

Incidence and mortality of laryngeal cancer in China, 2015

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Abstract

Objective: Using data from cancer registries to estimate laryngeal cancer incidence and mortality in China, 2015.

Methods: Data submitted from 501 cancer registries were checked and evaluated according to the criteria of data quality control and 368 registries' data were qualified for the final analysis. Data were stratified by area (urban/rural), sex, age group and combined with national population data to estimate laryngeal cancer incidence and mortality in China, 2015. China population census in 2000 and Segi's population were used for age-standardized.

Results: The percentage of cases morphological verified (MV%) of laryngeal cancer was 74.18%. The percentage of death certificate-only cases (DCO%) was 2.10%. And the mortality to incidence (M/I) ratio was 0.55. About 25,300 new cases of laryngeal cancer were diagnosed in 2015 and 13,700 deaths were reported. The crude rate of laryngeal cancer was 1.84 per 100,000 (males and females were 3.20 and 0.42 per 100,000, respectively). Age-standardized incidence rates by Chinese standard population (ASIRC) and by world standard population (ASIRW) were 1.18 and 1.19 per 100,000, respectively. The cumulative incidence rate (0–74 years old) was 0.15%. The crude mortality rate was 1.00 per 100,000. Age-standardized mortality rates by Chinese standard population (ASMRC) and by world standard population (ASMRW) were 0.61 and 0.61 per 100,000, respectively, with the cumulative rate (0–74 years old) was 0.07%. Incidence and mortality of laryngeal cancer in males were higher than those in females. And the rates in urban areas were higher than those in rural areas.

Conclusions: The incidence and mortality of laryngeal cancer in China were low. And the rates were significantly higher in males than in females. Risk factor control and targeted prevention should be strengthened.

Keywords: China; laryngeal cancer; incidence; mortality

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Introduction

Laryngeal cancer is one of the common cancer in the head and neck. Incidence and mortality of laryngeal cancer were low. But it's especially serious for males (1). And the burden of laryngeal cancer, expressed as years lived with

disability, has increased by nearly 25% during the past 3 decades (2). According to GLOBOCAN 2018, about 177 thousand new cases were diagnosed, accounting for 0.98% of all new cancer cases. Approximately 0.99% of all cancer deaths were attributed to laryngeal cancer and 95,000 deaths were caused by laryngeal cancer in 2018 worldwide.

Age-standardized incidence rate and mortality rate were 2.0 and 1.0 per 100,000, respectively in the world (3). The incidence and mortality of laryngeal cancer varied by age, sex and region. In this study, we extracted data of laryngeal cancer from the database of the National Central Cancer Registry of China (NCCRC) and provided nationwide laryngeal cancer incidence and mortality in 2015.

Materials and methods

Data source

A total of 501 cancer registries' cancer data from 31 provinces in China were collected by NCCRC. And it included 173 cancer registries in cities above the county level and 328 cancer registries in cities of the county level. A total of 368 cancer registries' data met the criteria of quality control and they were included in pooled data, of which 134 were located in the urban areas and 234 were located in the rural areas. It covered 309,553,499 populations (156,934,140 males and 152,619,359 females), accounting for 22.52% of the national population at the end of 2015. According to International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10), laryngeal cancer, which is C32.0–32.9, were extracted to analysis.

Quality control

The inclusion criteria for data were based on the "Guideline for Chinese Cancer Registration" (4) and requirement by the International Agency for Research on Cancer (IARC)/International Association of Cancer Registries (IACR) (5,6). The validity, reliability, completeness and comparability of data were evaluated based on the percentage of case morphological verified (MV%), the percentage of death certificate-only cases (DCO%), the mortality to incidence (M/I) ratio and the percentage of the diagnosis of unknown basis (UB%).

Statistical analysis

According to the National Bureau of Statistics of the People's Republic of China, each city or county was classified as urban or rural areas. Crude incidence and mortality rates of laryngeal cancer were calculated in each stratum by age group (0-, 1-4, 5-84 by 5 years and 85+ years old), sex, area (urban/rural). The numbers of new cases and deaths of laryngeal cancer were estimated in China, 2015. Age-standardized rates by Chinese and world

standard population were calculated using the population of China in 2000 and Segi's population structure, respectively. SAS software (Version 9.4; SAS Institute Inc., Cary, USA) was used for statistical analysis.

Results

Data quality

In 368 population-based cancer registries, the MV%, M/I, DCO% and UB% of laryngeal cancer were 74.18%, 0.55, 2.10% and 0.31%, respectively. And the MV%, M/I, DCO% and UB% of laryngeal cancer were 77.35%, 0.53, 2.72% and 0.31%, respectively in urban areas, and 70.21%, 0.58, 1.33% and 0.31%, respectively in rural areas (Table 1).

Incidence of laryngeal cancer

In 2015, incidence rate of laryngeal cancer ranked the 21st in all kinds of cancer. The estimated new cases diagnosed of laryngeal cancer were 25,300 (22,500 in males and 2,800 in females) in China, accounting for 0.65% of all cancers combined and the estimated new cases were 16,000 and 9,300 in urban and rural areas, respectively. The crude

Table 1 Quality evaluation of laryngeal cancer in China, 2015

Areas	Sex	M/I	%		
			MV	DCO	UB
All areas	Both	0.55	74.18	2.10	0.31
	Male	0.54	75.99	2.04	0.27
	Female	0.63	60.06	2.59	0.61
Urban areas	Both	0.53	77.35	2.72	0.31
	Male	0.53	79.53	2.65	0.24
	Female	0.57	58.88	3.25	0.89
Rural areas	Both	0.58	70.21	1.33	0.31
	Male	0.57	71.47	1.25	0.31
	Female	0.69	61.32	1.89	0.31
Eastern areas	Both	0.51	76.78	1.95	0.35
	Male	0.50	79.16	1.88	0.26
	Female	0.61	56.18	2.53	1.12
Middle areas	Both	0.63	73.73	2.03	0.13
	Male	0.63	74.46	1.99	0.15
	Female	0.64	69.37	2.25	0.00
Western areas	Both	0.61	63.88	2.88	0.50
	Male	0.61	65.24	2.77	0.55
	Female	0.68	51.28	3.85	0.00

M/I, mortality to incidence ratio; MV, morphological verified; DCO, death certificate-only; UB, unknown basis.

incidence rate was 1.84 per 100,000. The age-standardized incidence rate by Chinese standard population (age-standardized incidence rate China, ASIRC) and world standard population (age-standardized incidence rate world, ASIRW) were 1.18 and 1.19 per 100,000, respectively. The ASIRW in males and females were 2.14 and 0.25 per 100,000, respectively with the sex ratio of 8.56. The ASIRW ratio of different areas (urban/rural) was 1.24. The cumulative incidence rate (0–74 years old) was 0.15% and the truncated incidence rate was 2.05 per 100,000. Middle areas had the highest ASIRW (1.30/100,000), followed by Eastern areas (1.19/100,000) and Western areas (1.07/100,000). Males and females of laryngeal cancer incidence by different areas had the similar condition (Table 2).

Age-specific incidence rate of laryngeal cancer

Age-specific incidence rates were relatively low before 35 years old and increased rapidly afterwards, reaching peak at the age group of 75–79 years. In each age group, incidence rates in males were higher than those in females. Age-specific incidence rates reached the peak at the age group

of 75–79 years in males and the age group of 80–84 years in females, respectively. After age group of 35 years, age-specific incidence rates in urban areas were higher than those in rural areas (Table 3, Figure 1).

Mortality rate of laryngeal cancer

In 2015, laryngeal cancer was 21st leading cause of cancer-related death in China and it ranked 16th in males and 22nd in females. The estimated 13,700 laryngeal cancer deaths (12,000 in males and 1,700 in females) in 2015, accounted for 0.59% of all cancer deaths, and the estimated laryngeal cancer deaths were 8,300 and 5,400 in urban and rural areas, respectively. The crude mortality rate was 1.00 per 100,000. The age-standardized mortality rate by Chinese standard population (age-standardized mortality rate China, ASMRC) and world standard population (age-standardized mortality rate world, ASMRW) were 0.61 and 0.61 per 100,000, respectively. The sex ratio of ASMRW was 7.93 (ASMRW in males was 1.11/100,000 and in females was 0.14/100,000). The cumulative mortality rate (0–74 years old) was 0.07% and the truncated mortality rate was 0.82 per 100,000. Middle areas had the highest

Table 2 Estimated new cases and incidence rate of laryngeal cancer in China, 2015

Areas	Sex	New cases ($\times 10^4$)	Crude incidence (1/10 ⁵)	Ratio (%)	ASIRC (1/10 ⁵)	ASIRW (1/10 ⁵)	Cumulative rate 0–74 (%)	Truncated rate 35–64 (1/10 ⁵)	Rank
All areas	Both	2.53	1.84	0.65	1.18	1.19	0.15	2.05	21
	Male	2.25	3.20	1.05	2.11	2.14	0.27	3.71	17
	Female	0.28	0.42	0.16	0.26	0.25	0.03	0.35	23
Urban areas	Both	1.60	2.08	0.68	1.28	1.29	0.16	2.26	21
	Male	1.44	3.66	1.14	2.31	2.35	0.30	4.13	17
	Female	0.16	0.44	0.15	0.26	0.25	0.03	0.33	23
Rural areas	Both	0.93	1.54	0.59	1.03	1.04	0.13	1.73	22
	Male	0.82	2.62	0.91	1.83	1.85	0.24	3.07	17
	Female	0.11	0.40	0.17	0.25	0.25	0.03	0.37	23
Eastern areas	Both	1.01	1.97	0.62	1.18	1.19	0.15	2.09	21
	Male	0.92	3.53	1.07	2.17	2.20	0.28	3.87	17
	Female	0.09	0.37	0.12	0.22	0.21	0.02	0.29	23
Middle areas	Both	0.91	1.95	0.69	1.28	1.30	0.17	2.04	21
	Male	0.78	3.25	1.07	2.22	2.26	0.29	3.57	16
	Female	0.13	0.57	0.22	0.35	0.35	0.04	0.47	22
Western areas	Both	0.61	1.55	0.62	1.05	1.07	0.13	1.99	22
	Male	0.55	2.72	0.99	1.90	1.94	0.24	3.63	17
	Female	0.06	0.31	0.14	0.20	0.19	0.02	0.28	23

ASIRC, age-standardized incidence rate adjusted by Chinese standard population; ASIRW, age-standardized incidence rate adjusted by world standard population.

Table 3 Age-specific incidence rate of laryngeal cancer in China, 2015 (1/10⁵)

Age group	All areas			Urban areas			Rural areas		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
0–	0.03	0.06	0.00	0.00	0.00	0.00	0.06	0.12	0.00
1–	0.01	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.06
5–	0.01	0.02	0.00	0.02	0.03	0.00	0.01	0.02	0.00
10–	0.01	0.03	0.00	0.02	0.03	0.00	0.01	0.02	0.00
15–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20–	0.01	0.03	0.00	0.02	0.04	0.00	0.01	0.02	0.00
25–	0.04	0.05	0.02	0.04	0.06	0.02	0.03	0.04	0.02
30–	0.05	0.05	0.04	0.04	0.02	0.07	0.05	0.10	0.00
35–	0.12	0.13	0.11	0.15	0.16	0.14	0.08	0.08	0.07
40–	0.49	0.80	0.17	0.52	0.88	0.16	0.44	0.68	0.19
45–	1.05	1.75	0.33	1.07	1.82	0.27	1.02	1.63	0.41
50–	2.58	4.68	0.38	2.95	5.34	0.40	2.00	3.64	0.36
55–	4.29	7.97	0.45	4.88	9.09	0.44	3.37	6.19	0.47
60–	5.86	10.88	0.84	6.35	11.94	0.74	5.21	9.47	0.96
65–	7.49	13.58	1.43	8.08	14.61	1.62	6.75	12.31	1.18
70–	8.08	14.43	2.04	8.66	15.77	2.07	7.35	12.79	1.99
75–	8.92	16.11	2.44	9.54	17.23	2.77	8.06	14.59	1.96
80–	8.10	14.16	3.23	8.60	15.04	3.28	7.39	12.85	3.17
85+	5.41	10.28	2.29	5.70	11.02	2.02	4.98	9.07	2.66

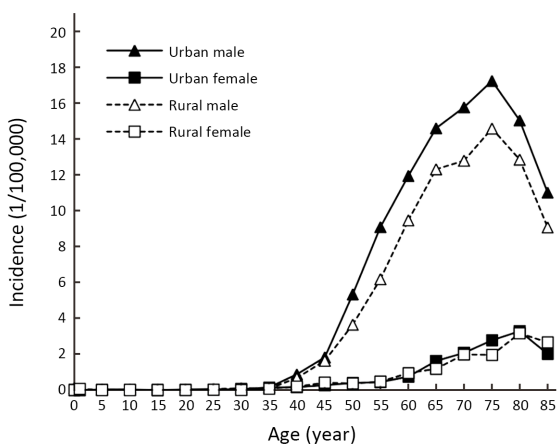


Figure 1 Age-specific laryngeal cancer incidence rate in China, 2015.

ASMRW (0.74/100,000), followed by Western areas (0.58/100,000) and Eastern areas (0.53/100,000) (Table 4).

Age-specific mortality rate of laryngeal cancer

Age-specific mortality rate of laryngeal cancer was relatively low under 40 years old and increased rapidly

afterwards, reaching peak at the age group of 80–84 years. The trend of age-specific mortality rate in males was similar with the trend in both sexes. And age-specific mortality rate in females reached the peak at the age group of 85+ years. In each age group, mortality in males was higher than those in females (Table 5, Figure 2).

Discussion

Based on the data of 561 cancer registries collected by NCCRC, this study estimated laryngeal cancer burden in China in 2015 using the data of 368 local cancer registries that met the inclusion criteria. It was estimated that 25,300 new diagnosed cases and 13,700 deaths from laryngeal cancer in China in 2015 with the incidence rate of 1.84 per 100,000 and mortality rate of 1.00 per 100,000. Both the incidence and mortality of laryngeal cancer ranked the 21st in all kinds of cancer, and reached the peak at the age group of 75– years and 80– years, respectively. The incidence and mortality of laryngeal cancer in males were significantly higher than those in females.

According to GLOBOCAN 2018, the ASIRW of laryngeal cancer was 2.0 per 100,000 in the world. ASIRW

Table 4 Estimated deaths and mortality rate of laryngeal cancer in China, 2015

Areas	Sex	Deaths (×10 ⁴)	Crude mortality (1/10 ⁵)	Ratio (%)	ASMRC (1/10 ⁵)	ASMRW (1/10 ⁵)	Cumulative rate 0–74 (%)	Truncated rate 35–64 (1/10 ⁵)	Rank
All areas	Both	1.37	1.00	0.59	0.61	0.61	0.07	0.82	21
	Male	1.20	1.70	0.81	1.11	1.11	0.13	1.52	16
	Female	0.17	0.25	0.20	0.14	0.14	0.01	0.11	22
Urban areas	Both	0.83	1.08	0.62	0.63	0.63	0.07	0.86	21
	Male	0.75	1.88	0.89	1.17	1.17	0.13	1.61	16
	Female	0.08	0.24	0.18	0.12	0.12	0.01	0.07	23
Rural areas	Both	0.54	0.89	0.54	0.58	0.58	0.07	0.77	21
	Male	0.45	1.48	0.71	1.02	1.02	0.12	1.38	17
	Female	0.09	0.27	0.22	0.16	0.16	0.02	0.16	21
Eastern areas	Both	0.48	0.94	0.52	0.53	0.53	0.06	0.72	21
	Male	0.43	1.64	0.75	0.99	0.99	0.11	1.35	16
	Female	0.05	0.22	0.16	0.11	0.11	0.01	0.07	23
Middle areas	Both	0.54	1.16	0.67	0.74	0.74	0.09	1.00	21
	Male	0.46	1.91	0.90	1.29	1.30	0.16	1.81	16
	Female	0.08	0.35	0.27	0.20	0.20	0.02	0.17	21
Western areas	Both	0.35	0.89	0.58	0.58	0.58	0.07	0.76	21
	Male	0.31	1.55	0.79	1.06	1.06	0.12	1.40	17
	Female	0.04	0.19	0.17	0.11	0.11	0.01	0.09	22

ASMRC, age-standardized mortality rate by Chinese standard population in 2000; ASMRW, age-standardized mortality rate by world standard population.

was 3.6/100,000 in males and 0.48/100,000 in females. ASMRW was 1.0 per 100,000 (3). Incidence and mortality were significantly higher in economically developed areas than in poor areas. About 52.6% of laryngeal cancer cases and 54.9% of deaths worldwide occurred in Asia. The incidence and mortality of laryngeal cancer in China (ASIRW: 1.19 per 100,000 and ASRMW was 0.61/100,000) are lower than the world average. The new diagnosed cases of laryngeal cancer in China accounts for 15.7% of the global incidence and 16.6% of the global mortality of laryngeal cancer (3). Compared with the data in previous years, the incidence and mortality of laryngeal cancer in China showed an increasing trend, with the incidence rising from 1.49/100,000 in 2003 to 1.84/100,000 in 2015. The mortality rate rose from 0.79 per 100,000 in 2003 to 1.00 per 100,000 (7,8). The same trend was observed in different regions and genders (9,10).

In 2015, the incidence and mortality of laryngeal cancer were geographically varied, and they were higher in urban areas than in rural areas, and were higher in eastern and central regions than in western regions. In 2015, ASIRW in urban areas was 1.24 times of that in rural areas, and

ASRMW was 1.09 times of that in rural areas. The trend was consistent with global economic condition that areas in high levels of economic development had high incidence and mortality of laryngeal cancer. The regional disparities of laryngeal cancer was associated with geographical environment, different economic development levels and the health conditions of the region (11,12).

The studies demonstrated that incidence and mortality of laryngeal cancer vary significantly in different gender. In 2015, ASIRW and ASMRW in Chinese males were 8.56 times and 7.93 times higher than those in females, respectively. The global ASIRW and ASMRW in males were 7.50 and 5.59 times higher than those in females, respectively. Tobacco use is a well-established risk factor for laryngeal cancer, with risk increasing with the duration and amount of use (13). It is also thought that interaction with alcohol consumption increases cancer risk (14). Among German laryngeal cancer patients over 35 years old, 74.4% of men and 65.7% of women had laryngeal cancer due to smoking (15). In Korea, the incidence of laryngeal cancer in 73.0% of men and 24.0% of women was closely related to smoking (16). Tobacco polycyclic

Table 5 Age-specific mortality rate of laryngeal cancer in China, 2015 (1/10⁵)

Age group	All areas			Urban areas			Rural areas		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
0-	0.03	0.06	0.00	0.00	0.00	0.00	0.06	0.12	0.00
1-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.00
15-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.00
25-	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.02
30-	0.01	0.02	0.00	0.01	0.02	0.00	0.02	0.03	0.00
35-	0.05	0.09	0.02	0.05	0.09	0.02	0.06	0.10	0.02
40-	0.19	0.30	0.08	0.15	0.26	0.05	0.25	0.38	0.12
45-	0.41	0.76	0.06	0.39	0.74	0.02	0.45	0.78	0.11
50-	1.00	1.85	0.11	1.18	2.21	0.09	0.71	1.28	0.16
55-	1.61	2.95	0.22	1.76	3.23	0.21	1.38	2.51	0.23
60-	2.53	4.79	0.25	2.50	4.88	0.11	2.56	4.68	0.45
65-	3.81	6.88	0.75	3.68	6.86	0.54	3.97	6.90	1.03
70-	4.71	8.26	1.33	4.85	8.65	1.34	4.52	7.78	1.31
75-	6.82	11.82	2.30	6.99	12.49	2.16	6.58	10.92	2.52
80-	8.56	15.60	2.89	9.30	16.95	2.99	7.47	13.58	2.75
85+	6.91	13.08	2.96	8.28	15.29	3.43	4.90	9.43	2.32

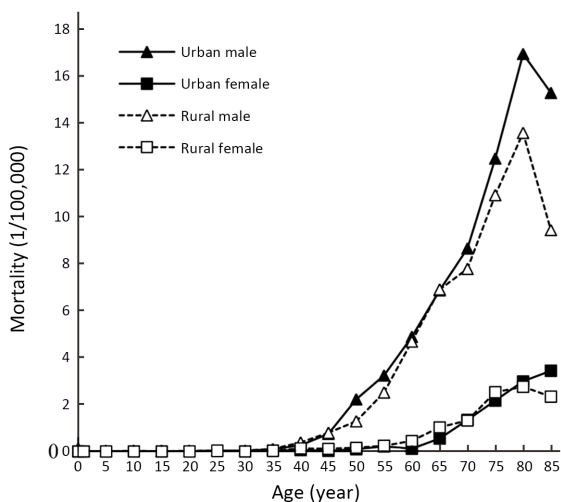


Figure 2 Age-specific laryngeal cancer mortality rate in China, 2015.

aromatic hydrocarbons (benzopyrene), aromatic groups, heterocyclic amines and nitrosamines and other compounds into the body, can be converted into carcinogens, resulting in DNA damage. If the DNA repair is not timely, it may cause cancer (17). Smoking and alcohol consumption have a synergistic effect on the

incidence of laryngeal cancer. Research had showed that there was a linear relationship between amount of alcohol consumption and the risk of laryngeal cancer. A study in China demonstrated that drinkers had a higher risk of laryngeal cancer [odds ratio (OR)=2.69, 95% confidence interval (95% CI): 1.60–4.52]. The OR of light drinkers and heavy drinkers were 2.15 and 3.51, respectively (18). Status and intensity of alcohol drinking were related to the overall survival rate (current drinkers: hazard ratio (HR)=1.73, 95% CI: 1.16–2.58). In a study which focuses on the effects of alcohol and tobacco in laryngeal cancer, the multivariate OR was 2.46 for nonsmoking heavy drinkers (defined as >8 drinks per day) and 9.38 for nondrinking smokers (19). Control of tobacco and alcohol intake for the prevention and control of laryngeal cancer is of great significance.

The studies showed evidences that being overweight or obese probably increased the risk of laryngeal cancer. In a pooled analysis of 1.9 million people, greater waist circumference and waist-to-hip ratio, adjusted for body mass index (BMI), were associated with higher risk of squamous cell carcinoma of the head and neck (20). Relationships between BMI and smoking-related cancers

may be confounded by smoking. Stratified by smoking condition, larger BMI was associated with higher risk of head and neck cancer in never smokers, but not in former smokers or current smokers (20). And one study identified that BMI was predictors of overall survival for laryngeal cancer and had an inverse association (21).

In addition, the risk factors for laryngeal cancer also include occupational exposure, gender, family cancer history, dietary factors and other risk factors (22,23). A study demonstrated that human papillomavirus (HPV) infection may be a high-risk factor for laryngeal cancer and closely relate to the development and prognosis of laryngeal cancer. HPV positive rate in laryngeal cancer patients was 8%–83% (24,25). The mechanism is excessive expression of HR-HPV E6 and E7 proteins which could affect the stability and activity of proto-oncogenes and suppressor genes (26). Dietary factors and healthy lifestyle probably affect the risk of laryngeal cancer. A diet varied in fruit and vegetables might has a protective effect and red meat could increase the risk (27,28). Moderate-intensity physical activity, such as equaling short distance running, might be beneficial for lowering the risk of developing laryngeal cancer and for improving the quality of life of larynx cancer survivors (29). So controlling exposure of risk factors and keeping healthy lifestyle should be strengthened to prevent from laryngeal cancer.

Conclusions

Laryngeal cancer could significantly affect the patients' life quality. The updated statistics provided a national profile of current laryngeal cancer burden in China in 2015. Controlling tobacco and alcohol consumption, preventing from occupational hazards, maintaining a healthy weight, being physically active and keeping a healthy diet were effective strategies to prevent and control laryngeal cancer. This study could create scientific evidences for laryngeal cancer prevention and control policymaking.

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Footnote

Conflicts of Interest: The authors have no conflicts of

interest to declare.

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