Appendix 1

Supplemental text

1. Strategies for data quality control

There were several strategies to ensure the validity of the data collected in the China Cardiovascular Association (CCA) –Chest Pain Center (CPC) Database.

First, the CCA–CPC database has strict data quality control measures during both the data collection and the data entry processes. When a hospital was preparing to enter CCA–CPC network, its staff would receive standardized training by data managers on definitions of data elements, disease diagnosis, and data reporting procedures. Information on individual characteristics (e.g., sex and age), date and time of symptom onset, diagnosis, measures of clinical examinations, and treatment procedures were collected and inputted into the web–based database according to their medical records by well–trained staffs in each CPC. All diagnoses were made by cardiologists and were based on symptoms, laboratory biochemical tests, electrocardiogram (ECG) measurements, or electrophysiological examinations, following certain clinical guidelines. Besides, rigorous quality control at data entry was also developed to avoid missing data, outliers, and logic errors. Automatic data check was performed for invalid and illogical values. Most data modules are structured, so that valid data must be entered before the case can be saved as a complete record and reported to the CCA–CPC Database.

Second, external quality control was implemented semi–annually to ensure data completeness and accuracy, and review reports are sent to registered hospitals. For example, cases should be registered within 7 days once patients receive first medical contact, and the online data reporting should be finished within 30 days after the patients are discharged. All registered cases have also been audited by the National Chest Pain Center Quality Control

Appendix 1, as submitted by the authors. Appendix to: Xue X, Hu J, Xiang D, et al. Hourly air pollution exposure and the onset of symptomatic arrhythmia: an individual-level case–crossover study in 322 Chinese cities. *CMAJ* 2023. doi: 10.1503/cmaj.220929.

Expert Working Group.

Last, we only included data from certified Chest Pain Centers, which were defined as those have passed complete and rigorous construction criteria and review processes.

2. Detailed information about case ascertainment

This study utilized a national disease registry called “Chinese Cardiovascular Association Database-Chest Pain Center”. Compared with the Hospital Information System, the specialized registry for Chest Pain Center is more complicated and do not contain any ICD-10 codes. Cardiologists at chest pain centers were requested to input patients’ clinical information into this registry through a series of formatted electronic questionnaires and forms, and the whole process is under uniform and strict quality control. Although no ICD-10 codes were used in this registry, the principal diagnosis for each symptomatic patient with chest pain or discomfort could be selected through a drop-down list, which comprised the Chinese names of specific diseases that were simultaneously matched by indicative, standardized, numerical codes.

Specifically, in the Chinese Cardiovascular Association Database–Chest Pain Center, the principal diagnoses include ST–segment–elevation myocardial infarction, non–ST–segment–elevation myocardial infarction, unstable angina, aortic dissection, pulmonary embolism, atrial fibrillation, atrial flutter, atrial premature beat, ventricular premature beat (the two summed as premature beat in our analysis), supraventricular tachycardia, and other causes of cardiac or non-cardiac chest pain. This dataset only recorded principal diagnosis that was mainly determined according to the patients’ chief complaint and clinical examinations following the common clinical practice guidelines, and the selection of diagnosis was independent of each other. Therefore, principal diagnoses in the Chest Pain Center database were mutually exclusive.

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Actually, the symptomatic arrhythmia patients were diagnosed by cardiologists, which were based on primary symptoms, laboratory biochemical tests, electrocardiogram (ECG) measurements, or electrophysiological examinations, following certain clinical guidelines. Besides, patients with chest discomfort and arrhythmia secondary to another diagnosis (e.g., acute coronary syndrome or pulmonary embolism) were not registered as arrhythmia patients included into this database. In addition, this registry database only has the five arrhythmia categories, and cannot provide more specific diagnosis information on arrhythmia (e.g., incidental, persistent, permanent). Moreover, the present database did not include asymptomatic arrhythmia, ventricular fibrillation and flutter patients due to the characteristic of chest pain center.

3. The calculation formula of the results

(1) percent change and 95% confidence intervals (95%CIs) for the risk of arrhythmia onset associated with an interquartile range (IQR) increase of air pollutant concentrations

$$\text{Percent change} = \left(e^{\beta \times \text{IQR}} - 1\right) \times 100\% \quad (1)$$

$$\text{Lower 95\% CI} = \left(e^{(\beta - 1.96 \times \text{SE}) \times \text{IQR}} - 1\right) \times 100\% \quad (2)$$

$$\text{Upper 95\% CI} = \left(e^{(\beta + 1.96 \times \text{SE}) \times \text{IQR}} - 1\right) \times 100\% \quad (3)$$

where β was the coefficient of point estimates, and SE was the corresponding standard error.

(2) percent change and 95% confidence intervals (95%CIs) for the risk of arrhythmia onset associated with 10 μg/m^3 (CO: 1 mg/m^3) increase of air pollutant concentrations

$$\text{Percent change} = \left(e^{\beta \times 10} - 1\right) \times 100\% \quad (4)$$

$$\text{Lower } 95\%\ \text{CI} = \left(e^{(\beta - 1.96 \times \text{SE}) \times 10} - 1\right) \times 100\% \quad (5)$$

$$\text{Upper } 95\%\ \text{CI} = \left(e^{(\beta + 1.96 \times \text{SE}) \times 10} - 1\right) \times 100\% \quad (6)$$

where β was the coefficient of point estimates, and SE was the corresponding standard error.

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