancer. In addition to these findings, the Cook County study found higher rates in natives for cancers of the cervix and esophagus in females and cancers of the colon, rectum, and pancreas in males. The second study regarding intra-U.S. migration examined lung cancer mortality among white and non-white migrants, as discussed above.[13]

Several studies have examined North-South differences in cancer rates among all races combined. Similar to the data reported here for African Americans, cancer of the breast and lung are higher in the North than in the South.[22,23] The breast cancer ratios reported for Atlanta, as the southern homeland, are slightly higher and may also be affected by the urban-rural differences in breast cancer that have been reported elsewhere.[18] Differences between this study and others focusing on northern U.S. migration were found for cancers of the prostate, ovary, uterus, male lung, stomach, and colon. In all cases, the ratios in the South were higher than those in the North, findings not supported by the data reported here. It is plausible that, since many of these ratios have race differences as well, the race differences may contribute to the disparate findings.

Many other reports have identified migration differences in cancer rates, although mostly in Asian or Hispanic migrants. Despite the race differences among the studies, some similar differences by cancer type were found. Explanations for these specific differences also may be relevant to African-American, intra-U.S. migrants. Shimuzu and colleagues explain that differing breast cancer rates among migrant groups can be attributed to early childhood exposures or the concomitant effect of increasing affluence, which is highly correlated with migration.[3] They also state the complexities in the variation of stomach cancer rates were not totally explained by diet, but that poverty also contributed to higher stomach cancer risk.[2,3] Anton-Culver and colleagues attributed differences in

bladder cancer between whites and Asian/Pacific Islanders to differences in smoking behavior and occupation.[24]

Consistent with the data reported here, prostate cancer does not exhibit a migration effect.[1-3] Incidence appears to reflect current environment, and is consistent with a theory that exposures later in adult life are more important than those in childhood or young adulthood.

Colon cancer rates appear to increase with migration to more industrialized areas, and child migrants acquire the risk from the current environment.[2] This finding was not supported in this study. Colon cancer ratios were lower in both male and female natives than they were in the migrants. As mentioned above, most Illinois African Americans reside in urban areas of the state. Neither was evidence found for a difference among the migrants, depending on the time of their migration.

In conclusion, the data suggest that, consistent with other studies, regional differences in cancer proportional incidence ratios among African Americans exist and, among those African Americans who migrate to the North from the South, proportional ratios in some cancer sites also change. Further, evidence was found in some cancer sites for the effect of the timing of northern migration on cancer risk. However, factors other than race that can be associated with migration and also can be determinants of cancer risk, such as socio-economic status, occupation, patterns of medical care, environmental exposures, and lifestyle changes, were discussed as complicating issues that prevent a simplistic interpretation of the data. More study is needed that considers actual homeland ratios and takes into account migration patterns and intra-regional variation within the U.S. regions. Developing population estimates of migrants could strengthen the methodology of these studies by improving the ability to use standardized rates for the comparisons.

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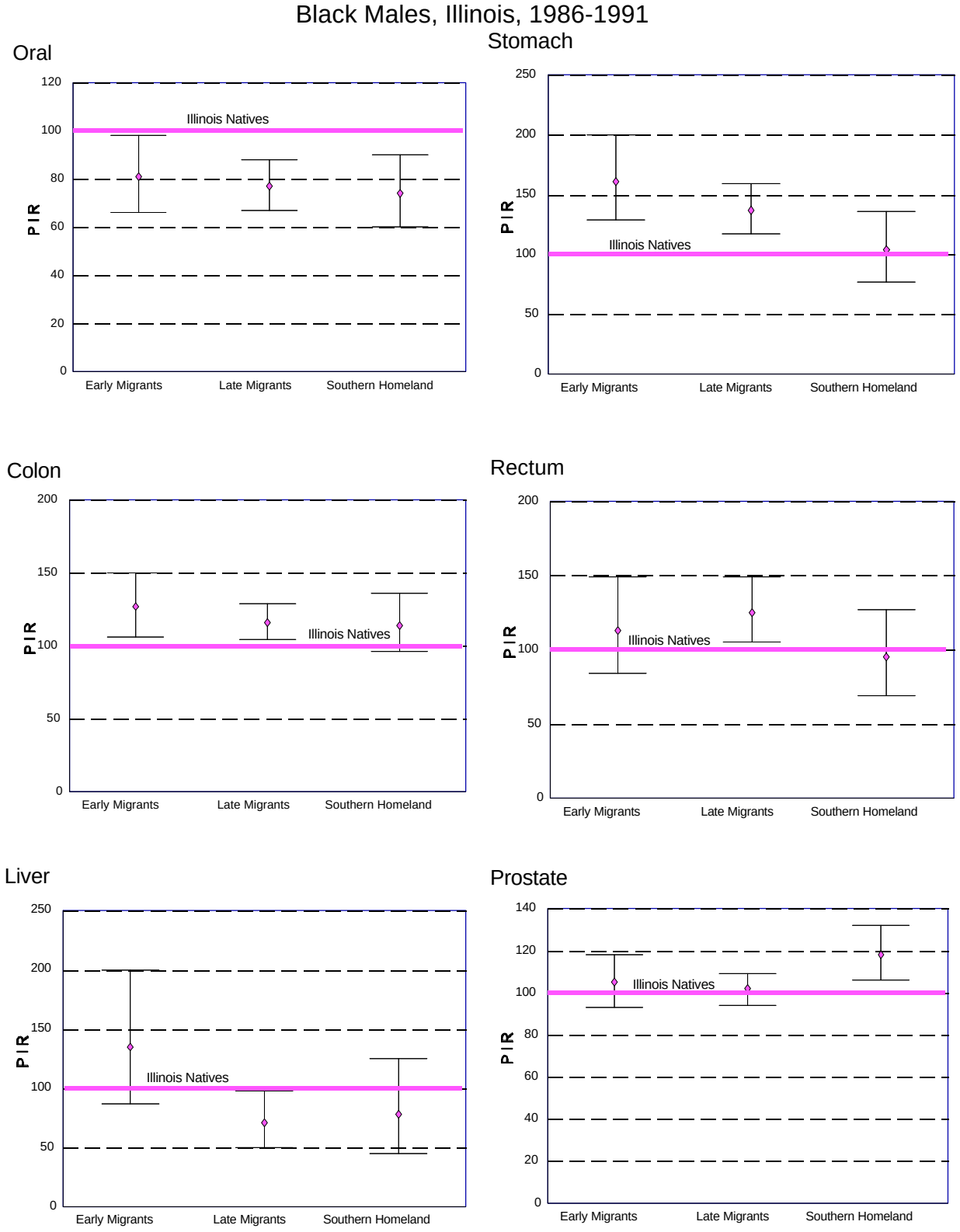
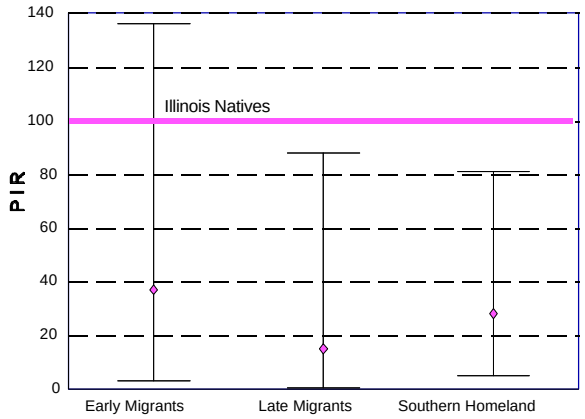
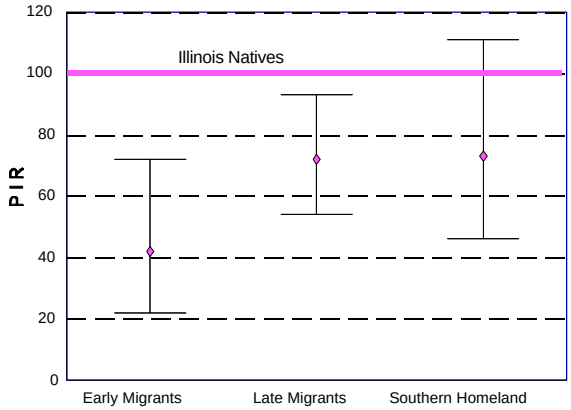
Figure 1: PIRs for Cancer Sites that Significantly Differ by Migration Group



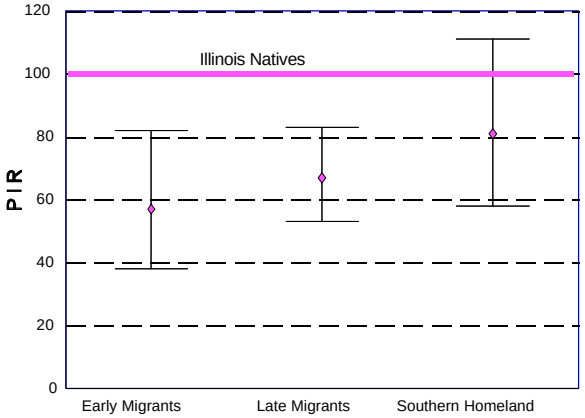
Testes



Myelomas



Bladder

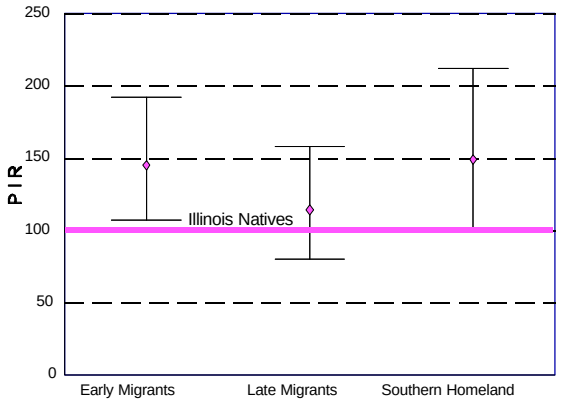


Source: Illinois Department of Public Health, Illinois State Cancer Registry, 1995.

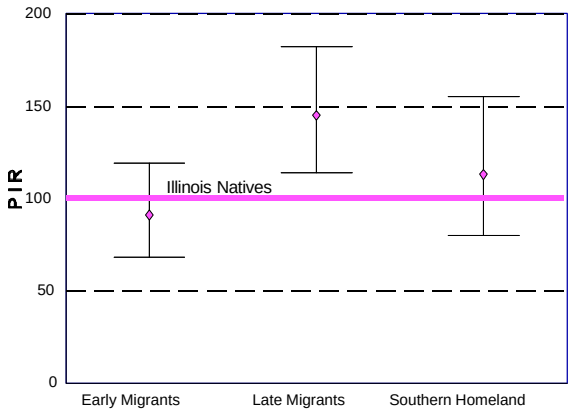
Figure 2: PIRs for Cancer Sites that Significantly Differ by Migration Group

Black Females, Illinois 1986-1991

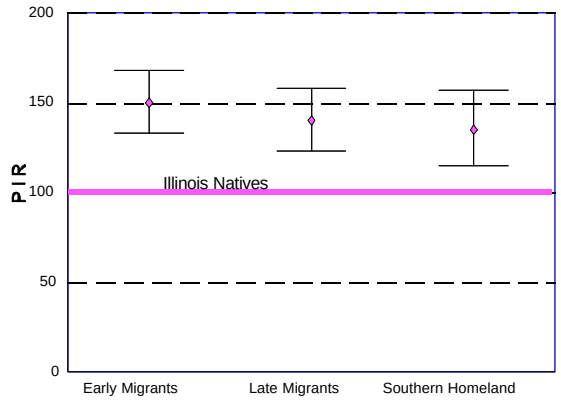
Esophagus



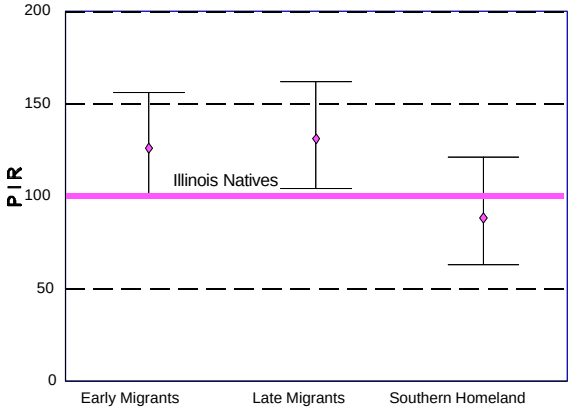
Stomach



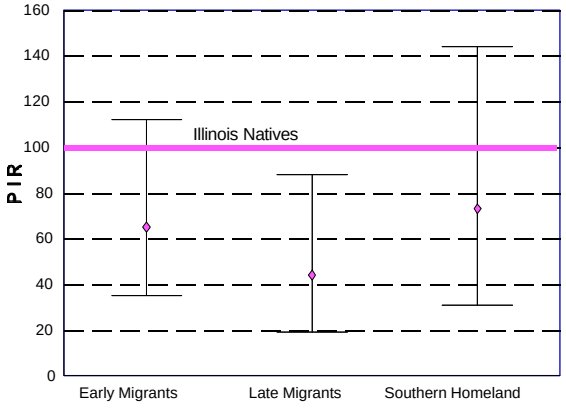
Colon



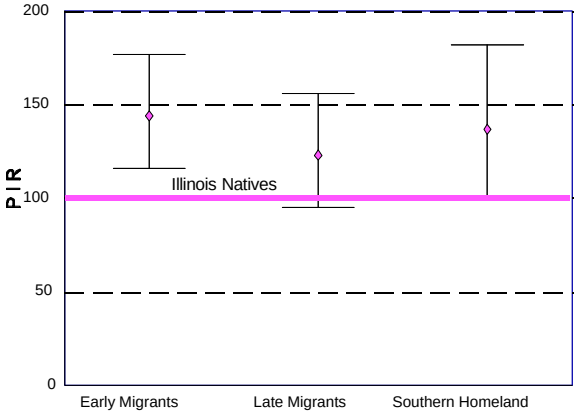
Rectum



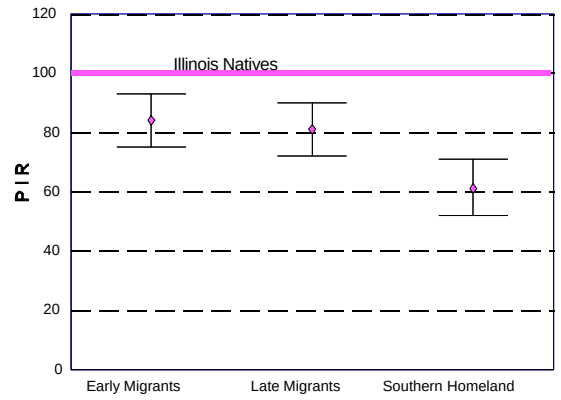
Liver



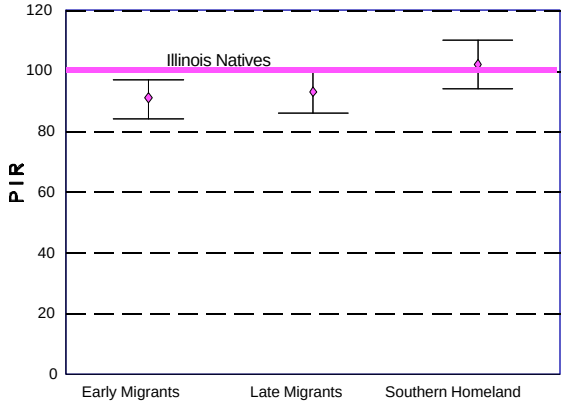
Pancreas



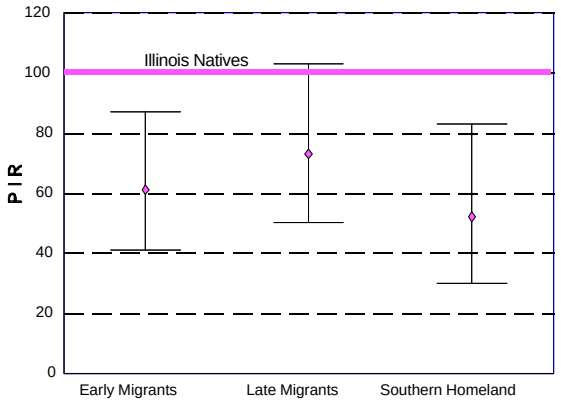
Lung



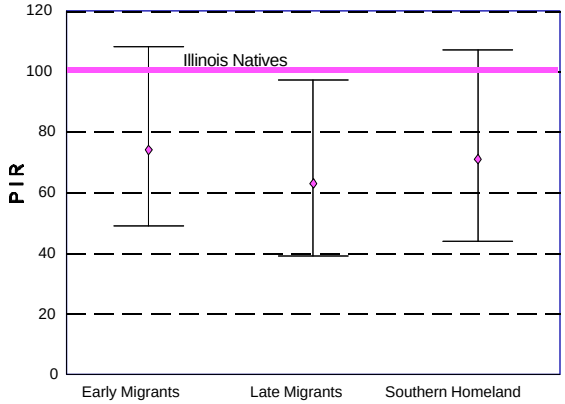
Breast



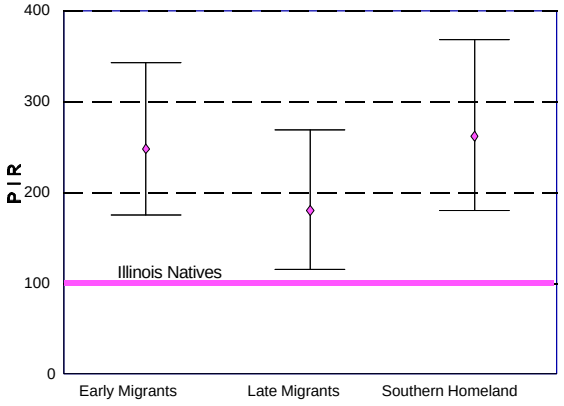
Kidney



Nervous System



Leukemias



Source: Illinois Department of Public Health, Illinois State Cancer Registry, 1995.

TABLE 1. *Age-standardized proportional incidence rations and tests for trend for early and late migrants and southern blacks compared with Illinois natives, black males, 1986-1991*

	Illinois Natives (*n*=1508)	Early Migrants (*n*=1465)		Late Migrants (*n*=3660)		Southern homeland (*n*=1586)	
Cancer site	PIR (*n*)	PIR (*n*)	95% CI	PIR (*n*)	95% CI	PIR (*n*)	95% CI
Oral cavity	100 (135)	81[a] (102)	66, 98	77[b] (221)	67, 88	74[a] (99)	60, 90
Esophagus	100 (70)	125 (81)	99, 156	111 (183)	95, 128	119 (87)	95, 146
Stomach	100 (44)	162[b] (83)	129, 200	137[b] (170)	117, 159	104 (52	77, 136
Colon	100 (100)	127[a] (137)	106, 150	117[a] (325)	104, 129	114 (133)	96, 136
Rectum	100 (43)	113 (50)	84, 149	125[a] (130)	105, 149	95 (44)	69, 127
Liver	100 (21)	135 (25)	87, 200	71[a] (36)	50, 98	78 (17)	45, 125
Pancreas	100 (47)	75 (33)	51, 105	86 (100)	70, 105	84 (42)	61, 114
Lung	100 (371)	92 (346)	83, 102	102 (988)	96, 108	100 (405)	91, 111
Bone	100 (5)	111 (3)	21, 329	66 (3)	13, 197	74 (3)	14, 222
Melanoma	100 (4)	45 (1)	0, 261	70 (4)	18, 181	186 (6)	67, 411
Prostate	100 (218)	105 (296)	93, 118	102 (753)	94, 109	118[a] (315)	106, 132
Testis	100 (16)	37 (2)	3, 136	15[a] (1)	0, 88	28[a] (3)	5, 81
Bladder	100 (46)	57[a] (29)	38, 82	67[b] (84)	58, 83	81 (39)	58, 111
Kidney	100 (47)	90 (36)	63, 124	92 (96)	74, 112	117 (55)	88, 152
Nervous system	100 (23)	93 (12)	48, 164	129 (32)	88, 182	84 (16)	48, 137
Hodgkin's disease	100 (25)	97 (7)	39, 201	118 (12)	61, 208	74 (12)	38, 129
Non-Hodgkin's lymphomas	100 (47)	99 (26)	64, 144	107 (62)	82, 137	104 (40)	74, 141
Myelomas	100 (25)	42[b] (13)	22, 72	72[a] (55)	54, 93	73 (22)	46, 111
Leukemias	100 (26)	117 (23)	74, 175	84 (33)	58, 118	132 (30)	89, 188
Other sites	100 (195)	106 (161)	90, 124	100 (368)	90, 111	90 (166)	77, 104

[a] Poisson test, $p < 0.05$.
[b] Poisson test, $p < 0.001$.

TABLE 2. *Age-standardized proportional incidence rations and tests for trend for early and late migrants and southern blacks compared with Illinois natives, black females, 1986-1991*

	Illinois Natives (*n*=2495)	Early Migrants (*n*=2631)		Late Migrants (*n*=2402)		Southern homeland (*n*=2004)	
Cancer site	PIR (*n*)	PIR (*n*)	95% CI	PIR (*n*)	95% CI	PIR (*n*)	95% CI
Oral cavity	100 (55)	87 (59)	67, 113	79 (49)	58, 104	80[a] (38)	57, 110
Esophagus	100 (26)	145[a] (48)	107, 192	114 (37)	80, 158	149[a] (30)	100, 212
Stomach	100 (37)	91 (52)	68, 119	145[a] (73)	114, 182	113 (39)	80, 155
Colon	100 (134)	150[b] (300)	133, 168	139[b] (256)	123, 158	135[b] (164)	115, 157
Rectum	100 (51)	126[a] (85)	101, 156	130[a] (83)	104, 162	88 (39)	63, 121
Liver	100 (12)	65 (13)	35, 112	45[a] (8)	19, 88	73 (8)	31, 144
Pancreas	100 (38)	144[a] (88)	116, 177	123 (68)	95, 156	137[b] (47)	100, 182
Lung	100 (283)	84[b] (341)	75, 93	81[b] (307)	72, 90	61[b] (155)	52, 71
Bone	100 (1)	813 (1)	0, 4664	813 (1)	0, 4661	346 (2)	33, 1274
Melanoma	100 (3)	123 (2)	12, 453	250 (4)	65, 646	206 (4)	53, 531
Breast	100 (746)	91[a] (731)	84, 97	93 (695)	86, 100	102 (607)	94, 110
Cervix	100 (600)	104 (308)	93, 117	96 (244)	85, 109	105 (423)	96, 116
Uterus	100 (67)	101 (103)	82, 122	108 (100)	88, 131	114 (71)	89, 144
Ovary	100 (52)	125 (72)	98, 158	128 (65)	99, 163	101 (42)	73, 137
Bladder	100 (23)	80 (32)	55, 114	119 (43)	86, 160	67 (16)	38, 109
Kidney	100 (37)	61[a] (30)	41, 87	73 (33)	50, 103	52[a] (17)	30, 83
Nervous system	100 (39)	74 (27)	49, 108	64[a] (21)	39, 97	71 (22)	44, 107
Hodgkin's disease	100 (15)	71 (5)	23, 168	131 (8)	56, 260	140 (14)	76, 236
Non-Hodgkin's lymphomas	100 (37)	105 (42)	75, 141	81 (30)	55, 116	114 (35)	79, 159
Myelomas	100 (27)	75 (36)	53, 104	125 (53)	94, 164	111 (32)	76, 157
Leukemias	100 (16)	249[b] (37)	175, 343	181[a] (24)	115, 269	263[b] (33)	180, 368
Other sites	100 (196)	101 (219)	88, 116	102 (200)	88, 117	100 (166)	86, 117

[a] Poisson test, $p < 0.05$.

[b] Poisson test, $p < 0.001$.

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