

Trends in Incidence and Histological Subtypes of Lung Cancer, Kingston and St Andrew, Jamaica, 1968–1997

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ABSTRACT

Several scientific publications have reported a progressive shift in the distribution of the histologic subtypes of lung carcinoma in the latter decades of the 20th century, with adenocarcinoma now surpassing squamous cell carcinoma as the most commonly diagnosed morphologic pattern. A 30-year review (1968–1997) of lung cancer cases registered in the Jamaica cancer registry shows a similar trend among males in Kingston and St Andrew with a progressive increase in the documented cases of adenocarcinoma relative to squamous cell carcinoma. Similar changes were not observed in females.

Tendencias en la Incidencia y Subtipos Histológicos de Cáncer Pulmonar en Kingston y St Andrew, Jamaica, 1968–1997

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RESUMEN

Varias publicaciones científicas han reportado un desplazamiento progresivo en la distribución de los subtipos histológicos del carcinoma pulmonar en las últimas décadas del siglo 20. En las mismas se evidencia que, en el presente, el adenocarcinoma supera al carcinoma celular escamoso como patrón morfológico más comúnmente diagnosticado. Una revisión de 30 años (1968–1997) de casos de cáncer pulmonar registrados en el registro de cáncer de Jamaica, muestra una tendencia similar entre los hombres en Kingston y Saint Andrew, con un aumento progresivo en los casos documentados de adenocarcinoma en relación con el carcinoma celular escamoso. No se observaron cambios similares en las mujeres.

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INTRODUCTION

Lung carcinoma is the most common malignant tumour worldwide and is the major cause of death from cancer (1). It was a rare disease prior to the 20th Century and the dramatic rise in its incidence is primarily a reflection of the increased prevalence of exposure to environmental tobacco smoke (1). In Kingston and St Andrew (KSA), Jamaica, lung carcinoma is the second most commonly diagnosed cancer among males as well as the second leading cause of cancer-related deaths among men. Age-standardized incidence rates in males have increased from 12.0 per 10⁵ per year in 1968–1972 to 25.4 per 10⁵ per year in 1993–1997. The incidence in females has increased from 3.4 per 10⁵ per year in 1968–1972 to 4.9 per 10⁵ per year in 1993–1997, making lung carcinoma the eighth-most diagnosed cancer in women (2–7).

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Global trends indicate that there has been a shift in the distribution of histologic types of lung cancer since the decade of the 1980s with adenocarcinoma now being the most commonly diagnosed histologic subtype of lung cancer in most locales. This contrasts with squamous cell carcinoma being the most predominant morphologic pattern documented in most cancer registries up until the 1980s (8–14).

The aim of this study is to analyze data collected in the Jamaica Cancer Registry over the 30-year period 1968–1997, to see if a similar trend has occurred in KSA, Jamaica. Theories for the changing histologic pattern being observed worldwide are also discussed.

MATERIALS AND METHODS

This study is based on data collected by the Jamaica Cancer Registry which has been in operation since 1958. It is a population based registry that documents malignant neoplasms occurring in Jamaica which has a population size of 2.6 million and is divided into 14 parishes. Active data collection is employed by registry personnel who abstract information from medical records departments, pathology

laboratories, autopsy reports, death certificates and general practitioners. For this study, only information collected from the parishes of KSA were analyzed because of the necessity to ensure accuracy and completeness of data sourced from the population living within the delimited geographic area. Kingston and St Andrew are two adjoining parishes comprising many rural communities as well as the island's largest urban centre and has a resident population of 650 000 which is approximately 26% of Jamaica's population (15).

All patients from the resident population of KSA diagnosed with an ICD-9 code of 162 (cancer of lung, trachea, bronchus) between the period of 1968–1997 were extracted from the datafiles of the Jamaica Cancer Registry. Data extracted for each case included gender, histologic subtype of cancer, age at diagnosis and date of diagnosis. Cases were grouped into the following histologic subtypes based on morphologic tumour characteristics: squamous cell carcinoma, adenocarcinoma, other carcinomas, including small cell and large cell carcinoma and carcinomas, not otherwise specified (NOS). For the time period under review, cases diagnosed on clinical examination, radiological examination, bronchoscopy or post mortem examination and for

RESULTS

During the study period, a total of 1450 (1145 male and 305 female) cases of lung cancer were diagnosed of which 59% were confirmed microscopically. There were 39 cases (28 male, 11 female) below the age of 40 years and these were excluded from analysis. The male to female ratio for the remaining 1411 cases was 3.8:1.

The number of cases and age-standardized incidence rates per 100 000 of lung cancer with respect to calendar period, histologic subtypes and gender are shown in Tables 1 and 2 while time trends in age-standardized incidence rates over the 30-year period 1968–1997 for both genders are demonstrated in Figures 1–5. The changing trends in the proportion of microscopically confirmed lung cancers by histologic type for males and females over the time period under review are shown in Figures 6 and 7.

For males 40–64 years, the incidence of squamous cell carcinoma increased from 7.2 per 10⁵ for the calendar period 1968–1972 to 11.4 per 10⁵ for 1978–1982 and then decreased to 8.1 per 10⁵ for 1993–1997. The incidence of adenocarcinoma demonstrated a generally progressive increase from 4.1 per 10⁵ for 1968–1972 to 7.1 per 10⁵ for 1993–1997.

Table 1: Numbers of documented lung carcinomas, and age-standardized (World Standard Population) lung carcinoma incidence rates per 100 000 males, 40–64 years and > 65 years, Kingston and St Andrew, 1968–1997

Age (yr)	Histologic Subtype	1968 – 1972		1973 – 1977		1978 – 1982		1983 – 1987		1988 – 1992		1993 – 1997	
		No	Rate	No	Rate	No	Rate	No	Rate	No	Rate	No	Rate
40 – 64	SCC*	14	7.2	19	8.9	23	11.4	20	8.9	19	9.1	19	8.1
	Adenocarcinoma	8	4.1	18	8.3	7	3.7	12	5.4	23	10.9	17	7.1
	Other	14	7.5	26	12.1	17	8.4	29	13.3	32	15.0	37	14.7
	Non-microscopic	35	18.0	13	6.1	40	19.6	34	15.2	50	24.2	54	22.9
	Total	71	36.8	76	35.4	87	43.1	95	42.8	124	59.2	127	52.8
> 65	SCC*	16	37.1	23	49.4	15	23.0	21	28.2	19	27.6	28	38.1
	Adenocarcinoma	3	7.0	8	17.4	3	4.3	9	13.3	9	12.2	22	30.4
	Other	10	23.4	14	30.1	24	35.5	16	21.9	17	25.2	25	33.7
	Non-microscopic	39	90.7	26	56.8	37	55.2	45	62.3	54	75.1	54	70.0
	Total	68	158.2	71	153.7	79	118.0	91	125.7	99	140.4	129	172.2

which microscopic confirmation was not available were separately categorized. As the number of incident cases among persons less than 40 years of age was negligible, incidence rates were computed using the World Standard Population (16) for five-year population age bands 40–79 years and persons 80 years and older. The direct method of standardization is applied (17). Rates were calculated for both sexes for squamous cell carcinoma, adenocarcinoma, NOS and other cancers and non-microscopically confirmed cancers for five-year calendar blocks beginning in 1968.

The incidence of all other microscopically confirmed lung cancers was 7.5 per 10⁵ in 1968–1972 and 14.7 per 10⁵ in 1993–1997.

The incidence of squamous cell carcinoma for males older than 65 years was 37.1 per 10⁵ for 1968–1972, increased to 49.4 per 10⁵ for 1973–1977, decreased to 23.0 per 10⁵ for 1978–1982 and then gradually increased to 38.1 per 10⁵ for 1993–1997. The incidence of adenocarcinoma for males older than 65 years increased progressively from 7 per 10⁵ in 1968–1972 to 30.4 per 10⁵ for 1993–1997.

Table 2: Numbers of documented lung carcinomas, and age-standardized (World Standard Population) lung carcinoma incidence rates per 100 000 females, 40–64 years and > 65 years, Kingston and St Andrew, 1968–1997

Age (yr)	Histologic Subtype	1968 – 1972		1973 – 1977		1978 – 1982		1983 – 1987		1988 – 1992		1993 – 1997	
		No	Rate	No	Rate	No	Rate	No	Rate	No	Rate	No	Rate
40 – 64	SCC*	2	0.8	7	2.3	3	1.2	6	2.3	3	1.3	1	0.4
	Adenocarcinoma	5	2.1	10	3.4	4	1.7	4	1.5	8	3.3	7	2.5
	Other	1	0.4	6	2.1	5	2.0	5	1.8	6	2.3	16	5.8
	Non-microscopic	16	6.7	3	1.0	6	2.5	16	6.0	11	4.4	12	4.3
	Total	24	10.0	26	8.8	18	7.4	31	11.6	28	11.3	36	13.0
> 65	SCC*	4	5.8	5	6.7	3	3.4	1	1.0	3	2.8	6	6.1
	Adenocarcinoma	6	9.2	5	6.7	4	4.0	3	3.0	6	6.9	7	5.5
	Other	2	3.2	9	10.0	1	0.7	3	2.9	5	3.3	5	5.6
	Non-microscopic	10	14.4	3	3.4	12	13.3	7	5.8	10	8.5	11	7.0
	Total	22	32.6	22	26.8	20	21.4	14	12.7	24	21.5	29	24.2

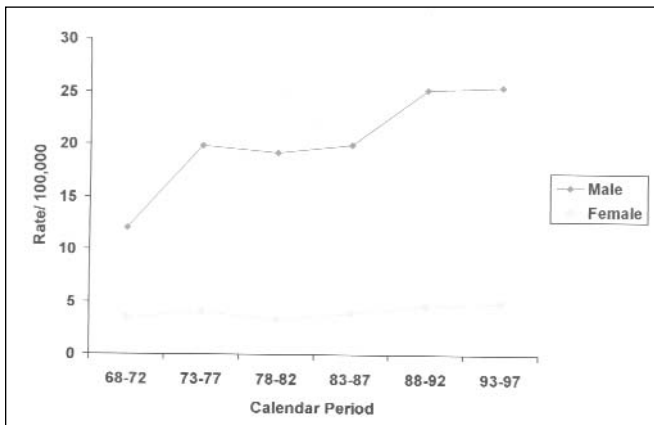


Fig. 1: Age-standardized (World Standard Population) incidence rates per 100 000 for lung carcinoma, Kingston and St Andrew, by gender, 1968-1997.

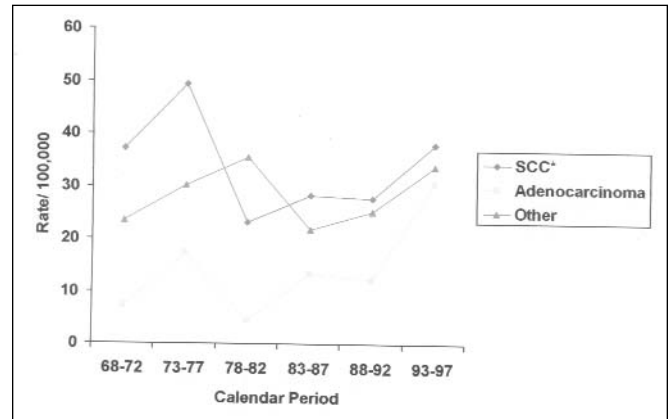


Fig. 3: Trends in age-standardized (World Standard Population) incidence rates per 100 000 for lung carcinoma in males > 65 years, by histologic type in Kingston and St Andrew, 1968–1997

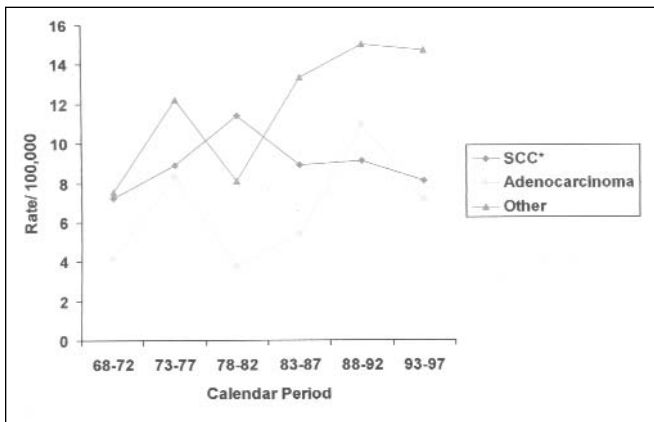


Fig. 2: Trends in age-standardized (World Standard Population) incidence rates per 100 000 for lung carcinoma in males, 40 – 64 years, by histologic type in Kingston and St Andrew, 1968-1997

*Squamous cell carcinoma

*Squamous cell carcinoma

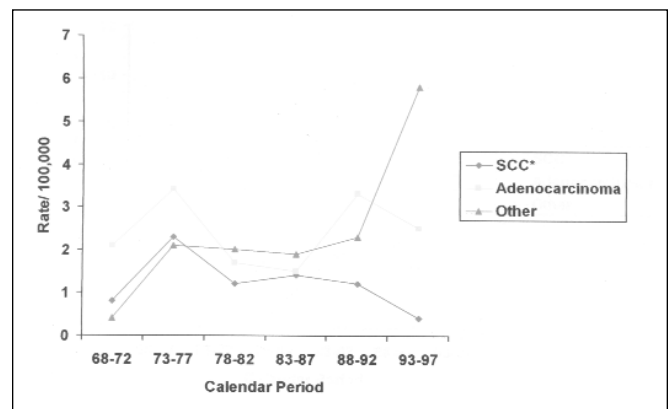


Fig. 4: Trends in age-standardized (World Standard Population) incidence rates per 100 000 for lung carcinoma in females, 40-64 years, by histologic type in Kingston and St Andrew, 1968- 1997

*Squamous cell carcinoma

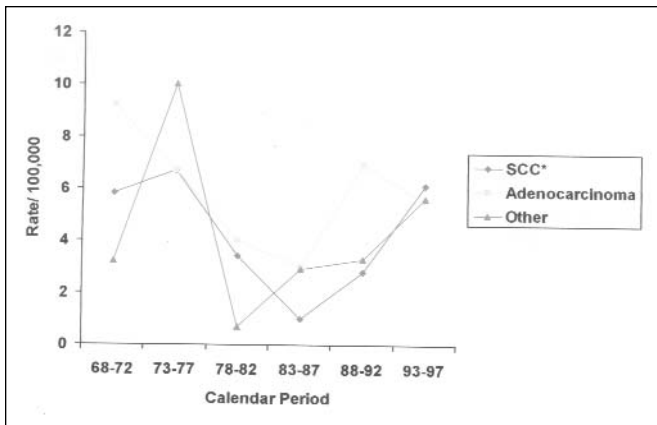


Fig. 5: Trends in age-standardized (World Standard Population) incidence rates per 100 000 for lung carcinoma in females > 65 years, by histologic type in Kingston and St Andrew, 1968-1997

*Squamous cell carcinoma

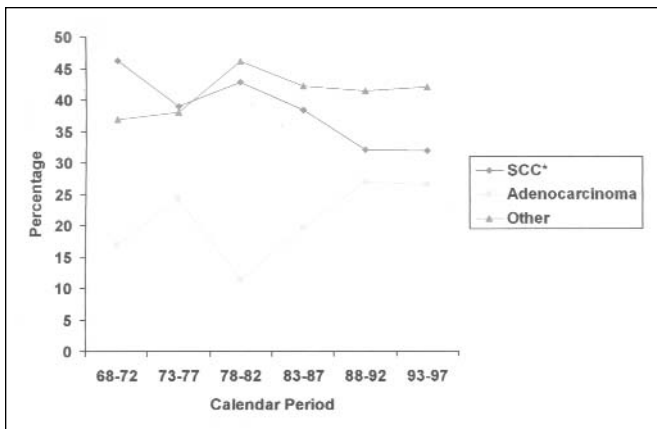


Fig. 6: Trends in proportion of microscopically confirmed lung carcinomas by histologic type for males in Kingston and St Andrew, 1968-1997

*Squamous cell carcinoma

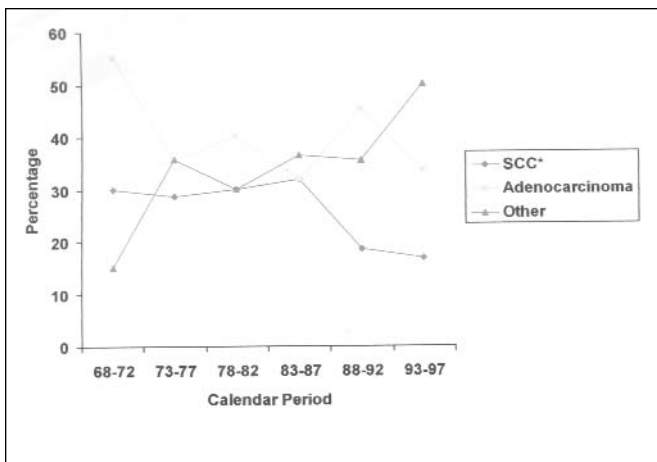


Fig. 7: Trends in proportion of microscopically confirmed lung carcinomas by histologic type for females in Kingston and St Andrew, 1968-1997

*Squamous cell carcinoma

The incidence of squamous cell carcinoma for females 40–64 years was 0.8 per 10⁵ for the period 1968–1972 and 0.4 per 10⁵ in 1993–1997 while the comparable incidence rates for adenocarcinoma are 2.1 per 10⁵ and 2.5 per 10⁵ respectively. The incidence rates of both squamous cell carcinoma and adenocarcinoma for elderly females (> 65 years) decreased over the time period 1968–1987 and then progressively increased over the subsequent calendar periods.

The proportion of all histologically confirmed lung cancers among males registered as adenocarcinoma was 8% at the beginning of the study period while at the end of the calendar period under review was 15%. Squamous cell carcinoma accounted for 21.6% of all male lung cancers in 1968–1972 and 18.4% in 1993–1997.

There were no documented cases of tumours from sites other than the lung in the persons registered with lung as the primary cancer site.

DISCUSSION

The analysis of data collected from the Jamaica Cancer Registry demonstrates a progressive shift in the distribution of major histologic subtypes of lung carcinoma, reflecting both absolute and relative increases in the incidence of adenocarcinoma for lung cancer cases registered for the region of KSA, Jamaica, over the time 1968–1997. This mirrors similar trends that have been documented from population-based data compiled from other countries. Publications from diverse geographic sites such as the United States of America (USA), Scotland, Italy, Hong Kong and Japan have all demonstrated an increase in the proportion of lung adenocarcinoma in the last two decades (8–14).

In the present study, comparison of incidence trends for squamous cell carcinoma and adenocarcinoma in males aged 40–64 years, shows that by 1993–1997, the incidence of both cancers was about equal, in contrast to the much higher incidence of squamous cell carcinoma in 1968–1972. The incidence of adenocarcinoma has demonstrated a generally steady upward trend while squamous cell carcinoma showed increases in incidence until 1978–1982 but then steadily decreased so that the incidence for 1993–1997 is about equal to that of 1968–1972. The changing distribution of squamous cell carcinoma and adenocarcinoma is most dramatically represented in the examination of incidence trends for elderly males, 65 years and older. Although the incidence of squamous cell carcinoma for 1993–1997 is still marginally above that for adenocarcinoma, this reflects a marked narrowing compared to the wide disparity seen at the beginning of the review period in 1968–1972.

The registered number of lung cancer cases in KSA women *per* five-year calendar period is generally small and this may compromise analysis. However, for the review period, the incidence of adenocarcinoma was in excess of that recorded for squamous cell carcinoma, both in middle-aged as well as elderly women. Adenocarcinoma is the most

frequent histologic subtype in non-smokers (18) and although there are no published data on smoking prevalence in Jamaican women, these findings are most likely reflective of the fact that the majority of cancers in women resident in KSA are not related to exposure to tobacco-derived carcinogens. The rate of lung cancer in women in KSA has consistently remained less than 5 per 10⁵ per year. A rate that was noted in the USA for both genders prior to the 1930s when lung cancer was a rare disease due to the low smoking prevalence (19).

Statistical and clinical observations have both established a positive relationship between exposure to tobacco smoke and the incidence of lung cancer (20). Lung cancer risks rise sharply with increasing numbers of cigarettes consumed per day as well as duration of smoking. It is estimated that approximately 90% of lung cancers in men and 79% in women are directly attributable to smoking exposure (21).

The widely observed geographic as well as temporal changes in lung cancer histologic type are thought to be as a result of changes in smoking patterns with a progressive shift towards the use of low-tar, low-nicotine filtered cigarettes and a downward trend in the smoking prevalence within the population (13). Early cigarettes were predominantly unfiltered, high tar products and smoke from these products were thought to be too irritating to be inhaled deeply thus restricting the deposition of tobacco-related carcinogens to the central bronchi, where squamous cell carcinomas primarily arise (13). The introduction of low-tar, low-nicotine, filtered cigarettes would facilitate deeper inhalation, transporting carcinogens to the more peripheral branches of the bronchial tree where adenocarcinomas often originate (22). In addition, it could be hypothesized that a smoker of filtered cigarettes with low-nicotine content would be inclined to increase the number as well as the depths of puffs as a means of satisfying the craving for nicotine. It has also been reported that low-tar cigarettes contain a higher level of nitrates and generate higher levels of nitrosamines which have been shown to induce adenocarcinomas in animal models (23). The possibility of changing levels of exposure to other environmental factors such as dietary factors influencing the perceived trends in lung cancer histological types needs to be explored.

There are a number of variables that should be highlighted as they may be indicative of an artefactual rather than true change in the occurrence of lung adenocarcinoma in KSA for 1968–1997. These include the possible misclassification of metastatic disease as primary lung cancer. Considering that adenocarcinomas rather than squamous cell carcinomas from non-lung sites are more likely to present with pulmonary metastases, then increases in incidence of cancers from sites such as the gastrointestinal tract or prostate gland, if not accurately registered, may contribute to shifts of histologic classification. Secondly, the relatively high proportion of non-microscopically confirmed tumours

should be emphasized. The high proportion of non-microscopically confirmed tumours noted in the earlier periods (54% of all registered cases for 1968–1973 compared to 41% for 1993–1997) coupled with the increased use in the latter years of flexible bronchoscopy increasing access to the peripheral lung parenchyma – where the majority of adenocarcinomas arise – may also account for some of the shift in the ratio of adenocarcinoma and squamous cell carcinoma being identified. Thun *et al* have demonstrated that the incidence of adenocarcinoma in the USA antedated the use of new diagnostic techniques such as the fiberoptic bronchoscope and fine needle aspiration biopsy (24).

In summary, analysis of incidence trends has demonstrated a progressive increase in the absolute as well as relative incidence of adenocarcinoma of the lung in males in KSA, Jamaica, for the time period 1968–1997, mirroring similar trends that have been noted worldwide. In contrast, over the time period studied, adenocarcinomas were consistently the predominant histologic subtype in females resident in KSA and this is probably indicative of a relatively large proportion of non-smoking related cancers in the female population.

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