A Comparative Analysis of Acute Respiratory Infection Outpatient Visits by Age Group in Selected Areas of Melaka and Johor

Noor Aniza Binti Ibrahim

Jabatan Kesihatan Negeri Melaka, Melaka, Malaysia

DOI: https://doi.org/10.47772/IJRISS.2026.100700936

Received: 06 August 2026; Accepted: 12 August 2026; Published: 18 August 2026

ABSTRACT

Acute respiratory infection (ARI) is a common respiratory condition that contributes to outpatient healthcare utilisation across different age groups. This study aimed to compare outpatient visits for ARI among three age groups, namely <12 years, 13–59 years, and >60 years, at selected sentinel clinics in Melaka and Johor from 2015 to 2018. Data were obtained from daily outpatient visit reports at Klinik Kesihatan Bukit Rambai, Melaka (KKBR), Klinik Kesihatan Bandar Maharani, Johor (KKBM), and Klinik Kesihatan Bandar Penawar, Johor (KKBP). Descriptive analysis was used to determine the distribution, mean, and standard deviation of outpatient visits according to age group. A one-way ANOVA was performed to determine whether outpatient visits differed significantly among the three age groups, followed by Duncan's post-hoc test for multiple comparisons. The findings showed significant differences in outpatient visits among the three age groups at all three sentinel clinics ($p<0.01$). The 13–59-year age group consistently recorded the highest mean outpatient visits at Klinik Kesihatan Bukit Rambai (M=12.51, SD=5.86), Klinik Kesihatan Bandar Maharani (M=104.88, SD=52.75), and Klinik Kesihatan Bandar Penawar (M=15.24, SD=8.90), compared with the <12-year and >60-year age groups. During the study period, Muar showed a continuous increase in outpatient visits, whereas Bukit Rambai and Bandar Penawar showed fluctuating annual trends. Differences in healthcare-seeking behaviour between age groups may partly explain the observed pattern, although healthcare-seeking behaviour was not directly measured in this study. In conclusion, outpatient visits for ARI differed significantly by age group across the three study areas, with individuals aged 13–59 years consistently recording the highest outpatient attendance. The findings demonstrate an age-related variation in ARI outpatient visits and highlight the importance of considering differences between age groups when interpreting patterns of outpatient healthcare utilisation.

Keywords: Acute respiratory infection; Outpatient visits; Age groups; Healthcare-seeking behaviour; One-way ANOVA; Melaka; Johor.

INTRODUCTION

Acute respiratory infection (ARI) represents an important respiratory health concern and contributes substantially to healthcare utilisation, particularly through outpatient services. The occurrence of respiratory conditions and the decision to seek medical treatment may vary according to age, susceptibility, exposure, symptoms, and healthcare-seeking behaviour. Therefore, examining outpatient visits according to age group may provide useful information on differences in healthcare utilisation for respiratory conditions within a population.

Numerous studies on the health effects of ambient air pollution have examined the relationships between specific air pollutants and respiratory health outcomes. Many of these studies have focused on children because of their susceptibility to the adverse respiratory effects of air pollution (He et al., 2022; Ibrahim et al., 2022; Song et al., 2018). Children may experience different respiratory health effects compared with adults and older populations because of differences in physiological development, exposure patterns, and healthcare-seeking behaviour.

However, respiratory health effects are not restricted to children, and differences in outpatient attendance may also occur among adult and older age groups.

Outpatient visits may provide a sensitive indicator of acute or short-term respiratory health conditions because they include individuals who seek medical treatment without requiring hospitalisation (Guo et al., 2021). Unlike hospital admission data, outpatient records capture a broader range of patients seeking treatment for respiratory symptoms. Examining these records according to age group may therefore provide a clearer understanding of the distribution of ARI outpatient attendance within different population groups.

This study focused on ARI outpatient visits at three selected sentinel clinics: Klinik Kesihatan Bukit Rambai in Melaka (KKBR), Klinik Kesihatan Bandar Maharani in Muar, Johor (KKBM), and Klinik Kesihatan Bandar Penawar in Johor (KKBP). Bandar Penawar was selected as a comparative study area because it is a coastal town facing the South China Sea, whereas Bukit Rambai and Muar are coastal areas located along the Straits of Malacca. Outpatient visit data from 2015 to 2018 were examined according to three age groups: <12 years, 13–59 years, and >60 years.

Although previous studies have frequently emphasised respiratory health effects among children and older populations, differences in ARI outpatient attendance among age groups within these selected study areas have not been clearly established. Understanding these differences is important because the number of outpatient visits may reflect not only the occurrence of respiratory illness but also variations in healthcare-seeking behaviour among different age groups.

Therefore, the objective of this study was to compare outpatient visits for ARI among the <12-year, 13–59-year, and >60-year age groups at Klinik Kesihatan Bukit Rambai, Klinik Kesihatan Bandar Maharani, and Klinik Kesihatan Bandar Penawar from 2015 to 2018. The study also examined whether the differences in outpatient visits among the three age groups were statistically significant.

METHODOLOGY

Outpatient Visits Data

ARI data were obtained from daily outpatient visit reports covering the four-year period from 2015 to 2018. The selected clinics were Klinik Kesihatan Bukit Rambai (KKBR), Klinik Kesihatan Bandar Maharani (KKBM), and Klinik Kesihatan Bandar Penawar (KKBP). KKBR represented Bukit Rambai, KKBM represented Muar, and KKBP represented Bandar Penawar. The age categories were retained according to the reporting format used for the outpatient data: <12 years, 13–59 years, and >60 years.

Descriptive Analysis

Descriptive analysis was used to summarise the number and proportion of patients recorded with ARI in each age group from 2015 to 2018. In this study, N represents the number of patients recorded in the outpatient visit data for the relevant age group, rather than the number of reporting days. The mean (M) and standard deviation (SD) were used to describe the daily outpatient visits for each of the three age groups.

One-Way ANOVA

One-way ANOVA was used to compare the frequency of outpatient visits among the three age groups: <12 years, 13–59 years, and >60 years. Statistical significance was set at $p<0.01$. Following a statistically significant one-way ANOVA, Duncan's post-hoc test was performed to determine which age groups differed significantly from each other.

RESULTS AND DISCUSSION

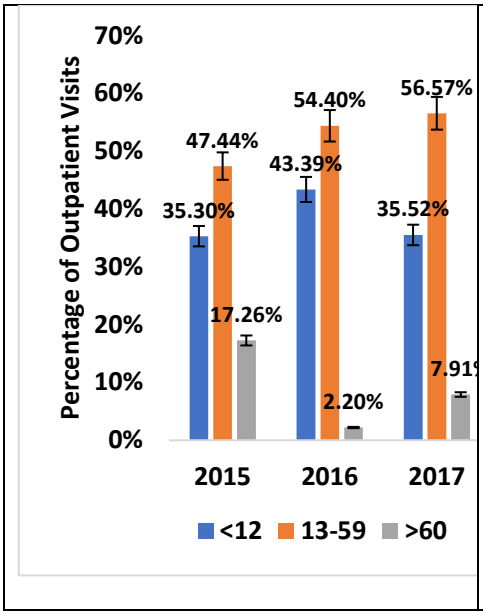

Figure 1. Percentage distribution of outpatient visits based on the main age group of patients who suffered ARI at Klinik Kesihatan Bukit Rambai from 2015-2018

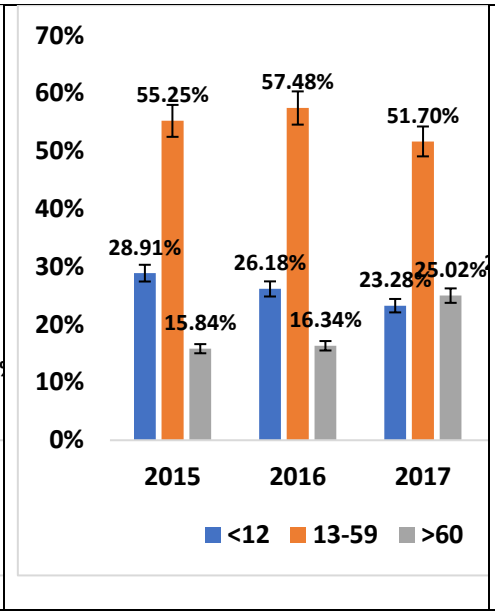

Figure 2. Percentage distribution of outpatient visits based on the main age group of patients who suffered ARI at Klinik Kesihatan Bandar Maharani from 2015-2018

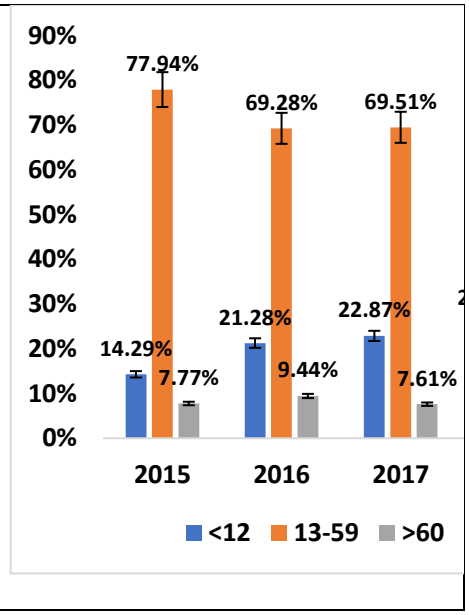

Figure 3. Percentage distribution of outpatient visits based on the main age group of patients who suffered ARI at Klinik Kesihatan Bandar Penawar from 2015-2018.

Table 1. Means and standard deviations of daily outpatient visits based on the age group of patients who suffered ARI at KKBR, KKBM and KKBP from 2015-2018

		Daily Outpatient Visits KKBR		Daily Outpatient Visits KKBM		Daily Outpatient Visits KKBP	
Year	**Age Range**	***N***	***Mean ± SD***	***N***	***Mean ± SD***	***N***	***Mean ± SD***
2015	<12	1583	$8.80_b \pm 4.44$	7486	$33.83_a \pm 16.09$	848	$5.06_b \pm 2.89$
	13-59	2127	$10.97_c \pm 4.83$	14308	$79.67_c \pm 63.16$	4626	$22.48_c \pm 8.32$
	>60	774	$6.28_a \pm 2.74$	4101	$42.53_b \pm 36.24$	461	$4.02_a \pm 3.15$
2016	<12	2246	$11.24_b \pm 4.48$	6256	$29.69_a \pm 15.24$	597	$3.08_b \pm 1.32$
	13-59	2816	$13.32_c \pm 4.58$	13738	$71.73_c \pm 52.25$	1944	$9.23_c \pm 3.14$
	>60	114	$2.63_a \pm 1.18$	3906	$46.63_b \pm 61.06$	265	$2.51_a \pm 1.91$
2017	<12	1468	$9.61_b \pm 5.97$	14374	$58.97_a \pm 20.23$	748	$4.13_b \pm 2.21$
	13-59	2338	$13.05_c \pm 6.38$	31921	$125.02_c \pm 35.46$	2273	$10.76_c \pm 3.64$
	>60	327	$2.80_a \pm 1.11$	15448	$65.84_b \pm 26.04$	249	$3.58_a \pm 1.65$
2018	<12	1877	$10.14_a \pm 5.46$	18341	$33.83_b \pm 16.09$	661	$4.10_b \pm 2.58$
	13-59	2082	$12.37_b \pm 7.26$	32558	$79.67_c \pm 63.16$	1611	$8.04_c \pm 3.18$
	>60	565	$10.75_a \pm 19.22$	18775	$42.53_a \pm 36.24$	296	$2.05_a \pm 0.97$

Note. Means with different superscript letters differ significantly according to Duncan's post-hoc test following a statistically significant one-way ANOVA

Klinik Kesihatan Bukit Rambai

Table 1 showed that in 2015, outpatient visits in the 13–59-year age group (M=10.97, SD=4.83) were higher than those in the <12-year age group (M=8.80, SD=4.44) and the >60-year age group (M=6.28, SD=2.74). In 2016, the 13–59-year age group again recorded the highest mean outpatient visits (M=13.32, SD=4.58), followed by the <12-year age group (M=11.24, SD=4.48) and the >60-year age group (M=2.63, SD=1.18). A similar pattern was observed in 2017, with the highest mean recorded among those aged 13–59 years (M=13.05, SD=6.38), followed by those aged <12 years (M=9.61, SD=5.97) and >60 years (M=2.80, SD=1.11). In 2018, the 13–59-year age group continued to record the highest mean outpatient visits (M=12.37, SD=7.26), followed by the >60-year age group (M=10.75, SD=19.22) and the <12-year age group (M=10.14, SD=5.46).

A one-way ANOVA revealed statistically significant differences in outpatient visits among the three age groups in 2015, $F(2, 4481)=346.60$, $p<0.01$; 2016, $F(2, 5173)=398.93$, $p<0.01$; 2017, $F(2, 4130)=483.17$, $p<0.01$; and 2018, $F(2, 4521)=30.60$, $p<0.01$. Duncan's post-hoc test was subsequently used to identify differences among the age groups. In 2018, the <12-year and >60-year age groups did not differ significantly from each other.

As shown in Figure 1, Klinik Kesihatan Bukit Rambai recorded 4,484 outpatient visits for ARIs in 2015. The highest proportion was recorded among the 13–59-year age group, with 2,127 visits (47.44%) and a maximum of 28 patients per day, followed by the <12-year age group with 1,583 visits (35.30%) and a maximum of 29 patients per day, and the >60-year age group with 774 visits (17.26%) and a maximum of 16 patients per day. In 2016, a total of 5,176 outpatient visits were recorded. The 13–59-year age group again accounted for the highest proportion, with 2,816 visits (54.40%) and a maximum of 26 patients per day, followed by the <12-year age group with 2,246 visits (43.39%) and a maximum of 24 patients per day, and the >60-year age group with 114 visits (2.20%) and a maximum of 5 patients per day.

In 2017, Klinik Kesihatan Bukit Rambai recorded 4,133 outpatient visits for ARIs. The 13–59-year age group accounted for 2,338 visits (56.57%), with a maximum of 30 patients per day, followed by the <12-year age group with 1,468 visits (35.52%) and a maximum of 24 patients per day, and the >60-year age group with 327 visits (7.91%) and a maximum of 5 patients per day. In 2018, a total of 4,524 outpatient visits were recorded. The highest proportion remained among the 13–59-year age group, with 2,082 visits (46.02%) and a maximum of 32 patients per day, followed by the <12-year age group with 1,877 visits (41.49%) and a maximum of 31 patients per day, and the >60-year age group with 565 visits (12.49%) and a maximum of 64 patients per day. Overall, Klinik Kesihatan Bukit Rambai recorded 18,317 outpatient visits from 2015 to 2018, with the highest proportion among the 13–59-year age group, followed by the <12-year and >60-year age groups.

Klinik Kesihatan Bandar Maharani

At Klinik Kesihatan Bandar Maharani, the results showed that in 2015, the 13–59-year age group recorded the highest mean outpatient visits (M=79.67, SD=63.16), followed by the >60-year age group (M=42.53, SD=36.24) and the <12-year age group (M=33.83, SD=16.09). In 2016, the highest mean was again recorded among those aged 13–59 years (M=71.73, SD=52.25), followed by those aged >60 years (M=46.63, SD=61.06) and <12 years (M=29.69, SD=15.24). In 2017, the 13–59-year age group recorded the highest mean outpatient visits (M=125.02, SD=35.46), followed by the >60-year age group (M=65.84, SD=26.04) and the <12-year age group (M=58.97, SD=20.23). In 2018, the highest mean was also recorded among the 13–59-year age group (M=130.86, SD=37.07), followed by the <12-year age group (M=98.45, SD=43.86) and the >60-year age group (M=86.79, SD=37.13).

A one-way ANOVA revealed statistically significant differences in outpatient visits among the three age groups in 2015, $F(2, 23897)=1800.99$, $p<0.01$; 2016, $F(2, 25892)=2393.57$, $p<0.01$; 2017, $F(2, 61740)=33094.63$, $p<0.01$; and 2018, $F(2, 15133)=2088.07$, $p<0.01$. Duncan's post-hoc test was subsequently used to identify differences among the age groups.

As shown in Figure 2, Klinik Kesihatan Bandar Maharani recorded 23,900 outpatient visits for ARIs in 2015. The 13–59-year age group accounted for the highest proportion, with 13,738 visits (57.48%) and a maximum of 330 patients per day, followed by the <12-year age group with 6,256 visits (26.18%) and a maximum of 80

patients per day, and the >60-year age group with 3,906 visits (16.34%) and a maximum of 261 patients per day. In 2016, a total of 25,895 outpatient visits were recorded. The highest proportion was again observed among the 13–59-year age group, with 14,308 visits (55.25%) and a maximum of 341 patients per day, followed by the <12-year age group with 7,486 visits (28.91%) and a maximum of 112 patients per day, and the >60-year age group with 4,101 visits (15.84%) and a maximum of 147 patients per day.

In 2017, Klinik Kesihatan Bandar Maharani recorded 61,743 outpatient visits for ARIs. The 13–59-year age group accounted for 31,921 visits (51.70%), with a maximum of 225 patients per day, followed by the >60-year age group with 15,448 visits (25.02%) and a maximum of 135 patients per day, and the <12-year age group with 14,374 visits (23.28%) and a maximum of 135 patients per day. In 2018, a total of 69,674 outpatient visits were recorded. The 13–59-year age group remained the largest group, with 32,558 visits (46.73%) and a maximum of 215 patients per day, followed by the >60-year age group with 18,775 visits (26.95%) and a maximum of 167 patients per day, and the <12-year age group with 18,341 visits (26.32%) and a maximum of 192 patients per day. Overall, Klinik Kesihatan Bandar Maharani recorded 181,212 outpatient visits from 2015 to 2018, with the highest proportion among the 13–59-year age group, followed overall by the <12-year and >60-year age groups.

Klinik Kesihatan Bandar Penawar

At Klinik Kesihatan Bandar Penawar, the results showed that in 2015, the 13–59-year age group recorded the highest mean outpatient visits (M=22.48, SD=8.32), followed by the <12-year age group (M=5.06, SD=2.89) and the >60-year age group (M=4.02, SD=3.15). In 2016, the 13–59-year age group again recorded the highest mean outpatient visits (M=9.23, SD=3.14), followed by the <12-year age group (M=3.08, SD=1.32) and the >60-year age group (M=2.51, SD=1.91). The same pattern was observed in 2017, with the highest mean among those aged 13–59 years (M=10.76, SD=3.64), followed by those aged <12 years (M=4.13, SD=2.21) and >60 years (M=3.58, SD=1.65). In 2018, the 13–59-year age group continued to record the highest mean outpatient visits (M=8.04, SD=3.18), followed by the <12-year age group (M=4.10, SD=2.58) and the >60-year age group (M=2.05, SD=0.97).

A one-way ANOVA revealed statistically significant differences in outpatient visits among the three age groups in 2015, $F(2, 1092)=323.68$, $p<0.01$; 2016, $F(2, 2803)=1584.08$, $p<0.01$; 2017, $F(2, 3267)=1510.04$, $p<0.01$; and 2018, $F(2, 2558)=821.27$, $p<0.01$. Duncan's post-hoc test was subsequently used to identify differences among the age groups.

As shown in Figure 3, Klinik Kesihatan Bandar Penawar recorded 5,935 outpatient visits for ARIs in 2015. The 13–59-year age group accounted for the highest proportion, with 4,626 visits (77.94%) and a maximum of 45 patients per day, followed by the <12-year age group with 848 visits (14.29%) and a maximum of 14 patients per day, and the >60-year age group with 461 visits (7.77%) and a maximum of 16 patients per day. In 2016, a total of 2,806 outpatient visits were recorded. The 13–59-year age group again accounted for the highest proportion, with 1,944 visits (69.28%) and a maximum of 18 patients per day, followed by the <12-year age group with 597 visits (21.28%) and a maximum of 7 patients per day, and the >60-year age group with 265 visits (9.44%) and a maximum of 7 patients per day.

In 2017, Klinik Kesihatan Bandar Penawar recorded 3,270 outpatient visits for ARIs. The 13–59-year age group accounted for 2,273 visits (69.51%), with a maximum of 19 patients per day, followed by the <12-year age group with 748 visits (22.87%) and a maximum of 12 patients per day, and the >60-year age group with 249 visits (7.61%) and a maximum of 8 patients per day. In 2018, a total of 2,568 outpatient visits were recorded. The 13–59-year age group remained the largest group, with 1,611 visits (62.73%) and a maximum of 19 patients per day, followed by the <12-year age group with 661 visits (25.74%) and a maximum of 13 patients per day, and the >60-year age group with 296 visits (11.53%) and a maximum of 5 patients per day. Overall, Klinik Kesihatan Bandar Penawar recorded 14,579 outpatient visits from 2015 to 2018, with the highest proportion among the 13–59-year age group, followed by the <12-year and >60-year age groups.

Overall Trend

The analysis showed different annual patterns across the three study areas. Muar was the only study area that showed a continuous increase in the total number of outpatient visits from 2015 to 2018. In contrast, outpatient

visits at Bukit Rambai and Bandar Penawar fluctuated throughout the study period. Despite these differences in annual trends, the 13–59-year age group consistently accounted for the highest proportion of outpatient visits across all three sentinel clinics. Overall, the <12-year age group recorded the second-highest proportion, followed by the >60-year age group.

Children are particularly susceptible to the adverse health effects of air pollution due to their immature immune, respiratory, and metabolic systems, as well as their susceptibility to respiratory infections (Lee, 2021). The associations between specific air pollutants and respiratory health outcomes have been extensively investigated, with many previous studies focusing on children. The effect of NO_2 on emergency department visits for acute upper respiratory tract infections was reported to be stronger among children aged 0–5 years, whereas the effect of PM_{10} was greater among those aged 6–14 years. Song et al. (2018), in a study conducted in Shijiazhuang, China, also found significant associations between ambient NO_2 and SO_2 levels and outpatient visits among children with respiratory diseases.

Similarly, a 2022 study reported a strong association with respiratory hospitalisations among children aged 0–4 years in Bintulu. In Poland, short-term changes in O_3 were associated with increased school absences due to respiratory illnesses among children aged 9–10 years. Ratajczak et al. (2021) found that moderate-term exposure to air pollution was associated with an increased risk of upper respiratory infections among children aged 3–12 years, while a 2018 study reported that ambient air pollutants were associated with an increased risk of upper respiratory infections. Several studies have also suggested that children exposed to higher concentrations of air pollutants may continue to experience lower lung function, particularly when exposure persists over time (Schultz et al., 2017).

These findings differ from the pattern observed in the present study, where the highest proportion of outpatient visits for ARIs was recorded among individuals aged 13–59 years. However, this difference does not necessarily indicate that adults are more biologically susceptible to ARIs than children. The present study measured outpatient attendance according to age group, whereas many previous studies examined other outcomes, including emergency department visits, hospitalisations, respiratory symptoms, and changes in lung function.

In a study by Mohd Shafie et al. (2022), Klang was identified using the AirQ+ model as a significantly high-risk location for chronic bronchitis in the adult population in 2009, involving 804,240 residents and a relative risk of 1.85. Most areas were exposed to annual PM_{10} concentrations exceeding the recommended levels of the Department of Environment and the World Health Organization Global Air Quality Guidelines. However, the specific age range examined in that study was not identified. Nevertheless, the findings demonstrate that respiratory health effects associated with air pollution are not restricted to children and may also affect the adult population.

Differences in behaviour and access to health-related information may also influence how different population groups respond to health risks. Older individuals may depend more heavily on family members in making healthcare-related decisions, while younger individuals may have greater access to information through social media and other sources. However, greater access to information does not necessarily mean that individuals are able to distinguish relevant health information from inaccurate or unnecessary information (Aamir et al., 2022). Therefore, differences in outpatient attendance among age groups may reflect not only differences in respiratory health conditions but also differences in individual behaviour and decisions to seek treatment.

Another possible explanation for the higher proportion of outpatient visits among individuals aged 13–59 years is their potential exposure to environmental pollutants through occupational and daily activities. Adults represent a population group that may experience substantial exposure to air pollution depending on their working and living environments. Achilleos et al. (2019), in Kuwait, reported acute health impacts of air pollution across different age groups, involving 32,044 elderly individuals (21,670 Kuwaitis and 10,374 non-Kuwaitis), 33,250 adolescents/adults (12,938 Kuwaitis and 20,312 non-Kuwaitis), and 8,454 children (4,781 Kuwaitis and 3,673 non-Kuwaitis). These findings indicate that the health impacts of air pollution can occur across different age groups, including the adult population.

The association between air pollution and lung function may also provide a possible explanation for the higher number of outpatient visits observed among individuals aged 13–59 years. Many studies have reported

associations between air pollution exposure and lung function among both adults and children. In a study involving 30 healthy young adults in China, the effects of air pollution on lung function, inflammation, and oxidative stress were examined using a linear mixed-effects model. Interleukin-6 (IL-6) and C-reactive protein (CRP) were used as markers of inflammation, while malondialdehyde (MDA), a stable by-product of lipid peroxidation, was used as a biomarker of oxidative stress. Higher $PM_{2.5}$ exposure was associated with changes in lung function, CRP, and MDA. Every 10 μg/m³ increase in $PM_{2.5}$ at a two-day lag was associated with a decrease in forced expiratory volume (FEV1), a decrease in peak expiratory flow (PEF) of 46.34 ml/s, an increase in CRP of 2.86% (95% CI: 1.47%, 4.27%), and an increase in MDA of 1.63% (95% CI: 0.14%, 3.14%) (Xu et al., 2022).

According to longitudinal observational data from the Dutch Lifelines cohort study, which followed 49,705 adults aged 18 years and above between 2006 and 2015, higher exposure to $PM_{2.5}$, but not black carbon, was associated with higher cognitive processing time (CPT) and slower cognitive processing speed [Total Effect $PM_{2.5}$: FEV1 model = 8.31×10^{-3}; forced vital capacity (FVC) model = 8.30×10^{-3} (95% CI: 5.69×10^{-3}, 10.91×10^{-3})]. More than 97% of the observed effect was directly associated with $PM_{2.5}$ exposure (Aretz et al., 2021).

Although $PM_{2.5}$ may be relevant to respiratory health, its contribution to the pattern of outpatient visits observed in the present study could not be assessed because $PM_{2.5}$ was not included in the analysis, as the Department of Environment did not collect $PM_{2.5}$ data until 2019. Therefore, the higher proportion of outpatient visits among adults aged 13–59 years should not be directly attributed to $PM_{2.5}$ exposure based on the findings of the present study.

Individuals with diabetes and pre-existing heart or lung diseases, particularly asthma, are recognised as vulnerable populations who should be aware of appropriate health-protection measures. Even on days with relatively low air pollution levels, vulnerable and sensitive individuals may still experience adverse health effects (Manisalidis et al., 2020). Other studies have also linked air pollution exposure among adults and older populations with broader health outcomes. Trevenen et al. (2022) and Mork et al. (2023) reported associations involving Alzheimer's disease and related dementias, while Ju et al. (2022) described adverse effects of long-term air pollution exposure on both physical and mental health among middle-aged and older adults. These studies further demonstrate that the health effects associated with air pollution may occur across different age groups, although these broader health outcomes were not directly examined in the present study.

Table 2. Analyses for the Age Groups of Outpatients Visits for ARI at Klinik Kesihatan Bukit Rambai from 2015-2018.

Measure	<12	13-59	>60	*F* ratio	*p*	η2
	M ± SD	M ± SD	M ± SD			
Age Groups	$10.08_b \pm 5.15$	$12.51_c \pm 5.86$	$6.82_a \pm 11.39$	720.57*	<.001	0.08

Note. Means with different superscript letters differ significantly according to Duncan's post-hoc test following a statistically significant one-way ANOVA.

Table 3. Analyses for the Age Groups of Outpatients Visits for ARI at Klinik Kesihatan Bandar Maharani from 2015-2018.

Measure	<12	13-59	>60	*F* ratio	*p*	η2
	M ± SD	M ± SD	M ± SD			
Age Groups	$53.38_a \pm 31.55$	$104.88_c \pm 52.75$	$63.58_b \pm 37.88$	17448.19*	<.001	0.22

Note. Means with different superscript letters differ significantly according to Duncan's post-hoc test following a statistically significant one-way ANOVA.

Table 4. Analyses for the Age Groups of Outpatients Visits for ARI at Klinik Kesihatan Bandar Penawar from 2015-2018.

Measure	<12	13-59	>60	*F* ratio	*p*	Ƞ2
	M ± SD	M ± SD	M ± SD			
Age Groups	$4.18_b \pm 2.48$	$15.24_c \pm 8.90$	$3.18_a \pm 2.28$	3530.72*	<.001	0.32

Note. Means with different superscript letters differ significantly according to Duncan's post-hoc test following a statistically significant one-way ANOVA.

At Klinik Kesihatan Bukit Rambai, a one-way ANOVA in Table 2 showed that there was a statistically significant difference in outpatient visits among the three age groups, F (2, 18314) =720.57, p<0.001. According to Duncan's post-hoc test for multiple comparisons, significant differences were observed among the three age groups. The 13–59-year age group recorded the highest mean outpatient visits (M=12.51, SD=5.86), followed by the <12-year age group (M=10.08, SD=5.15) and the >60-year age group (M=6.82, SD=11.39). Therefore, the 13–59-year age group recorded significantly higher outpatient visits for ARI compared with the <12-year and >60-year age groups at this sentinel clinic.

At Klinik Kesihatan Bandar Maharani, a one-way ANOVA in Table 3 revealed that there was a statistically significant difference in outpatient visits among the three age groups, F (2, 126671) =17448.19, p<0.001. According to Duncan's post-hoc test for multiple comparisons, significant differences were observed among the three age groups. The 13–59-year age group recorded the highest mean outpatient visits (M=104.88, SD=52.75), followed by the >60-year age group (M=63.58, SD=37.88) and the <12-year age group (M=53.38, SD=31.55). Therefore, the 13–59-year age group recorded significantly higher outpatient visits for ARI compared with the <12-year and >60-year age groups at this sentinel clinic.

At Klinik Kesihatan Bandar Penawar, a one-way ANOVA in Table 4 revealed that there was a statistically significant difference in outpatient visits among the three age groups, F (2, 14861) =3530.72, p<0.001. According to Duncan's post-hoc test for multiple comparisons, significant differences were observed among the three age groups. The 13–59-year age group recorded the highest mean outpatient visits (M=15.24, SD=8.90), followed by the <12-year age group (M=4.18, SD=2.48) and the >60-year age group (M=3.18, SD=2.28). Therefore, the 13–59-year age group recorded significantly higher outpatient visits for ARI compared with the <12-year and >60-year age groups at this sentinel clinic.

Overall, a one-way ANOVA was performed to compare outpatient visits for ARI among the three age groups at Klinik Kesihatan Bukit Rambai, Klinik Kesihatan Bandar Maharani, and Klinik Kesihatan Bandar Penawar. Across all three clinics, outpatient visits for ARI varied significantly by age group. The 13–59-year age group consistently recorded the highest mean outpatient visits compared with the <12-year and >60-year age groups. Duncan's post-hoc multiple comparison test further demonstrated significant differences among the age groups at each sentinel clinic.

Age and symptoms have been shown to influence healthcare-seeking behaviour (Gabrani et al., 2021; Zhang et al., 2020; Lee et al., 2018). Zhang et al. (2020) observed that older adults aged >55 years with symptoms including fever, sore throat, and headache had a higher consultation rate compared with other age groups. This finding differs from the pattern observed in the present study, where the 13–59-year age group recorded the highest outpatient visits. ILI (influenza-like illness) and ARI (acute respiratory disease) had 30-day incidence rates of 0.8% and 7.2%, respectively, while 91% and 64% of those affected sought medical attention. Likewise, individuals aged over 65 years had a higher likelihood of seeking treatment according to a national study of people with incident severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections (Kojima et al., 2022).

A study by Barua et al. (2017) indicated that 56.1% of the elderly had a positive attitude towards seeking medical care, while others were driven to self-medicate due to financial constraints. Similarly, a study conducted in Tamil Nadu reported a relationship between mothers' awareness of the danger signs of ARI in children and treatment-

seeking behaviour despite the presence of high-risk districts (p=0.254; p=0.008) (Challa et al., 2016). These findings indicate that healthcare-seeking behaviour may vary according to age, awareness, and individual circumstances.

In contrast, a study conducted in China by Zhong et al. (2021) indicated that self-medication was the primary form of home treatment, with 36.28% using self-medication alone and 27.92% combining self-medication with physical cooling measures, while 36.5% accepted advice from medical specialists. In Nigeria, care-seeking for fever among children under five was relatively low. Among 3,632 (12.6%) children under five who had experienced fever during the previous two weeks, 1,142 (31.4%) had been treated at an appropriate health facility (Baba and Zainab, 2017).

Logistic regression analyses were used to evaluate data from 1,408 children under five who had experienced ARI symptoms in Indonesia during the two weeks preceding the surveys conducted between 2012 and 2017. Approximately 25% of these children did not obtain medical treatment (Titaley et al., 2020). These findings further demonstrate that healthcare-seeking behaviour for respiratory symptoms may vary considerably among different population groups.

Other studies reported that the proportion of individuals using a hospital to initiate care was 40% among those aged 18–59 years compared with 28% among those aged >60 years (p<0.01) (Gabrani et al., 2021). This finding is consistent with the pattern observed in the present study, where the 13–59-year age group recorded higher outpatient visits than the >60-year age group across the three study areas. This suggests that differences in healthcare-seeking behaviour between age groups may partly contribute to the observed differences in outpatient attendance.

From February 8, 2012, to March 1, 2012, 2,520 households in the districts of East Jakarta and Bogor participated in a survey. Nearly half (47%) of the households reported managing severe respiratory diseases at home, with 24% receiving home care only and 23% purchasing medication from a pharmacy or shop. A similar proportion (47%) sought treatment at a health facility, including 37% at a health clinic, 10% at a hospital, and 6% elsewhere, including traditional healers. There were no differences in care-seeking behaviour according to educational level, either overall or by district (Praptiningsih et al., 2016).

These findings suggest that different age groups may have different healthcare-seeking preferences. Paternal education, religion, geographical location of residence, age, and female empowerment significantly influenced healthcare-seeking behaviour (Baba and Zainab, 2017). Decisions to manage a severe illness at home, with or without medication obtained from a pharmacy, or to seek treatment at a government or private clinic may also influence whether an individual attends a hospital or other healthcare facility (Praptiningsih et al., 2016). Therefore, the higher outpatient visits observed among the 13–59-year age group in the present study may partly reflect differences in healthcare-seeking behaviour between age groups. However, healthcare-seeking behaviour was not directly measured in the present study and should therefore be considered as a possible explanation rather than a confirmed determinant of the observed outpatient visit pattern.

CONCLUSION

Outpatient visits for ARIs at the three clinics differed significantly by age group. Across the three study areas, the 13–59-year age group consistently recorded the highest outpatient visits compared with the <12-year and >60-year age groups. These findings indicate that outpatient attendance for ARIs varied according to age group during the study period.

Differences in healthcare-seeking behaviour may partly explain the variation in outpatient visits between age groups, although healthcare-seeking behaviour was not directly measured in this study. Therefore, the findings should be interpreted cautiously and should not be used to infer individual-level risk solely from group-level patterns.

Overall, the findings demonstrate that the 13–59-year age group accounted for the highest outpatient attendance for ARIs across the three study areas.

ACKNOWLEDGEMENT

The author would like to express their sincere appreciation to the Melaka State Health Department and Johor State Health Department for their support and for providing access to the outpatient visit data used in this study. The author also gratefully acknowledges all individuals who contributed directly or indirectly to the completion of this research.

REFERENCES

1. Aamir, F. B., Zaidi, S. M. A., Abbas, S., Aamir, S. R., Zaidi, S. N. A., Lal, K. K., & Fatima, S. S. (2022). Non-compliance to social distancing during COVID-19 pandemic: A comparative cross-sectional study between the developed and developing countries. Journal of Public Health Research, 11(1), 188–195. https://doi.org/10.4081/jphr.2021.2614
2. Abdulkadir, M. B., & Abdulkadir, Z. A. (2017). A cross-sectional survey of parental care-seeking behavior for febrile illness among under-five children in Nigeria. Alexandria Journal of Medicine, 53(1), 85–91. https://doi.org/10.1016/j.ajme.2016.02.005
3. Achilleos, S., Al-Ozairi, E., Alahmad, B., Garshick, E., Neophytou, A. M., Bouhamra, W., Yassin, M. F., & Koutrakis, P. (2019). Acute effects of air pollution on mortality: A 17-year analysis in Kuwait. Environment International, 126, 476–483. https://doi.org/10.1016/j.envint.2019.01.072
4. Aretz, B., Janssen, F., Vonk, J. M., Heneka, M. T., Boezen, H. M., & Doblhammer, G. (2021). Long-term exposure to fine particulate matter, lung function and cognitive performance: A prospective Dutch cohort study on the underlying routes. Environmental Research, 201, 111533. https://doi.org/10.1016/j.envres.2021.111533
5. Barua, K., Borah, M., Deka, C., & Kakati, R. (2017). Morbidity pattern and health-seeking behavior of elderly in urban slums: A cross-sectional study in Assam, India. Journal of Family Medicine and Primary Care, 6(2), 345–350. https://doi.org/10.4103/2249-4863.220030
6. Challa, S., Chowdavarapu, R. R., Pattnaik, S., & Mathai, D. (2016). Mapping the awareness levels of mothers about the danger signs of acute respiratory infections in children of the Southern States of India, its relation with treatment seeking behaviour. International Journal of Infectious Diseases, 45, 294–295. https://doi.org/10.1016/j.ijid.2016.02.649
7. Department of Environment Malaysia. (2020). Environmental Quality Report 2020. Portal Rasmi Jabatan Alam Sekitar, 36–105. https://www.doe.gov.my/portalv1/wp-content/uploads/formidable/5/Kualiti-Air-Sungai.pdf
8. Gabrani, J., Schindler, C., & Wyss, K. (2021). Health seeking behavior among adults and elderly with chronic health condition(s) in Albania. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.616014
9. Guo, H., Wang, M., Wei, H., Gong, X., & Yang, H. (2021). Air pollution and outpatient visits for cardiovascular and cerebrovascular diseases: A time-series analysis in Luoyang, China. Meteorological Applications, 28(6), 1–13. https://doi.org/10.1002/met.2036
10. He, M., Zhong, Y., Chen, Y., Zhong, N., & Lai, K. (2022). Association of short-term exposure to air pollution with emergency visits for respiratory diseases in children. iScience, 25(9), 104879. https://doi.org/10.1016/j.isci.2022.104879
11. Ibrahim, M. F., Hod, R., Ahmad Tajudin, M. A. B., Wan Mahiyuddin, W. R., Mohammed Nawi, A., & Sahani, M. (2022). Children's exposure to air pollution in a natural gas industrial area and their risk of hospital admission for respiratory diseases. Environmental Research, 210, 112966. https://doi.org/10.1016/j.envres.2022.112966
12. Ju, K., Lu, L., Chen, T., Duan, Z., Chen, D., Liao, W., Zhou, Q., Xu, Z., & Wang, W. (2022). Does long-term exposure to air pollution impair physical and mental health in the middle-aged and older adults?—A causal empirical analysis based on a longitudinal nationwide cohort in China. Science of the Total Environment, 827, 154312. https://doi.org/10.1016/j.scitotenv.2022.154312
13. Kojima, N., Brobeck, M., Slepnev, V., & Klausner, J. D. (2022). A national survey of early treatment seeking behavior among those with incident SARS-CoV-2 infection. Respiratory Medicine and Research, 82, 100934. https://doi.org/10.1016/j.resmer.2022.100934

14. Lee, J. T. (2021). Review of epidemiological studies on air pollution and health effects in children. Clinical and Experimental Pediatrics, 64(1), 3–11. https://doi.org/10.3345/cep.2019.00843
15. Lee, J. Y., & Kim, H. (2018). Ambient air pollution-induced health risk for children worldwide. The Lancet Planetary Health, 2(7), e285–e286. https://doi.org/10.1016/S2542-5196(18)30149-9
16. Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: A review. Frontiers in Public Health, 8, 14. https://doi.org/10.3389/fpubh.2020.00014
17. Mohd Shafie, S. H., Mahmud, M., Mohamad, S., Rameli, N. L. F., Abdullah, R., & Mohamed, A. F. (2022). Influence of urban air pollution on the population in the Klang Valley, Malaysia: A spatial approach. Ecological Processes, 11(1). https://doi.org/10.1186/s13717-021-00342-0
18. Mork, D., Braun, D., & Zanobetti, A. (2023). Time-lagged relationships between a decade of air pollution exposure and first hospitalization with Alzheimer's disease and related dementias. Environment International, 171, 107694. https://doi.org/10.1016/j.envint.2022.107694
19. Praptiningsih, C. Y., Lafond, K. E., Wahyuningrum, Y., Storms, A. D., Mangiri, A., Iuliano, A. D., Samaan, G., Titaley, C. R., Yelda, F., Kreslake, J., Storey, D., & Uyeki, T. M. (2016). Healthcare-seeking behaviors for acute respiratory illness in two communities of Java, Indonesia: A cross-sectional survey. Journal of Epidemiology and Global Health, 6(2), 77–86. https://doi.org/10.1016/j.jegh.2016.01.002
20. Ratajczak, A., Badyda, A., Czechowski, P. O., Czarnecki, A., Dubrawski, M., & Feleszko, W. (2021). Air pollution increases the incidence of upper respiratory tract symptoms among Polish children. Journal of Clinical Medicine, 10(10), 2150. https://doi.org/10.3390/jcm10102150
21. Schultz, E. S., Litonjua, A. A., & Melén, E. (2017). Effects of long-term exposure to traffic-related air pollution on lung function in children. Current Allergy and Asthma Reports, 17, 41. https://doi.org/10.1007/s11882-017-0709-y
22. Song, J., Lu, M., Zheng, L., Liu, Y., Xu, P., Li, Y., Xu, D., & Wu, W. (2018). Acute effects of ambient air pollution on outpatient children with respiratory diseases in Shijiazhuang, China. BMC Pulmonary Medicine, 18(1), 1–10. https://doi.org/10.1186/s12890-018-0716-3
23. Titaley, C. R., Que, B. J., de Lima, F. V. I., Angkejaya, O. W., de Lima, F. V. I., Maelissa, M. M., Latuconsina, V. Z., Taihuttu, Y. M. J., van Afflen, Z., Radjabaycolle, J. E. T., Mutyara, K., Agustian, D., & Atik, N. (2020). Health care–seeking behavior of children with acute respiratory infections symptoms: Analysis of the 2012 and 2017 Indonesia Demographic and Health Surveys. Asia Pacific Journal of Public Health, 32(6–7), 310–319. https://doi.org/10.1177/1010539520944716
24. Trevenen, M. L., Heyworth, J., Almeida, O. P., Yeap, B. B., Hankey, G. J., Golledge, J., Etherton-Beer, C., Robinson, S., Nieuwenhuijsen, M. J., & Flicker, L. (2022). Ambient air pollution and risk of incident dementia in older men living in a region with relatively low concentrations of pollutants: The Health in Men Study. Environmental Research, 215, 114349. https://doi.org/10.1016/j.envres.2022.114349
25. Xu, R., Li, Z., Zhu, X., Guo, C., Su, Q., Peng, J., Wang, Z., Qian, Y., Li, X., Xu, Q., & Wei, Y. (2022). Acute effects of exposure to fine particulate matter and ozone on lung function, inflammation and oxidative stress in healthy adults. Ecotoxicology and Environmental Safety, 243, 114013. https://doi.org/10.1016/j.ecoenv.2022.114013
26. Zhang, Q., Feng, S., Wong, I. O. L., Ip, D. K. M., Cowling, B. J., & Lau, E. H. Y. (2020). A population-based study on healthcare-seeking behaviour of persons with symptoms of respiratory and gastrointestinal-related infections in Hong Kong. BMC Public Health, 20, 402. https://doi.org/10.1186/s12889-020-08555-2
27. Zhong, D., Zhang, N., Qin, X. Q., Tan, Y., Yang, Y., Tu, J., & Zhang, L. (2021). A cross-sectional survey of family care behaviors for children with upper respiratory tract infections in China: Are there opportunities for improvement? Journal of Pediatric Nursing, 60, 146–153. https://doi.org/10.1016/j.pedn.2021.04.033