Associations between Household Usage of Cooking Fuels and Respiratory Symptoms in Middle-School Teenagers

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SUMMARY
In this work, we studied the association between fuel use pattern and its impact on respiratory health. A cross-sectional study was conducted on 5,891 households in Suzhou, China, where information about family cooking habits and teenagers' respiratory health were collected through questionnaire. The data were analysed using logistic regression, focusing on the type of cooking fuel and the frequency of using different fuel types adjusted for possible confounders. Results showed that using electricity and induction oven for cooking has protective effect on teenagers' respiratory health, including reduced risks for asthma, pneumonia, rhinitis and eczema.

PRACTICAL IMPLICATIONS
The results of this study provides important implications on the health effect of cooking fuel types, and could guide people towards a better cooking style that is beneficial to residents' respiratory health.

KEYWORDS
Induction Stove, Asthma, Indoor Air

1 INTRODUCTION
Fuel use pattern for cooking has a significant impact on indoor environment, and is associated with various health effects. As the world's largest developing country, China is seeing a rapid transition in the past decade, during which the dependence on solid fuel combustion was alleviated while cleaner energy sources such as gas and electricity played an increasingly important role. This paper focuses on studying the fuel use pattern in Suzhou, a medium sized city in China, and its effect on teenagers' respiratory health.

2 MATERIALS/METHODS
We conducted a cross-sectional study in 12 middle schools across Suzhou from November 2014 to January 2015. Parents answered questions about the primary type of cooking fuel and frequency of induction oven usage. Information about respiratory health conditions for their children was also obtained through the survey.

3 RESULTS
Cooking fuel type and respiratory health
The total household sample size was 5,891. A logistic regression adjusted for age, gender and family allergy history and was conducted to compare the effect on respiratory health between

people using electricity as cooking fuel and those using gas. The symptoms investigated include doctor-diagnosed asthma, pneumonia, rhinitis and eczema, etc. (Table 1)

Table 1. ORs (95% CIs) of respiratory outcomes associated with cooking fuel types

(reference = only use gas)	Only electricity	Both electricity and gas (adjusted)
Asthma	0.82 (0.58 , 1.13)	0.89 (0.62 , 1.24)
Pneumonia	0.80 (0.63 , 1.01)	1.05 (0.82 , 1.33)
Rhinitis	0.70 (0.54 , 0.90) *	0.79 (0.60 , 1.03)
Eczema	0.65 (0.50 , 0.85) *	0.92 (0.71 , 1.20)

Induction oven use and respiratory health

There are 6.4%, 20.0%, 32.0% and 38.5% people who reported using induction stove as "always", "sometimes", "rarely" and "never", respectively. Adjusted odds ratio between people who often use induction stove (always and sometimes) and seldom (rarely and never) for doctor-diagnosed asthma is 0.72 (95% CI 0.56, 0.91), pneumonia 0.71 (95% CI: 0.60, 0.84), rhinitis 0.70 (95% CI: 0.59, 0.84) and eczema 0.72 (95% CI: 0.60, 0.86), respectively.

4 DISCUSSION

This study found that cooking fuel type has a strong impact on indoor air quality and health, which is in agreement with several previous studies [Wong et al., 2004, 2013; Buchner and Rehfuess, 2015]. Our study adds a novel perspective to this area as induction oven usage is relatively new [in households in China] (or within households in China). Experimental measurement is encouraged to provide quantitative assessment of indoor air quality under different cooking fuel usage scenarios.

5 CONCLUSIONS

Our results show protective effect by electricity and induction stove usage for cooking on teenagers' respiratory health conditions.

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