The impact of petrochemical industrialisation on life expectancy and per capita income in Taiwan: an 11-year longitudinal study

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Abstract

Background: Petrochemical industries have been identified as important sources of emissions of chemical substances, and adverse health outcomes have been reported for residents who live nearby. The purpose of the current study was to examine the adverse effects of petrochemical industrialization in Taiwan on the life expectancy and personal income of people living in nearby communities.

Methods: This study compared life expectancies and personal income between one industrial county (Yunlin County) and one reference county (Yilan County), which had no significant industrial activity that might emit pollutants, in Taiwan through analysis of 11 year long and publicly available data. Data from before and after the petrochemical company in the industrial county started (year 1999) operating were compared.

Results: Residents of the industrialized county had lesser increases in life expectancy over time than did residents of a similar but less-industrialized county, with difference means ranging from 0.89 years (p < 0.05) to 1.62 years (p < 0.001) at different stages. Male residents were more vulnerable to the effects of industrialization. There were no significant differences in individual income between the two counties.

Conclusions: Countries, including Taiwan and the U.S., embracing petrochemical industries now face the challenge of environmental injustice. Our findings suggested that life expectancy lengthening was slowed and income growth was stalled for residents living in the industrial communities.

Background

In 2012 August, U.S. state regulators and the Obama administration tried to rescue Sunoco’s Philadelphia refinery by agreeing to loosen certain environmental restrictions. This action raised an environmental justice question of weighing 850 jobs against the health of people living nearby the refinery. Such environmental justice issues are faced by many developing countries—including Taiwan and the other three countries that were in the 1960s to 1990s termed the Four Little Dragons or Four Asian Tigers, and now also those countries grouped together as BRICS and ASEAN nations. These nations adopted industrialisation, especially of their petrochemical industries, to achieve the goal of economic growth [1]. In Taiwan, development of the petrochemical industry began in the past half century, and the country has experienced fast economic growth during that same period of time.

Petrochemical industries have been identified as important sources of emissions of a wide range of chemical substances, some of which have been recognized as environmental carcinogens [2]. Research studies have reported the health hazards of exposure to these chemicals and the adverse health effects on residents of environmental pollution resulting from the petrochemical industry [3-9]. Only very few studies reported no additional risk to human health [10]. Most of these studies were occupational exposure studies which focused on workers at the petrochemical facilities. However, it is not only workers, but also non-occupationally related populations living nearby, that have the potential to be exposed to a large set of chemicals, including some that are health hazards. People who live nearby petrochemical facilities may be exposed to pollution resulting from the facilities, but it...
remains unknown whether their life expectancy is affected by the emissions or other factors associated with industrialisation.

Economic growth and health are in most cases positively related [11-13]. However, Szreter [1] examined the relationships between industrialisation and health and concluded that all economic exchange entails health risks, and that industrialisation typically results in a particularly concentrated cocktail of such health risks. Previous studies have shown that industrial facilities are more likely to be located in more disadvantaged communities [14,15]. This further raises an environmental injustice issue; do people who live near these facilities benefit from the economic growth that arrives with industrialisation.

Researchers in Taiwan have considered the petrochemical industry to be the main source of industrial air pollution in Taiwan. Subsequent to several high-profile air-pollution events in Taiwan in 2010 and 2011, public concern regarding potential health hazards for residents living near petrochemical facilities has been elevated [7].

Study purpose
The purpose of the current study was to examine the adverse effects of petrochemical industrialisation in Taiwan on health. The study also examined whether petrochemical industrialisation contributed to economic growth among people living in nearby communities. Studies investigating the effects of industrialisation on health have been limited due to lack of appropriate data, especially longitudinal data. The current study seized an opportunity to observe how petrochemical facilities influence local residents’ life expectancy and personal income by analyzing 11 years of data collected both before and after a petrochemical facility began operating in central Taiwan.

Using Taiwan’s national data, the current study examined (1) the long-term health influence of petrochemical facilities on local residents, by comparing the life expectancy of residents living within a county in which a petrochemical facility resides to the life expectancy of residents of a reference area that did not have significant local pollution sources within its borders; and (2) the economic influence of petrochemical facilities on local residents, by comparing the per capita income of residents living within a county in which a petrochemical facility resides to the per capita incomes of residents of a reference county that did not include any petrochemical facilities within its borders.

Methods
Study design and the two counties chosen for study
We used a comparative study design to estimate the impact of petrochemical industry on life expectancies and per capita income by observing two counties in Taiwan, one with a petrochemical facility and one with no significant industrial activity that might emit pollutants. We compared outcome variables within each county and between the two counties at time points both before and after the petrochemical facility began operating.

We first selected Yunlin County as the industrialized county (referred to in this study as the industrialized county). Yunlin County has traditionally been an agriculturally based county in the western part of southern Taiwan, and has a population around 735,000 persons. A petrochemical industrial complex is located within this county (see Figure 1). The complex includes 66 facilities, including a naphtha cracking plant, petrochemical manufacturing, and coal-fired power plants. Since the Complex started operating in 1999, one study has pointed out that the concentrations of air pollutants such as PM10, ozone, and sulfur dioxide in Yunlin County have increased significantly [16]. The 2010 report of annual air pollutants emitted by the Complex indicated the following: particle pollutants, 3,340 metric tons; sulfur dioxide, 16,000 metric tons; NOx, 19,622 metric tons; and VOCs, 4,302 metric tons [16,17]. It is estimated that the Complex contributed to about 9.2% of Taiwan’s GDP in 2011 [18], which was increased significantly over the past 12 years since the Complex started operating [18,19]. Before settling down in the off-shore industrial zones in Yunlin County, the complex went through several options for selecting project sites due to local opposition in places such as Yilan County.

Yilan County (referred to in this study as the reference county) was very similar to the industrialized county in many ways, including its agricultural environment, and geographic proximity to the seashore. Yilan County had been first selected by the petrochemical complex company but then rejected by the Yilan County government in early 1990s. From 1996 to 2007, however, almost twice as many large manufacturing companies operated in the industrialized county as in the reference county. As a result, the current study uses Yilan County as a reference. See Table 1 for detailed information about these two counties.

Since the complex started operating in the industrialized county in 1999, studies have pointed out that the concentrations of air pollutants increased [16,17]. As for the reference county, instead of hosting a petrochemical facility, it has in the past decade continued to develop its agriculture industry as well as its sightseeing industry, with great effort toward maintaining the area’s natural beauty.

This study compared life expectancies and individual per capita income between the industrialized county and the reference county in Taiwan. Data from before and after the petrochemical facility in the industrial county started operating in 1999 were compared. Data from 1996
to 1998 were used as baseline data. Data collected from 1999 to 2007 were used to assess the effects of industrialisation, and findings were compared to the baseline data. To consider the phase-in effects of industrialisation, the study period was divided into four stages: (1) pre-industrialisation (1996–1998), (2) short-term industrialisation (1999–2001), (3) intermittent industrialisation (2002–2004), and (4) long-term industrialisation (2005–2007). As suggested in an environmental evaluation published by the Yunlin County government, the four stages of the study period were based on the complex’s manufacturing process and VOC (volatile organic compound) emission quantities [20].

Data sources
Due to the availability and completeness of the data sources, we only investigated life expectancy and individual per capita income of the industrialized and reference counties. Life expectancy was evaluated at birth (referred as LE\textsubscript{birth}), at 5 years old (referred as LE\textsubscript{5}), and at 65 years old. Life expectancy (referred as LE\textsubscript{65}) data was collected from Life Tables for Taiwan on the website of the Department of Statistics in the Ministry of the Interior [21]. Individual income data was available from the website of the Executive Yuan, Directorate-General of Budget, Accounting, and Statistics [22]. Data from 1996 to 2007 were included for analysis.

Table 1 Descriptive information for Yunlin and Yilan counties from 1996 to 2007

| County          | Yunlin (industrialized county) | Yilan (reference county) |
|-----------------|-------------------------------|--------------------------|
| Area (km\textsuperscript{2})\textsuperscript{a} | 1290.835                      | 2143.625                 |
| Year            | 1996–1998 1999–2002 2002–2004 2005–2007 | 1996–1998 1999–2002 2002–2004 2005–2007 |
| Population (person)\textsuperscript{a} | 752,427 746,241 742,797 725,672 | 465,120 465,004 464,107 460,398 |
| Number of large manufacturing\textsuperscript{b} | 35 42 48 42 22 21 25 22 | |
| Agricultural land (Hectare)\textsuperscript{c} | 112,870 112,364 111,992 112,550 | 58,265 158,641 164,438 200,826 |
| Number of doctors (/1000 people)\textsuperscript{a} | 0.66 0.71 0.76 0.92 0.86 1.00 1.12 1.19 | |
| Number of hospital (/1000 people)\textsuperscript{a} | 0.031 0.032 0.029 0.026 0.030 0.032 0.026 0.026 | |
| Life expectancy at birth | 74.05 74.88 75.51 76.16 74.84 75.8 76.88 77.65 | |
| Life expectancy at 5 years old | 69.74 70.52 71.12 71.69 70.62 71.51 72.59 73.31 | |
| Life expectancy at 65 years old | 15.98 16.63 17.17 17.78 16.59 17.05 17.94 18.64 | |
| Mortality rate (/10000) | 671.41 611.04 681.14 751.94 698.77 684.57 695.4 744.42 | |

Note. Large manufacturing indicating a company with more than 200 people.

Data source a. Ministry of the Interior. (URL: http://www.moi.gov.tw/stat/).
Data Source b. Small and Medium Enterprise Administration, Ministry of Economic Affairs (URL: http://www.moeasmea.gov.tw/mp.asp?mp=1).
Data Source c. Council of Agriculture, Executive Yuan (URL: http://www.coa.gov.tw/show_index.php).
Analysis
The life expectancies in the reference county (Yilan County) and the industrialized county (Yunlin County) were examined longitudinally. Variables of interest (differences between the two counties in life expectancy for the total population, male residents, and female residents) and time were also analyzed using first-order autoregression correlation structure. Life expectancy at birth (LE<sub>birth</sub>), at 5 years old (LE<sub>5</sub>), and at 65 years old (LE<sub>65</sub>) were all included for analysis. To further examine the impact of length of exposure to industrialisation, the life expectancies were compared cross-sectionally between the industrialized and the reference counties and examined at all four stages. Due to the concern of currency change over time, income per capita was compared only cross-sectionally. T-tests were employed to investigate the differences in life expectancy and per capita income between the two counties at four different stages. SAS version 9.1 was used for all analyses.

Results
Both the industrialized county and the reference county experienced steadily increased life expectancy from 1996 to 2007. The LE<sub>birth</sub> increased from 73.94 to 76.54 years and 74.52 to 77.94 years for the industrialized county and the reference county respectively. Since the patterns of increasing life expectancy were similar for life expectancies at different ages, the current study reports only life expectancy at 5 years old.

Life expectancy discrepancies between counties
Using autoregression, the increase in life expectancy over time of the industrialized county was 0.084 (p < 0.0001), 0.088 (p < 0.0001), and 0.0368 (p < 0.01) years lesser than that of the reference county per year for LE<sub>birth</sub>, LE<sub>5</sub>, and LE<sub>65</sub> respectively over the past 11 years (Table 2).

When the four stages of industrialisation were further analyzed and compared cross-sectionally, the LE<sub>birth</sub> and LE<sub>65</sub> in the reference county were higher and increased faster than the LE<sub>birth</sub> and LE<sub>65</sub> in the industrialized county in the four study stages, with difference means of 0.79 years (p < 0.05) at the pre-industrialisation stage, 0.92 years (p = 0.07) at the short-term industrialisation stage, 1.37 years (p < 0.01) at the intermittent industrialisation stage, and 1.49 years (p < 0.05) at the long-term industrialisation stage for LE<sub>birth</sub>; and difference means of 0.61 years (p < 0.05) at the pre-industrialisation stage, 0.42 years (p = 0.10) at the short-term industrialisation stage, 0.77 years (p < 0.05) at the intermittent industrialisation stage, and 0.86 years (p < 0.01) at the long-term industrialisation stage for LE<sub>65</sub>. The discrepancy of the mean differences between these two counties continued to increase over time. The patterns were even more prominent for LE<sub>5</sub>. The LE<sub>5</sub> in the reference county was significantly higher and increased faster than the LE<sub>5</sub> in the industrialized county in the four study stages, with the difference means of 0.89 years (p < 0.05) at the pre-industrialisation stage, 0.99 years (p < 0.05) at the short-term industrialisation stage, 1.47 years (p < 0.001) at the intermittent industrialisation stage, and 1.62 years (p < 0.001) at the long-term industrialisation stage (Table 3).

Table 2 Results of autoregression on life expectancy at birth, at 5 years old, and at 65 years old between the industrialized and reference counties

| Life expectancy at birth | All Estimates | Male Estimates | Female Estimates |
|--------------------------|---------------|---------------|------------------|
| Intercept                | 73.868***     | 70.738***     | 77.595***        |
| County                   | 0.6765***     | 0.8388***     | 0.6056***        |
| Year                     | 0.2329***     | 0.1877***     | 0.3045***        |
| County*Year              | 0.0843***     | 0.1229***     | 0.0050           |
| Life expectancy at age 5 |               |               |                  |
| Intercept                | 69.5763***    | 66.4387***    | 73.3118***       |
| County                   | 0.7546***     | 0.9750***     | 0.6094***        |
| Year                     | 0.2164***     | 0.1677***     | 0.2926***        |
| County*Year              | 0.0883***     | 0.1273***     | 0.0095           |
| Life expectancy at age 65|               |               |                  |
| Intercept                | 15.7964***    | 14.2856***    | 17.2277***       |
| County                   | 0.4633***     | 0.7333***     | 0.5823***        |
| Year                     | 0.1981***     | 0.1569***     | 0.2436***        |
| County*Year              | 0.0368***     | 0.0573***     | 0.0009           |

Note. The results are of the life expectancy of the reference county compared to the industrialized county. *p < 0.05; **p < 0.01; ***p < 0.001.
This evidence could indicate that the impact of industrialisation on life expectancy could start 3–5 years after the facilities start running (intermittent industrialisation stage), and middle age adults may suffer more from the impact as time goes by.

We further conducted trend tests for the discrepancies in life expectancies between the industrialized county and the reference county, and our findings showed that the trends of life expectancy discrepancies between these two counties for all residents increased over time (Fig. 2). This indicated the gap of life expectancy between the two counties increased over time.

### Life expectancy and gender differences

Using autoregression, the increase in life expectancy over time for male residents and female residents was different between the industrialized county and the reference county. Male residents in the industrialized county showed a smaller increase in life expectancy than the male residents living in the reference county, but there were no significant differences for female residents living in the two counties. The increase in life expectancy of the male resident in the industrialized county was 0.123 (p < 0.001), 0.127 (p < 0.0001), and 0.057 (p < 0.0001) years less than that of the reference county per year for LE\textsubscript{birth}, LE\textsubscript{5}, and LE\textsubscript{65} respectively over the past 11 years (Table 2).

The gender effect was also noted, when life expectancy was compared cross-sectionally. The discrepancy of life expectancies between the reference county and the industrialized county was greater for the male population than for the female and whole population. The life expectancies of male residents in the reference county were significantly higher than the life expectancy of male residents in the industrialized county in all four study stages, with difference means of 0.83 years (p < 0.05) at the pre-industrialisation stage, 1.43 years (p < 0.05) at the short-term industrialisation stage, 1.88 years (p < 0.0001) at the intermittent industrialisation stage, and 1.93 years (p < 0.01) at the long-term industrialisation stage for LE\textsubscript{birth}. Again, the gap of life expectancy for male residents between the two counties increased over time. This pattern was similar for LE\textsubscript{5} and LE\textsubscript{65} (Table 3).

The female residents in the reference county had significantly higher life expectancies than female residents in the industrialized county in only two study stages, with difference means of 0.85 years (p < 0.05) at the pre-industrialisation stage, 1.43 years (p < 0.05) at the short-term industrialisation stage, 1.88 years (p < 0.0001) at the intermittent industrialisation stage, and 1.93 years (p < 0.01) at the long-term industrialisation stage for LE\textsubscript{birth}. The patterns were similar for LE\textsubscript{5} and LE\textsubscript{65} (Table 3). This evidence could indicate that the impact of industrialisation on life expectancy could start soon after the facilities start running (short-term stage) for male residents living in the industrialized county, but it took longer (6–8 years) to manifest the impact for female residents.

We further conducted trend tests for the discrepancies in LE\textsubscript{5} between the reference county and the industrialized county for male and female residents in these two counties respectively. Our findings showed that the trends of life expectancy discrepancies between these two counties for male residents significantly increased

### Table 3 Differences of Life expectancies between the industrialized county and the reference county at all four stages

| Period                  | All Difference Mean (SD) | Male Difference Mean (SD) | Female Difference Mean (SD) | p-value | Male p-value | Female p-value |
|-------------------------|--------------------------|---------------------------|-----------------------------|---------|--------------|----------------|
| Life expectancy at birth|                          |                           |                             |         |              |                |
| Pre-industrialisation   | 0.79* (0.24)             | 0.02                      | 0.83* (0.25)                | 0.02    | 0.85* (0.25) | 0.01           |
| Short-term industrialisation | 0.92 (0.45)          | 0.07                      | 1.43* (0.49)                | 0.02    | 0.27 (0.39)  | 0.45           |
| Intermittent industrialisation | 1.37*** (0.18)     | < 0.01                    | 1.88*** (0.10)              | < 0.0001 | 0.66 (0.35)  | 0.08           |
| Long-term industrialisation | 1.49* (0.33)         | 0.01                      | 1.93* (0.35)                | < 0.01  | 0.76* (0.30) | 0.03           |
| Life expectancy at age 5 |                          |                           |                             |         |              |                |
| Pre-industrialisation   | 0.89* (0.89)             | 0.02                      | 1.01* (0.27)                | 0.01    | 0.84* (0.27) | 0.02           |
| Short-term industrialisation | 0.99* (0.39)         | 0.03                      | 1.51* (0.41)                | 0.01    | 0.33 (0.36)  | 0.33           |
| Intermittent industrialisation | 1.47** (0.24)      | < 0.01                    | 2.04*** (0.14)              | < 0.0001 | 0.68 (0.41)  | 0.11           |
| Long-term industrialisation | 1.62** (0.29)       | < 0.01                    | 2.13** (0.29)               | < 0.01  | 0.81** (0.28) | 0.02           |
| Life expectancy at age 65|                          |                           |                             |         |              |                |
| Pre-industrialisation   | 0.61* (0.22)             | 0.03                      | 0.85** (0.18)               | < 0.01  | 0.75* (0.27) | 0.03           |
| Short-term industrialisation | 0.42 (0.24)         | 0.10                      | 0.84* (0.25)                | 0.01    | 0.30 (0.25)  | 0.21           |
| Intermittent industrialisation | 0.77* (0.26)       | 0.02                      | 1.16** (0.19)               | < 0.01  | 0.68* (0.33) | 0.07           |
| Long-term industrialisation | 0.86** (0.18)       | < 0.01                    | 1.33** (0.14)               | < 0.01  | 0.62* (0.21) | 0.02           |

Note. Pre-industrialisation (1996–1998); Short-term industrialisation (1999–2001); Intermittent industrialisation (2002–2004); Long-term industrialisation (2005–2007).

*p < 0.05; **p < 0.01; ***p < 0.001.
over time ($p < 0.01$), but did not increase for female residents (Figure 2). This indicated the gap of life expectancy for male residents between the two counties increased over time.

**Per capita income between counties**
The per capita income of residents living in the industrialized county was not found to be significantly different from the individual’s per capita income of residents living in the reference county at any time period (Table 4). Residents living in the industrialized county did not economically benefit from having a chemical-intensive industry operating in their neighborhood.

**Discussion**
Our findings indicate that local residents seemed not to benefit economically from hosting a petrochemical company in their county. They did, however, suffer negative effects on life expectancy increases over time. The impact of the industrialisation process on local residents’ life expectancy also indicated strong gender differences.

**Industrialisation and life expectancy**
Although the industrialized county and the reference county have increased life expectancies from 1996 to 2007, the life expectancy in the reference county increased faster (by 0.084 years more each year) than did the life expectancy in the industrialized county, and the discrepancies increased over time. As previous literature has focused only on the adverse effect of the petrochemical industry on particular health problems, this study provides valuable information on the impact of a petrochemical industry on local residents’ life expectancies [3,9,23]. Our results also indicate that the impact of industrialisation on life expectancy could start 3–5 years after the facilities start running (intermittent industrialisation stage) for the whole population and the older population. For the adult population (life expectancy at 5 years old), who might be more likely to work in outdoor environment, may be more susceptible to the impact and suffer faster and more from the impact as the time goes by.

However, the mechanisms by which petrochemical industrialisation affects residents’ health were not fully

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**Table 4 Comparisons of per capita income between the reference county (Yilan County) and the industrialized county (Yulin County) from 1987 to 2007**

| Period                | Yilan | Yulan | Difference mean | SD    | p-value |
|-----------------------|-------|-------|-----------------|-------|---------|
| Pre-industrialisation | 189,408 | 179,850 | 9,558          | 13,614 | 0.44    |
| Short-term industrialisation | 219,520 | 219,743 | −222            | 11,229 | 0.98    |
| Intermittent industrialisation | 205,701 | 200,526 | 5,175           | 4,379  | 0.22    |
| Long-term industrialisation | 231,497 | 219,722 | 11,775          | 8,579  | 0.17    |

Note: Pre-industrialisation (1996–1998); Short-term industrialisation (1999–2001); Intermittent industrialisation (2002–2004); Long-term industrialisation (2005–2007).
understood, it is possible that the residents of the industrialized county suffered from air pollutants, possibly due to the local petrochemical facility, which resulted in more chronic illness and therefore smaller increases in life expectancy rates than in the reference county. Most of the previous literature reported negative effects of petrochemical emissions on neighboring residents’ health, which might explain the smaller increase in life expectancies in the industrialized county [3-9,24,25].

**Industrialisation and gender effects**

The current study’s findings showed that male residents of the industrialized county seemed to be more susceptible to health effects of industrialisation, with significantly less increased life expectancy (0.123 years less per year) than male residents of the reference county. Female residents seemed to be more resistant to the health effects of industrialisation. No research study in the literature has reported such gender differences, and this finding warrants further investigation into the mechanisms resulting in these effects.

Research studies on air pollution, which is likely to result from industrialisation, have shown contradictory information on gender and air pollution. A recent review study of air pollution indicated that air pollution has stronger health effects among women than among men [26]. However, the mechanism resulting in the gender differences is still not clear. Most of these studies attributed the decreased physical functions, such as lung function, to gender differences in physiology, activities, coexposures, behaviors, and occupations. However, most of these studies examined only the incidence of respiratory symptoms among men and women, and did not point out whether these symptoms would lead to actual changes in life expectancy between the genders.

Research in gender inequality has generally agreed that women experience more ill health but have lower rates of mortality [26,27]. Gender inequality in health is commonly attributed to differing exposure, resources, and lifestyle, with men more likely than women to smoke and consume alcohol, and women more likely than men to be physically inactive [28-30]. However, whether men in Taiwan are more vulnerable or women in Taiwan have greater resistance to environmental changes due to industrialisation, the gender effect of industrialisation requires further investigation.

**Industrialisation and economic growth**

Industrialisation itself, like all forms of economic growth, exerts intrinsically negative population health effects among those communities most directly involved in the transformations which it entails [1]. This is true for studies that have been published on populations in the western countries [31]. The current study’s findings provide evidence that in addition to suffering from a smaller increase in life expectancy, residents of the industrialized county did not experience any greater increase in individual income than did residents of the reference county. Taiwan, like many countries in the world, exchanges people’s health for economic growth through entering the industrialisation process [1]. However, while the literature discusses lessons learned from history regarding the effect of economic exchange and health risks resulting from industrialisation, the current study’s findings further raise the issue for the Taiwanese government regarding who shall benefit from the economic growth related to industrialisation.

**Limitations**

The influence of industrialisation can be examined from many different perspectives, including health effects, economic effects, and effects on natural resources. The current study examined only one major health and economic outcome, and so may miss some other aspects of industrialisation. Furthermore, the impact of industrialisation may differ by industry type and outcomes. This study’s findings also may not be generalizable to the development of industries other than high-emission industries.

**Conclusions**

The petrochemical industry is one of the fastest growing industries in East Asia, fuelled by the region’s rapid economic development. The growth of the petrochemical industry in Taiwan benefits not only the huge direct players but also the nation’s economic growth. Our study pointed out an environmental justice issue related to the development of such high-emission industry, which Taiwan’s government faces and which is shared by other countries that plan to or have already embraced petrochemical industrialisation.

**Competing interests**

The authors declare that they have no competing interests.

**Authors’ contributions**

YM has made substantial contributions to acquisition of data, and interpretation of data of this study and have been involved in drafting the manuscript and revising it critically for important intellectual content. WY has conducted analysis of data of this study and have been involved in drafting in manuscript and manuscript revision. CC has made substantial contributions to conception and design of the study and have been involved in drafting the manuscript and revising it critically for important intellectual content. YM has made substantial contributions to acquisition of data, and interpretation of data of this study and have been involved in drafting the manuscript and revising it critically for important intellectual content.

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