CLINICAL UPDATE

Does access to private healthcare influence potential lung cancer cure rates?

T-J John,[1] MB ChB, Dip HIV Man (SA); **D Plekker**,[2] MB ChB, FCP (SA), MMed (Int), Cert Pulm (SA);
E M Irusen,[1] MB ChB, FCP (SA), PhD; **C F N Koegelenberg**,[1] MB ChB, MMed (Int), FCP (SA), FRCP (UK), Cert Pulm (SA), PhD

[1] *Division of Pulmonology, Department of Medicine, Faculty of Medicine and Health Sciences, Stellenbosch University and Tygerberg Academic Hospital, Cape Town, South Africa*
[2] *Pulmonologist, Kuils River Hospital, Cape Town, South Africa*

Corresponding author: *T-J John (jessjohnt@gmail.com)*

Background. Numerous studies show a link between poor socioeconomic status (SES) and late-stage cancer diagnosis. However, this has not been consistently shown looking at non-small-cell lung cancer (NSCLC) in isolation. Despite the extremely high prevalence of lung cancer and disparities in access to healthcare based on health insurance in South Africa, there is a paucity of data on the influence of health insurance (as a surrogate for SES) on stage at presentation of NSCLC.
Objective. To assess the relationship between health insurance status (and invariably SES) and staging (and therefore resectability) of patients with primary NCSLC at the time of initial presentation.
Methods. Health-insured patients with NSCLC (n=51) were retrospectively compared with NSCLC patients with no health insurance (n=532) with regard to demographics, tumour node metastasis (TNM) staging, and cell type at initial presentation.
Results. Patients with no health insurance were younger (mean (standard deviation (SD)) 59.9 (10.1) years) than those with private health insurance (64.2 (9.6) years) (p=0.03). Poorly differentiated NSCLC was significantly more common in the privately health-insured group (23.6%) than among those with no health insurance (4.6%) (p<0.01). Six of 51 NSCLC patients (11.8%) with private health insurance presented with early-stage, potentially curable disease (up to stage IIIA), compared with 55 patients (10.3%) in the uninsured group (p=0.75).
Conclusions. Access to private health insurance did not have a significant impact on stage at initial presentation. The only significant differences were the relatively advanced age at presentation and relatively higher percentage of poorly differentiated NSCLC seen in patients with health insurance.

S Afr Med J 2017;107(8):687-690. DOI:10.7196/SAMJ.2017.v107i8.12277

According to the *World Cancer Report* of 2014,[1] lung cancer remains the most common cause of cancer-related death, resulting in >1.59 million reported deaths in 2012. The situation in South Africa (SA) is no different, although studies have consistently shown that SA patients with non-small-cell lung cancer (NSCLC) have an inferior potential cure rate at presentation when compared with the USA and Western Europe.[2-4] Only ~10% of patients diagnosed with lung cancer in SA are offered treatment with curative intent.[2-4]

The National Institute for Health and Clinical Excellence (NICE) guideline[5] recommends radical surgery for stage I - II NSCLC, with chemoradiotherapy with or without surgery (with curative intent) offered to patients with stage IIIA disease. Palliative chemotherapy and radiotherapy are recommended for later-stage NSCLC patients (stage IIIB and IV).[5] Stage at diagnosis is therefore an important indicator of survival in lung cancer.[6] Diagnosis at an advanced stage (IIIB or IV) usually precludes the possibility of cure and leads to poor long-term outcomes.[7-9] Five-year survival rates of patients diagnosed with late-stage disease range from ~4% to 6%, whereas those for early-stage disease range from 40% to 54%.[6,10-14]

Health insurance status is commonly used as a surrogate marker of socioeconomic status (SES).[15] In turn, SES has been shown to be an independent contributor to health status, as a surrogate for lifestyle, diet, and working and living conditions.[16] Lower SES is known to be associated not only with an increased incidence of cancer but also with worsened survival.[17,18] Although numerous studies across various cancers have shown that poor SES has been associated with late-stage diagnosis, this has not been consistently observed in studies looking at NSCLC in isolation.[18-21] Disparities in access to healthcare and its use, as well as lack of preventive healthcare services including cancer screening, may contribute somewhat to differentials in cancer stage distributions, especially in late-stage diagnosis.[18,22-25]

Objective

There is a paucity of SA data comparing the staging of lung cancer patients at the time of presentation based on SES. The objective of this study was to assess the relationship between health insurance status (and invariably SES) and staging of patients (and therefore resectability and potential cure) with primary NSCLC at the time of initial presentation. The study's null hypothesis, based on previous international research, was that there is no notable difference in the resectability rates of patients with v. without private health insurance diagnosed with NSCLC at the time of presentation.

Methods

All cases of primary lung cancer presenting to Tygerberg Academic Hospital and the Kuils River Respiratory Centre (Kuils River Hospital) in Cape Town, SA, between August 2013 and September 2015 were identified. Tygerberg Academic Hospital, a 1 380-bed public hospital, is a primary referral centre serving approximately three million people. Kuils River Respiratory Centre is based in the suburb of

Kuils River, with patients being admitted to the 180-bed Kuils River Hospital.[26] The two centres are in close proximity and serve a patient population group similar in demographics other than their SES.

All patients in the study population diagnosed with an underlying primary NSCLC in either of the institutions were included in the study group. In the study group, all patients who had a confirmed histological diagnosis together with complete staging details were included in the analysis. Patients were excluded if the presentation with primary lung malignancy was not their first presentation to the healthcare service with a malignancy, or if a second underlying malignancy was suspected at the time of presentation.

Information on individual patients was collected retrospectively from medical records, including routine demographic and clinical data. All patients had access to positron emission tomography/computed tomography, bronchoscopy with endobronchial ultrasound-guided transbronchial needle aspiration with rapid on-site evaluation, transthoracic image (ultrasound or tomography)-guided biopsy and related diagnostic techniques that were performed at the discretion of the treating doctors as per standard operating procedures. A combined panel of at least a pulmonologist, thoracic radiologist, thoracic surgeon, specialist oncologist and pathologist staged all patients as per the 2009 International Association for the Study of Lung Cancer tumour node metastasis (TNM) staging system. These findings were recorded prospectively in a lung cancer registry (administered by the investigators), which was retrospectively used to identify cases anonymously.

Pathological analyses were performed by the National Health Laboratory Services at Tygerberg Hospital (state patients) and Ampath Laboratories at N1 City Hospital in Cape Town (insured patients).

Statistical analysis

Data were collected on a customised Microsoft Excel spreadsheet, version 15.0.4797.1000 (Microsoft, USA). Chi-square or Fisher's exact tests (where indicated) were performed on dichotomous categorical variables, and *t*-testing on continuous data. A 5% significance level ($p<0.05$) was applied.

Ethical approval

Ethical approval for this retrospective analysis was provided by the Stellenbosch University Research Ethics Committee (ref. no. S16/04/077). The application included a waiver of consent owing to the retrospective nature and anonymity of the study design.

Results

During the 2-year study period, 665 patients were seen between the two institutions with a confirmed histological diagnosis of primary lung malignancy. All the patients who presented to Tygerberg Hospital ($n=610$) had no health insurance, whereas all the patients who presented to Kuils River Respiratory Centre ($n=55$) had access to private health insurance.

The patients with no health insurance were younger (mean (standard deviation (SD)) 59.9 (10.1) years) than those with private health insurance (64.15 (9.6) years) ($p=0.03$). There was no significant difference in gender distribution between the two groups (Table 1). Overall, adenocarcinoma was the commonest form of lung malignancy (48.1%), followed by squamous cell carcinoma (29.2%). In the privately health-insured group, poorly differentiated NSCLC (25.5%) was more common than squamous cell carcinoma (23.6%). Poorly differentiated NSCLC was also significantly more common in the privately health-insured group (23.6%) compared with those with no health insurance (4.6%) ($p<0.01$).

Sixty-one (10.5%) of the 583 patients with NSCLC were staged as early-stage disease (up to stage IIIA, Table 1). In total, 477 of 532 NSCLC state patients (89.7%) had incurable disease at presentation, compared with 45 of 51 privately insured patients (88.8%) ($p=0.75$). Conversely, 55 state patients (10.3%) presented with early-stage, potentially curable disease (up to stage IIIA) compared with 6 patients in the privately insured group (11.8%) ($p=0.75$).

Discussion

In this retrospective, observational study in patients with NSCLC, access to private health insurance (medical aid in SA) was shown not to have a significant effect on staging at initial presentation. The only significant differences were the relatively advanced age at presentation and relatively higher percentage of poorly differentiated NSCLC seen in private practice.

Potential theories regarding why a later-stage diagnosis would have been expected in

Table 1. Demographics, cell types and staging for all lung cancer patients by health insurance type (*N*=665)

	All* (*N*=665)	No health insurance (*n*=610)	Private health insurance (*n*=55)	*p*-value
Demographics				
Age (yr), mean (SD)	60.49 (10.1)	59.9 (10.1)	64.15 (9.6)	0.03
Gender male, *n* (%)	404 (60.8)	372 (61.0)	32 (58.2)	0.68
Cell type, *n* (%)				
NSCLC (*n*=583)				
Adenocarcinoma	320 (48.1)	298 (48.9)	22 (40.0)	0.26
Squamous cell carcinoma	194 (29.2)	181 (29.7)	13 (23.6)	0.35
Poorly differentiated	42 (6.3)	28 (4.6)	14 (25.5)	<0.01
Other	27 (4.1)	25 (4.1)	2 (3.6)	1
SCLC	82 (12.3)	78 (12.8)	4 (7.3)	0.28
Stage, *n* (%)				
NSCLC (*n*=583)				
I	8 (1.4)	7 (1.3)	1 (2.0)	1
II	15 (2.6)	15 (2.8)	0 (0.0)	0.38
IIIA	38 (6.5)	33 (6.2)	5 (9.8)	0.37
IIIB	128 (22.0)	115 (21.6)	13 (25.5)	0.52
IV	394 (67.6)	362 (68.0)	32 (62.7)	0.44
SCLC (*n*=82)				
Limited	11 (13.4)	10 (12.8)	1 (25.0)	1
Extensive	71 (86.6)	68 (87.2)	3 (75.0)	1

SD = standard deviation; NSCLC = non-small-cell lung cancer; SCLC = small-cell lung cancer.
*Stage I - IIIA v. stages IIIB - IV NSCLC.

those of lower SES include fatalistic views and medical mistrust, which has been shown to be more common among the poor and minorities[27,28] and leads to delays in seeking care for symptoms suggestive of lung cancer as well as delaying prompt work-up once a tumour has been identified. The poor may also prioritise health to a lesser degree and therefore postpone seeing a doctor, which can contribute to later stage of presentation.[6,28] However, these findings were not reproducible in this study, which showed that although patients without health insurance presented with later-stage disease, there was no significant difference between the privately insured and uninsured groups.

A systematic review of the literature from 1995 to 2005 by Woods *et al.*[15] found that most studies report an association between low SES and later stage at diagnosis of various cancers. As with our study, this does not always hold true when looking at NSCLC in isolation. Various studies of lung cancer from Canada, Denmark and Sweden have only indicated limited socioeconomic differences in advanced-stage diagnosis.[17,29,30] Other studies from the UK have in fact shown a lower frequency of advanced stage at diagnosis in more deprived patients.[31] The findings of our study, although not showing independent evidence of an association (p=0.75), may reflect a lack of power due to the lack of numbers in the privately insured group. To our knowledge, there are no available local data looking at the influence of SES or health insurance on the stage of presentation of primary lung malignancy.

The proportion of early-stage (up to stage IIIA) disease in the study group was calculated at 10.3% in our patients with no health insurance and 11.8% in those with private health insurance. This corresponds with reported resectability rates in patients with NSCLC in SA literature, where operability rates between 10% and 11% have been quoted in other studies from Johannesburg and Cape Town.[2-4,32,33] In the developed world, the proportion of patients who present with potentially curable disease is much higher. A study detailing >12 800 cases of lung cancer from Nebraska, Canada, revealed early-stage disease in 23.04% of patients.[34] Other studies from the developed world have revealed resectable disease in up to 33% of patients.[13] It must be noted that in the SA setting, other factors including the effect of the HIV pandemic on the stage of presentation must be kept in mind. A previous study from the Western Cape Province, SA, has shown that HIV-positive lung cancer patients were significantly less likely to have early-stage lung cancer compared with their HIV-negative counterparts.[4] Limited resources in the state sector and restricted funding by medical aids in the private sector also pose significant barriers to early detection of disease.

The present study revealed that poorly differentiated NSCLC was significantly more common in the privately health-insured group (23.6%) compared with those with no health insurance (4.6%) (p<0.01). Our data also support current worldwide lung cancer trends that have revealed an increase in the proportion of patients being diagnosed with adenocarcinoma in comparison with squamous cell carcinoma.[35-40] A steady decrease in daily smoking prevalence in association with switching to low-tar and filter cigarettes (enhancing delivery of smoke to peripheral regions of the lung) is believed to contribute to the decrease in rates of squamous cell carcinoma and the increase in rates of adenocarcinoma.[41-44] It has been postulated that filter tips effectively reduce deposition of larger particles in the central airway, resulting in a reduced risk of squamous cell carcinoma, but increase deposition of small-size particles in the deeper parts of the lung where adenocarcinoma preferentially occurs.[41,42]

Study limitations

A limitation of the study is possible selection bias, in that data from a single region that only includes <10% of the SA population may not be generalisable to the whole population. Furthermore, the lack of documentation of race makes it even more difficult to generalise the results and findings to the SA population as a whole. Access to and quality of healthcare institutions may also vary between metropolitan areas. A further potential limitation may be the fact that different laboratories were used for analysis and typing of lung cancer.

Health insurance type as a measure of SES has limitations in that it may be affected by the wide lack of homogeneity within each group. In future studies, a multilevel framework examining individual and area-specific socioeconomic variables, including housing standards, family income, etc., may be a better classification of SES. Further, larger-scale studies involving multiple centres (both public and privately run) from around the country may aid in proving significance of the above findings and minimise any selection bias that may be present. A multilevel assessment of SES as outlined above may also give a better indication of the true impact of SES on stage of presentation with underlying malignancy.

Conclusions

We found a nominal and statistically insignificant difference between the stage of presentation in patients who had health insurance compared with those who did not have access to private health insurance. Larger-scale studies involving multiple centres may need to be carried out to identify whether a true difference exists between the two groups; this is of great importance, as a difference may have important public health implications for the future. It is also evident that lung cancer screening as well as other methods to improve early-stage disease detection remains one of the most important tools in improving lung cancer cure rates.

Acknowledgements. None.

Author contributions. CFNK and T-JJ conceived the idea. All authors collected the data. T-JJ and CFNK analysed the data and prepared the manuscript, and EMI and DP were responsible for critical revision of the manuscript.

Funding. None.

Conflicts of interest. None.

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Accepted 7 April 2017.