RESEARCH ARTICLE

Trend Analysis of Lung Cancer Incidence Rates in Ninawa Province, Iraq, from 2000 to 2010 - Decrease and Recent Stability

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Abstract

Background: Lung cancer is the most frequent malignancy of men worldwide. In Ninawa in Iraq, lung cancer ranks first among cancers diagnosed in men. Since no prior studies have been conducted on incidence trends in our population the present investigation of rates during 2000-2010 was therefore performed. Materials and Methods: Registy data for lung cancer cases were collected from the Directorate of Health in Ninawa-Mosul Continuing Medical Education Center. We restricted our analyses to men categorized according to the age groups of 0- 39, 40-49, 50-59, 60-69 and 70+ years. The significance of incidence rate trends during 2000-2010 was tested using Poisson regression. Age-standardized rates (ASR), and age-specific rates per 100,000 population were calculated. Results: A total of 1,206 incident lung cancer were registered among males, accounting for 15.5% of all male cancers registered during 2000-2010. It ranked first throughout the period. Median age at diagnosis was 69 (mean 66.8± 11.0) years. The incidence rate of all male lung cancers in Ninawa (all ages) decreased from 26.4 per 100,000 in 2000 to 12.7 in 2010 (APC=-6.55%, p<.0001). The incidences in age groups 40-49, 50-59, 60-69 and 70+ decreased in earlier years and recently appeared (2007-2010) stable. The incidence in age group (0-39) remained stable between 2000-2010. Squamous cell carcinoma (SCC)was the most common type of lung cancer, while adenocarcinoma was relatively rare. Conclusions: With the data from Directorate of Health in Ninawa during the period 2000-2010, lung cancer is the most common cancer but generally declining. Among all age groups, the recent incidence of lung cancer remained stable. The SCC predominance suggests change in tobacco habits as an important factor in the trends observed.

Keywords: Lung cancer - incidence - time trends- decreasing and stable - Ninawa, Iraq

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Introduction

Lung cancer is the most frequent cancer in men worldwide. There were an estimated 1.1 million new cases, representing 16.5% of all new cancers. The majority of the cases now occur in the developing countries (55%), with high rates in Central-Eastern and Southern Europe, Northern America and Eastern Asia. Very low rates are still estimated in Middle and Western Africa (Age-Standardized Rates (ASR) 2.8 and 3.1 per 100,000 respectively). It was also the most common cause of death from cancer, with 1.38 million deaths (18.2% of the total) (Ferlay et al., 2010). In 2013, an estimated 118,080 male were expected to be diagnosed in the US with lung cancer, with 87,260 male were expected to die. In 2005-2009 calendar year, incidence and mortality ASR for male were 82.7 and 65.7 per 100000 (American Cancer Society, 2013).

In the Arab countries, lung cancer incidence rates and mortalities are still low as compared to Europe or USA nations, in addition, there is huge variations between different parts of the Arab countries (Salim et al., 2011). For instance, The ASR vary from 2.4 and 3.30 per 100,000 male in Sudan and Yemen to 33.5 and 31.1 per 100,000 male in Tunisia and Bahrain, respectively (GLOBOCAN, 2008).

According to the International Agency for Cancer Research and GLOBOCAN 2008, the (ASR) in Iraq was (14.6/100,000). Compared to the countries surrounding Iraq, Kuwait (15.10/100,000), Saudi Arabia (5.60/100,000), Jordan (16.60/100,000, Syria (10.30/100,000), Iran (9.10/100,000) and Turkey (49.10/100,000) (GLOBOCAN, 2008). Lung cancer is the most frequent cancer among men in Iraq. According to the latest Iraqi Cancer Registry, lung cancer a count for approximately 16% of the registered male cancers in Iraq, indicated that the lung cancer is the leading cancer site among males (Iraqi Cancer Board, 2010).

Ninawa province, is located in the north of Iraq. The Mosul is the capital, it's Iraq's second largest city. Ninawa

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is bordering Syria and Turkey (Johnson and Johnson, 2009). Away from Baghdad 402 km and from Basrah 854 km. It has an area of 37,323 square kilometers and an estimated population of 3,221,096 in 2010.

The purpose of this article was to describe the time trends of lung cancer incidence among Iraqi male from 2000 through 2010.

Materials and Methods

Data on lung cancer in male (ICD 9th, codes 34) between 1st January 2000 and 31st December 2010 were obtained from the annual book series published from the Directorate of Health in Ninawa/Mosul, Continuing Medical Education Center. This data was collected from all hospitals in Ninawa Province by the Mosul Cancer Registry (Directorate of Health in Ninawa, 2010).

Annual estimates of the population, by 5-year age-groups and by sex, were obtained from the Central Organization for Statistics, Ministry of Planning. The estimates according to the Population Census results as in 1997 (Ministry of Planning, 2012).

Because of the small number of women (172) during the period (2000-2010), our study was restricted to men only, and categorized according to the age groups as 0-39, 40–49, 50–59, 60-69 and 70+ years. We examined the overall and age group trends of lung cancer incidence in Ninawa/Iraq from 2000 to 2010 by using Poisson regression with the natural logarithm of the population as an offset. Annual percentage change (APC) from 2000 to 2010 were examined and the points in time when the direction of the trends changes significantly are detected.

Age-standardized incidence rates (ASR) were calculated based on World Standard Population. All statistical analyses were performed using SAS statistical software, version 9.2 (SAS Institute, Cary, NC, USA). For all analyses, the significance level was set at $p \leq 5\%$.

Results

1206 patient diagnosed with male lung cancer in Ninawa province were studied. There were 84 new cases diagnosed with lung cancer in 2010, accounting for 15.5% of overall new male cancer cases. It ranked the first among male in all the years between 2000 to 2010. The median age at diagnosis was 69, the mean age was (66.8±11.0) years, and ranges from 15 years old which is very rare to occur in this age to 70+ years. Figure 1 display the Age specific incidence rates of lung cancer, we can see an unusual rapid increase in age specific rate of lung cancer from age 40 years and peak in the age group (65-69) years. The highest percentage of cases were in the age group 70+ years (31.26%), followed by 60-64 years (19.40%), 65-69 years (19.07%), 55-59 years (12.68%), 50-54 (9.28), while the other's represented a small fraction of the diagnosed lung cancer (Table 1). The crude incidence rate for lung cancer was 5.23/100,000 and the age-standardized incidence rate was 12.67/100,000 male population in 2010.

The Histopathological characteristics of lung cancers registered in the Directorate of Health in Ninawa/Mosul, Continuing Medical Education Center are shown in (Table 2). The most common type of the lung cancer cases (44.94%) were diagnosed with squamous cell carcinoma, followed by small cell carcinoma (14.01%), (11.61%) large cell carcinoma, Adenocarcinoma (6.79%) and unspecified and other lung carcinoma (22.63%).

Figure 2 shows the Poisson regression analysis resulted in the trends of incidence rates of lung cancer of all ages in Ninawa/Iraq between 2000 and 2010. Throughout the decade, the incidence rate declined significantly from 26.35 per 100,000 in 2000 to 12.67 per 100,000 in 2010 (APC=-6.55%, $p<0.0001$). The rate decreased sharply from 26.35 per 100,000 in 2000 to 14.81 per 100,000 in 2006 (APC=-5.82%, $p \leq 0.0006$), remained stable between

Table 1. Age of Lung , Data from Directorate of Health in Ninawa/Mosul, Continuing Medical Education Center for Lung Cancer Diagnosed between 2000 and 2010 (N=1206)

Age range	No.	%
0-4	0	0.0
5-9	0	0.0
10-14	0	0.0
15-19	1	0. 08
20-24	3	0. 24
25-29	0	0. 0
30-34	1	0.08
35-39	13	1.08
40-44	22	1.82
45-49	60	4.97
50-54	112	9.28
55-59	153	12. 68
60-64	234	19. 40
65-69	230	19.07
70+	377	31.26

Table 2. Histology Type of Lung Cancer among Male in Ninawa/Iraq, Data from Directorate of Health in Ninawa/Mosul, Continuing Medical Education Center for Lung Cancer Diagnosed between 2000 and 2010 (N=1206)

Histology type	No.	%
Squamous cell carcinoma	542	44.94
Small-cell carcinoma	109	14.01
Large cell carcinoma	140	11.61
Adenocarcinoma	82	6.79
Unspecified and other lung carcinoma	273	22.63

Table 3. Histology Type of Lung Cancer in Ninawa/ Iraq Compared to Other Countries: Squamous Cell Carcinoma (SQC): Small Cell Carcinoma (SCLC): Large Cell Carcinoma (LGC): Adenocarcinoma (ADC)

	Lung Cancer Histopathology			
	SQC	SCLC	LGC	ADC
Ninawa/Iraq	44.94	14.01	11.61	6.79
Iraq*	37.6	8.3	7.0	13
GCC**	22.6	9.7	3.9	19.9
Jordan***	33.9	14.3	3.5	24.7
Egypt***	25.3	15.3	26.4	23.3
Australia****	19.9	11.2	17.4	26.4
US*****	25.3	12.8	2.8	37.2

* (Al Hasnawi et al., 2009); **(Al-Madouj et al., 2011); ***(Freedman et al., 2007); **** (Australian Institute of Health and Welfare & Cancer Australia, 2011);*****SEER Cancer Stat Fact Sheets.

(2006-2010) (APC=-2.45%, p=0.4466).

Stratified by age are shown in (Figure 3). The incidence rates for age groups 0-39, 40-49, 50-59, 60-69 and 70+, all had patterns similar to that observed for all ages. For age group (0-39), the incidence rates remained stable between (2000-2010) (APC=-4.54%, p=0.53). For age group (40-49), the incidence rates decreased significantly between 2000 to 2007 (APC=-10.96%, p=0.0368), remained stable between 2007 to 2010 (APC=-3.47%, p=0.8464). For age

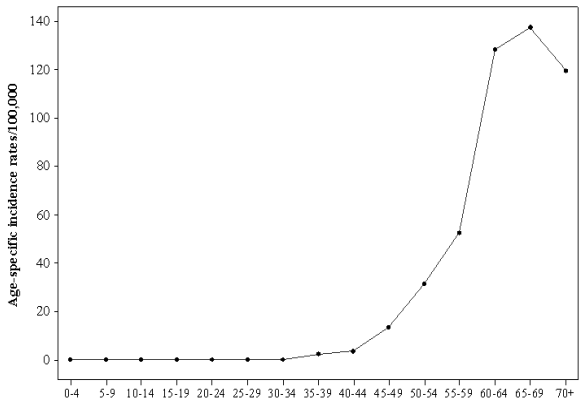

Figure 1. Age-Specific Incidence Rate of all Male Lung Cancer in Ninawa/Iraq Over the Period 2000-2010

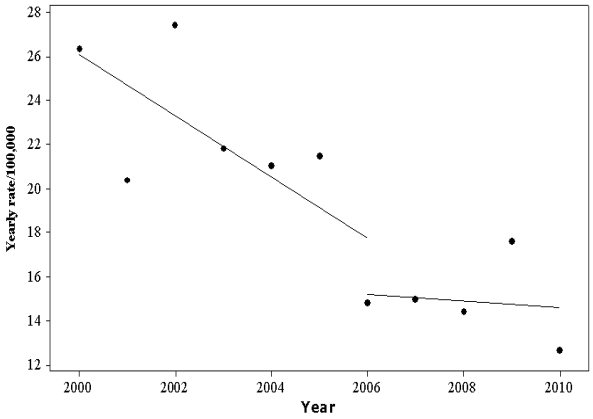

Figure 2. Trends in Annual Incidence Rate of all male Lung Cancer in Ninawa/Iraq (all ages) Over the Period 2000-2010. the point in time selected where trends significantly change direction at any given year

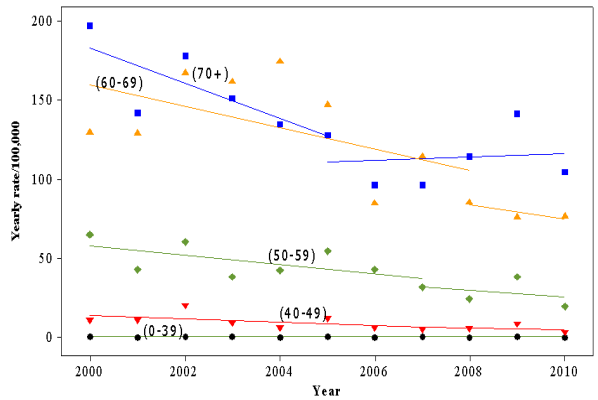

Figure 3. Trends in Annual Incidence Rate of all Male Lung Cancer in Ninawa/Iraq by Age Group Over the Period 2000-2010. the point in time selected where trends significantly change direction at any given year

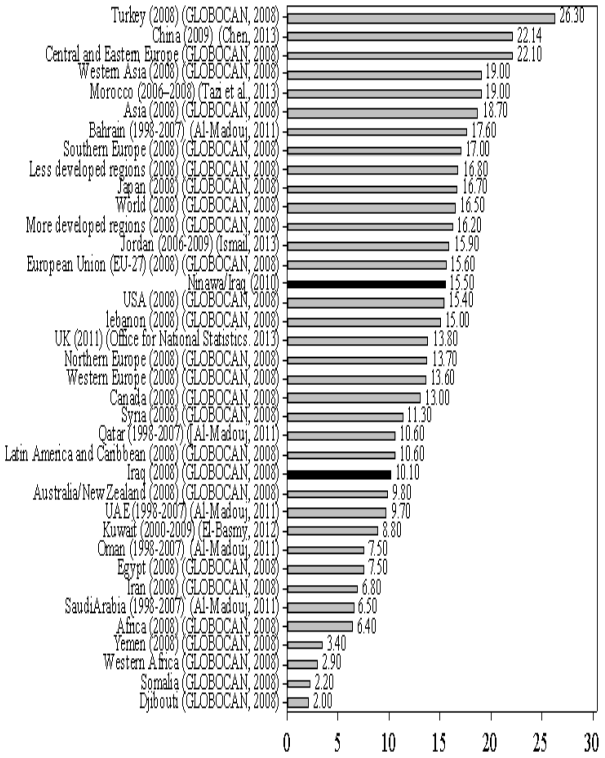

Figure 4. Proportion of Lung Cancer in Male in Ninawa/Iraq Compared to Other Countries. *Data from directorate of health in Ninawa MCMEC (2010). The gulf Cooperation Council (GCC countries) represent six Arab countries (Kuwait, Qatar, Bahrain, UAE, Oman and Saudi Arabia)

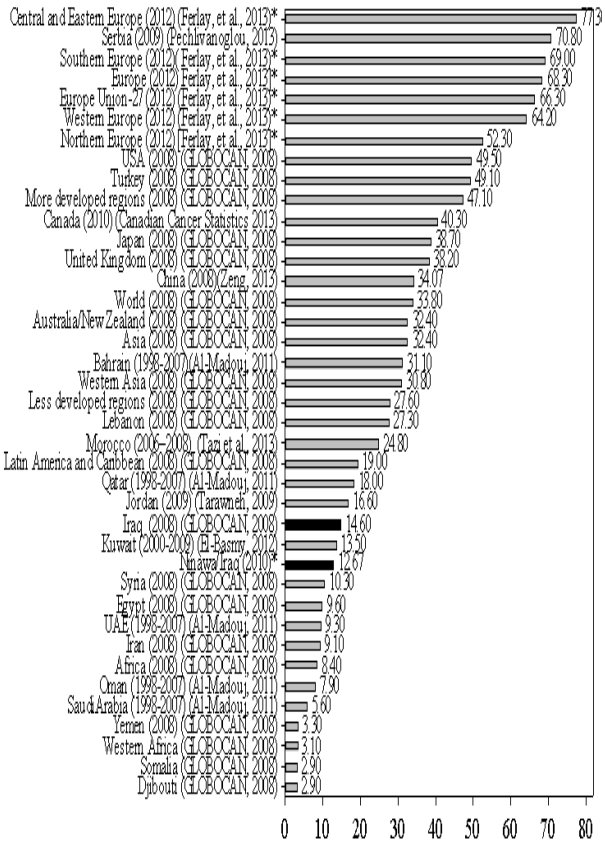

Figure 5. Age-standardized Incidence Rate for Male Lung Cancer in Ninawa/Iraq Compared to other Countries. *Data from directorate of health in Ninawa MCMEC (2010)

group (50-59), the incidence rates decreased significantly between 2000 to 2007 (APC=-6.12%, p=0.0366), remained stable between 2007 to 2010 (APC=-7.45%, p=0.4504). For age group (60-69), the incidence rates decreased significantly between 2000 to 2005 (APC=-7.23%, p=0.0361), increased insignificantly between 2005 to 2010 (APC=0.74%, p=0.8469). For age group (70+), the incidence rates decreased significantly between 2000 to 2008 (APC=-5.41%, p=0.0096), remained stable between 2008 to 2010 (APC=-5.31%, p=0.6938).

Discussion

No population-based data of lung cancer incidence from Ninawa/Iraq have been published before. This is the first report of cancer incidence in Ninawa/Iraq from a population-based cancer registry for the period 2000–2010. The purpose of this article was to describe the time trends of lung cancer incidence among Iraqi men from 2000 through 2010.

The analysis of lung cancer incidence trends among all male lung cancer in Ninawa/Iraq (all ages) during the period 2000-2010 shows that, lung cancer incidence appears to be declined approximately 6.55%, each year (Figure 2). The incidence in age groups (40-49), (50-59), (60-69) and (70+) are stabilizing after a period of rapid decreasing, while the incidence in age group (0-39) remained stable during the period (2000-2010). A global article describing that the incidence rates have been decreasing in men, in the United States, the United Kingdom, Canada, Australia (Jemal et al., 2010; Ramalingam et al., 2011).

The incidence of lung cancer is relatively rare among young adults (under 40 years) (Hsu et al., 2012), predominates in men aged 40 years and older, ranks first at ages 60 years (Jemal et al., 2010; Tas et al., 2012). Figure 4 show the Proportion of lung cancer in male in Ninawa/Iraq compared to other countries. In general, the Proportion are higher in developing countries than in the developed countries. The Proportion are highest in Asia and Turkey, while the lowest Proportion worldwide are in Djibouti and Somalia. The present study shows that in Ninawa/Iraq, the proportion of lung cancer in male (15.50% in 2010) is higher than the overall Iraq proportion, compared with very similar proportion in Lebanon Jordan, lower than that observed in regional countries such as, Bahrain and Turkey. It's higher than that estimated in several Arab and neighboring countries such as Yemen, Saudi Arabia, UAE, Qatar, Oman and Iran, and in non-regional countries such as Europe, Canada and Latin American and Caribbean.

In Ninawa/Iraq, lung cancer remains the most common cancer diagnosed in males. An Arab article show that 16/22 of the Arab countries have the lung cancer as one of the most common cancer. More than half 12/22 of the Arab countries have the lung cancer incidence ASRs as the most common cancer type (Salim et al., 2011).

Figures 5 show the ASR of lung cancer compared to other countries. In general, the incidence ASR of lung cancer in men are markedly higher in the developed countries than in the developing countries. The incidence ASR are highest in Europe ,USA, Canada and UK. In developing countries, the highest incidence ASR seems to be in Turkey and Asia, while the lowest ASR worldwide are found in Djibouti, Somalia, Western Africa and Yemen. The ASR (12.67 per 100,000 in 2010) for lung cancer in Ninawa/Iraq close to the rate that estimated to Kuwait. This rate was higher than that estimated in other Arab and regional countries, such as Syria, Egypt, UAE, Saudi Arabia and Iran, lower than the overall Iraq ASR and several Arab countries, such as Bahrain, Lebanon and Qatar and non Arab countries, such as Europe, USA and UK.

The mean age at diagnosis of our study was 66.8 years compared with almost similar mean age Qatar (66* years). This mean is higher to other Arab and regional countries, such as Oman (64* years), Jordan (64 years) (Tarawneh et al., 2009), UAE (65* years), Iran (56.6-60.4) (Sadraei and Teghi, 2013; Tarrahi et al., 2009; Mehrabani et al., 2008), Turkey (59.4- 63.45 years) (Gonlugur et al., 2008; Demirci et al., 2012), lower than those observed in, Kuwait (68* years), Saudi Arabia (68* years), Bahrain (73* years). While the mean age at diagnosis for men in Australia was 71 years (Cancer Australia, 2011), UK (71 years) (Hippisley and Coupland, 2011) and (Australia, Canada, Denmark, Norway, Sweden, and the UK) was 70.3 years (Coleman et al., 2011).

The median age at diagnosis of our study was 69 years compared with very similar median age in KSA, Kuwait and UAE (69* years), higher than the median age at diagnosis for men in several Arab countries, such as Jordan (62-64** years), Oman (64* years), Tunisia (64 years) (Missaoui et al., 2011), Qatar (66* years), and non Arab countries, such as Turkey (60 years) (Tas et al., 2012). While, the median age at diagnosis lower than that observed in Bahrain (74* years),. USA (70 years) (SEER, 2013). Australia (70.5 years) (Australian Institute of Health and Welfare & Cancer Australia, 2011). Lung cancer incidence rates increased with age with median age at diagnosis range from 64 to 70 years (Hayat et al., 2007).

Lung cancer is relatively rare in individuals younger than age 40 (Tas et al., 2012). The incidence of lung cancer among young adults has been found to be around 1.2% to 6.2% (under 40 years), 5.3% (under than 45 years), and 13.4% (under 50 years) (Hsu et al., 2012), and ranks first at ages 60 years and older (Jemal et al., 2009). Our data show that the incidence is rare under forty, predominates in aged forty years and older, rise steadily until age (70+) (Table 1).

Lung cancer consists of two major types, Small cell lung cancer (SCLC) representing about 10-15%. of all cases and non-small cell lung cancer (NSCLC) accounts for approximately 80-85% of all cases of lung cancer (D Der et al., 2011; D'addario et al., 2010). NSCLC is the most common type of lung cancer, divided into three subtypes based on the kind of cancer cells; squamous cell carcinoma, large cell carcinoma and adenocarcinoma (Ma et al., 2013). Squamous cell carcinoma and Adenocarcinoma are the most frequent histologic subtypes, accounts for about 50% and 30% of NSCLC cases, respectively (Perez-Moreno et al., 2012), while large cell carcinoma accounts approximately 10%. Tobacco smoking increases the risk of all histological

types of lung cancer including squamous-cell carcinoma, small-cell carcinoma, adenocarcinoma and large-cell carcinoma (Ignatius et al., 2012). In general, squamous cell carcinoma is strongly associated with a history of smoking. Adenocarcinoma is the most common type of lung cancer seen in current smokers, non-smokers and women. Large cell carcinoma accounts for about 10% of lung cancers and typically presents as a large peripheral mass with early metastasis and poor prognosis. (Yousefi et al., 2013).

Although all histologic types of lung cancer were significantly associated with cigarette smoking. The association was stronger with squamous cell carcinoma and small cell carcinoma than with large cell cancer and adenocarcinoma (Khuder, 2001). Our study show that squamous cell carcinoma and Small cell carcinoma was the most frequent cancer accounted to about 59% of all cases. The higher proportion of squamous cell and small cell carcinoma reflect the longer history of smoking.

Histology type of Lung Cancer in Ninawa/Iraq compared to other countries are shown in Table (3). The proportions of squamous cell carcinoma in Ninawa/Iraq (44.94%), higher than overall Iraq proportion, several Arab and developed countries such as GCC countries, Jordan, Egypt, USA and Australia. The proportion of small-cell carcinoma in Ninawa/Iraq (14.01%), compared with very similar proportion in Jordan, lower than that observed in Egypt. It's higher than that observed in overall Iraq, GCC countries, USA and Australia. The proportion of Large cell: *Computed by the authors; Data from (Al-Madouj et al., 2011); ** Computed by the authors; Data from (Abbasi and Badheeb, 2010)

Carcinoma (11.61%), lower than that observed in Egypt and Australia, higher than that observed in overall Iraq, GCC countries, Jordan and UAS. The proportion of adenocarcinoma (6.79%), lower than proportion of overall Iraq, and several Arab and developed countries such as, GCC countries, Egypt, Jordan, Australia and USA.

In conclusion, with the data from Directorate of Health in Ninawa during the period 2000-2010, lung cancer is the most common cancer in Ninawa/Iraq. The incidence of all male lung cancer in Ninawa/Iraq (all ages) has declined. Among age groups, the recent incidence of lung cancer remained stable. Squamous Cell Carcinoma the most common type of lung cancer, while Adenocarcinoma is uncommon.

There is a need to improve data access, improve the amount of data for each patient, such as: Stage of the tumor; conducted therapy; mortality/survival.

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