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The Editor-in-Chief: Pakistan Paediatric Journal

Dear Sir,

Attached, please find our second revised-manuscript entitled: “***Risk Factors of ARI among Under Five Children in Mountainous Area, Indonesia***” which we would like to submit to the scientific journal that you run as an original article.

We do believe that the manuscript would fill the data unavailability and also very much relevant to your reader.

I am looking forward to hearing your favorable reply

Sincerely yours,

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On behalf of the authors

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Title page

Original article

Risk Factors of ARI among Under Five Children in Mountainous Area, Indonesia

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Authors have no conflict of interest

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Risk factors of ARI among under 5 children in a mountainous area

Abstract

Introduction: Acute respiratory infection (ARI) is a common communicable infection among under-5 children. The disease occurrence is different based on geographic and altitude of the areas. This study aims to assess the occurrence and its associated factors of ARI among under-5 children in the mountainous region of Temanggung district, Central Java, Indonesia.

Methods: This cross-section study was conducted in Kentengsari village, Candiroto sub-district, Temanggung district, Central Java Province, Indonesia involved 49 under-five children who were selected randomly from each sub-village. Questionnaire based interviews on individual characteristics, behavioral factors, and ARI occurrence, and observations of the physical environment of houses were carried out in data collection. Data were analyzed descriptively and analytically by using the SPSS 16.0 version.

Results: As many as 51% of under-five children were female and 71.4% were toddlers. The physical condition of houses showed dusty-floors (36.7%), non-waterproof walls (53.1%), and poor kitchen ventilation (40.8%). The behavioral factors indicated the use wood fuel (53.1%) and often hold their child while cooking (44.9%). ARI occurred among 69.4% of under-five children, and it was significantly associated with the condition of house wall ($p=0.032$), house floors ($p=0.001$), kitchen ventilation ($p=0.022$), and the use of wood fuel ($p=0.008$) and held child while cooking ($p=0.001$), respectively.

Conclusion: This study finds 69.4% of prevalence of ARI among under 5 children. It was associated with physical of house and behavioral factors.

(Keywords. Acute respiratory infection; under-five children; mountainous area; indoor aerosol)

Introduction

ARI is a frequent infectious disease among under 5 children which is currently a global public health problem^{1,2}. The global prevalence of ARI is estimated to be 13%¹ with a mortality rate of 9.8%. Geographically, ARI occurrence varied among African³⁻⁵, Asian⁶⁻⁸, and American⁹ countries. National data on the incidence of ARI in Indonesia is estimated at 20.6%, but a number of studies in Java¹⁰, Sumatera¹¹, and Papua¹² showed a variation in the occurrence of the disease.

Mostly, studies on ARI reveal the incidence of this disease based on urban and rural areas, as well as sanitation aspects. Several risk factors of ARI were identified including under-nutrition^{7,13-15}, low birth weight¹³, wood and biomass fuels⁷, holding children while cooking^{3,16}, poor ventilation and passive smoking^{13,16}, household poverty^{16,17}, wood and mosquito coil smoke, ARI history in the family^{14,18}, household density and public transport use¹⁸, cow dung use and mother literacy¹⁵. In Indonesia, the risk factors of ARI were parental education and knowledge, family income, occupancy density, the presence of smokers in the family¹⁰, floor type and use of mosquito coils, room lighting and ventilation¹⁰, infant birth weight and exclusive breastfeeding¹¹.

There are no specific studies on the occurrence of ARI among under 5 children and risk factors in mountainous areas in Indonesia, and similar studies in other countries are also limited. Studies in Nepal and Columbia reported that ARI was found in the mountains¹⁹, with lower morbidity rather than in the low elevations^{9,20}. Factors associated with the ARI occurrence in these regions were the use of firewood²⁰, family history of ARI, race, economic status, malnutrition, and high humidity⁹. Mountainous areas are found in Indonesia, including parts of the Temanggung district. Data for 2020 showed the 20,291 cases of ARI in the district, but there is no specific analysis of the risk factors for ARI in this mountainous area. This study aims to assess the association of physical and behavioral factors and the ARI occurrence among under-five children in the mountainous region of Temanggung district, Central Java, Indonesia.

Methods

The cross-sectional study was conducted in Kentengsari village, Candiroto subdistrict, Temanggung district, Central Java Province, Indonesia where the ARI occurrence was highest among 14 villages in the subdistrict. The altitude average of the village is 1,061 m above sea level and at the geographical coordinates of 7.2300°S and 110.0301°E with air temperature ranges of 18 – 29 °C to sign the informed consent voluntarily. The sample size was determined by the Cochran's formula²¹ to estimate the proportion (occurrence) of disease: $n = Z_{1-\alpha}^2 pq/e^2$; where $Z_{1-\alpha}$ is statistic for a 95% of level confidence = 1.96; p is an expected prevalence = 0.9685; q = 1-p = 0.0315; and e is the level of precision = 0.05. The population density of the village was 775 people/km², including the low category. There were 153 under 5 children in this village accessed the Integrated Health Services (IHS) in the period 1-31 December 2018. As many as 49 under 5 children were randomly selected and the parents asked.

Data was collected using questionnaire and field observation. The questionnaire consists of individual characteristics, behavioral factors (smoker in family, opening house ventilation, using wood fuel), and the existence of child/children with ARI in the last three months. Field observation covers physical factors (house ventilation, kitchen ventilation, lighting intensity, temperature, and humidity) based on the requirements of house sanitation²². House and kitchen ventilation were categorized into poor (<10% of floor area) and proper ($\geq 10\%$ of floor area) and the existence of chimney above the kitchen. Air temperature and humidity were measured 24 hours by a hygrometer (HAAR-SYNT HYGRO), and recorded the lowest and highest values. Air temperature was categorized into unhealthy (<22 or >30 °C) and healthy (22–30°C), while the humidity was categorized into unhealthy (<40 or >60 %) and healthy (40-60 %). Indoor (room) lighting was measured by lux meter (DX-100 Digital Lux meter, Takemura Electric Works Ltd), and the results. were categorized into unhealthy (<60 lux) and healthy (≥ 60 lux) groups. Opening house ventilation was measured by the frequency of opening doors, windows and other ventilation a week for air change' and the results was categorized into rarely (0-3 days/week) and often (4-7 days/week). Smoker(s) in family is categorized as father or other family member(s). Interviews were conducted with parents followed by inspection of house for physical factors.

Statistical analysis was done using SPSS 16.0 version. The descriptive and analytic analysis results were presented in figures and tables. Strength of the risk factors association was determined by the value of the prevalence ratio (PR) and reinforced by the 95% confidence interval. The protocol of this study was reviewed and obtained ethical approval from the Ethics Committee of Health Research of Public Health Faculty, Universitas Muhammadiyah Semarang number 220/KEPK-FKM/Unimus/2018.

Results

In total, male participants were more than female, and the majority were under 36 months. In the last three months, as many as 69.4% of under-five children having ARI onsets with an average of 1.44 times, equivalent to 5.76 episodes/child/year (Table 1 and Table 3). Smoking behavior was found in all families with an intensity of 8-9 cigarettes per day. The majority of smokers are fathers (Table 3).

Table 1. Descriptive statistics of individual characteristics, ARI occurrence, and physical factors of house in mountainous area

Nu.	Variables	Minimum	Maximum	Mean	Std deviation
1.	Under-five children age (month)	1	56	28.20	15.65
2.	Ventilation area (% of floor area)	2.4	20.8	9.15	4.91
3.	Daily cigarettes smoked	2	16	8.63	4.05
4.	Frequency of ARI	0	2	1.00	0.79
5.	Indoor Air temperature (°C)	21	23	22.29	0.54
6.	Indoor Air humidity (%)	60	85	73.94	4.01
7.	Light intensity in room (lux)	30	130	72.55	24.51

The majority of houses have a poor ventilation and unhealthy humidity, although most of them have healthy lighting and air temperature range. The physical condition of the houses showed that more than 50% have non-waterproof walls, 36.6% have dusty soil and cement plaster floors, about 40% have unhealthy kitchen ventilation and only about 55% of houses with good lighting. Almost 96% of the houses have a good temperature, but only 4.1% of houses have healthy humidity ranges (Table 1 and Table 2).

In the context of healthy behavior, almost one third of the families rarely open the house ventilation, more than 53% use wood fuel, almost 45% of households often carry children when cooking (**Table 3**). **Table 4** showed the risk factors that were significantly associated with the incidence of ARI, namely the type of house wall ($p=0.032$, $PR=5.042$ and $95\%CI=1.316-19.317$), floor conditions ($p=0.001$, $PR=1.938$ and $95\%CI=1.378-2.724$), kitchen ventilation ($p=0.022$, $PR=7.312$ and $95\%CI=1.427-37.469$), use of wood fuel ($p=0.008$, $PR=9.266$ and $95\%CI=1.805-47.769$), and the habit of holding children while cooking ($p=0.001$, $PR=22.615$ and $95\%CI=2.652-192.878$).

Table 2. Physical factors of houses in settlements in mountainous area.

No.	Variables	n	%
1	Type of house wall		
	Non-water proof	26	53.1
	Water proof	23	46.9
2	Condition of house floor		
	Dusty	18	36.7
	Clean	31	63.3
3	Kitchen ventilation		
	poor	20	40.8
	Proper	29	59.2
4	Light intensity (lux)		
	< 60	22	44.9
	≥ 60	27	55.1
5	Air temperature (°C)		
	<20 or >30	2	4.1
	22 – 30	47	95.9
6	Humidity (%)		
	<40 or >70	47	95.9
	40 – 70	2	4.1

Table 3. Characteristics of person and health behavior among family members in mountainous area

No.	Variables	n	%
1	Sex		
	Male	25	51.0
	Female	24	49.0
2	Age group (years)		
	1 – 3	35	71.4
	4 – 5	14	28.6
3	Occurrence of ARI		
	Yes	34	69.4
	No	13	30.6
4	Opening ventilations of house		
	Rare	16	32.7
	Always (daily)	33	67.3
5	The use of wood fuel		
	Yes	26	53.1
	No	23	46.9
6	Holding the child when cooking		
	Often	22	44.9
	Rare	27	55.1
7	The smoker(s) in family		
	Father	40	81.6
	Other family member	9	18.4
8	Number of cigarettes was smoked in one day		

7 or more	36	73.5
0 – 6	12	26.5

Table 4. Bivariate analysis of risk factors of ARI among under 5 children in mountainous area

No.	Risk factors	Occurrence of ARI				p	PR	95% CI
		Yes		No				
		n	%	n	%			
1	Sex of under-5-children							
	Male	16	64.0	9	36.0	0.599	0.593	0.173 – 2.034
	Female	18	75.0	6	25.0			
2	Age group (years)							
	1 – 3	25	71.4	10	28.6	0.735	1.389	0.372 – 5.181
	4 – 5	9	64.3	5	35.7			
3	Type of house wall							
	Not water proof	22	84.6	4	15.4	0.032*	5.042	1.316 – 19.317
	Water proof	12	52.2	11	47.8			
4	Condition of house floor (type)							
	Dusty (soil and cement)	18	100	0	0.0	0.001*	1.938	1.378 – 2.724
	Clean (tile)	16	51.6	15	48.4			
5	Kitchen ventilation							
	Poor	18	90.0	2	10.0	0.022*	7.312	1.427 – 37.47
	Proper	16	55.2	13	44.8			
6	Light intensity (lux)							
	< 60	18	81.8	4	18.2	0.164	3.094	0.820 – 11.672
	≥ 60	16	59.3	11	40.7			
7	Air temperature (in Celsius degree)							
	<20 or >30	2	100	0	0.0	1.000	1.469	1.208 – 1.786
	22 – 30	32	68.1	15	31.9			
8	Humidity (%)							
	<40 or >70	33	70.2	14	29.8	0.523	2.357	0.138 – 40.402
	40 – 70	1	50.0	1	50.0			
9	Opening house ventilation(s)							
	Rarely	14	87.5	2	12.5	0.097	4.550	0.884 – 23.407
	Always (daily)	20	60.6	13	39.4			
10	The use of wood fuel							
	Yes	20	90.9	2	9.1	0.008*	9.266	1.805 – 47.769
	No	14	51.9	13	48.1			
11	Hold child when cooking							
	Often	21	95.5	1	4.5	0.001*	22.615	2.652 – 192.88
	Rarely	13	48.1	14	51.9			
12	The smoker(s) in family							
	Father	29	72.5	11	27.5	0.427	2.109	0.477 – 9.328
	Other family member	5	55.6	4	44.4			
13	Number of cigarettes consumed a day							
	7 or more	26	72.2	10	27.8	0.500	1.625	0.428 – 6.171
	0 – 6	8	61.5	5	38.5			

PR = prevalence ratio

* = significantly associated (p<0.05)

Discussion

This study reports for the first time an analysis of risk factors for the incidence of ARI in mountainous areas in Indonesia. Literature search found only four studies that explicitly analyzed the occurrence and risk factors for ARI at high altitudes^{9,21,22,24}. This study provides an additional information of ARI problem at the specific area so that appropriate problem-solving efforts can be made. In general, ARI in study site showed a prevalence rate of 69.4%, equivalent to 5.76 episodes/child/year. It was different

with the other studies that found 3.27 and 8-9 episodes of ARI/child/year^{23,24}. This prevalence was also lower than the District Health Office report, similar to the study reports in Nepal and the Republic of Columbia where the prevalence of ARI decreases with increasing the altitude of the area, although the range of ARI prevalence in both countries is lower^{9,22}. The result was also lower than the occurrence of ARI at mountainous areas of Vietnam²⁵. Even though Temanggung is a mountainous area, the highest altitude is only 1061 m asl so that the condition of environmental physical factors is still within the range of health requirements, and is also exposed to sunlight 12 hours per day. This condition can inhibit the growth of pathogens, including the cause of ARI.

The occurrence of ARI in children has been reported world-widely¹. Studies on ARI analyzes the disease occurrence based on geographic conditions and focuses on aspects of the home environment, population behavior, and health history of under-five children. This study found five associated factors that were significant with the prevalence of ARI in mountainous area, namely condition of walls and floors, kitchen ventilation, the use of wood fuel, and holding children while cooking. The wood-fuel-use factor is in line with the finding in Columbia⁹, whereas the other factors such as smoking behavior, room lighting and ventilation, under-nutrition, low birth weight, history of ARI, and low education and health literacy are found at low elevation areas^{10,15-17}.

This finding indicated that less than 50% of houses were made of permanent walls and waterproof. The walls of most houses were made of bamboo or wood, so they become damp during the rainy season because of the high humidity. This condition supports the growth of bacteria and viruses in indoor air so that it provides a higher opportunity for infection, including ARI. More than 36% of houses use soil and cement plaster floor which they were dusty and hard to be cleaned. Moist wall and dusty floor allowed pathogens to survive longer and give a greater risk of infection. ARI is caused by several types of viruses and bacteria²⁵ where the humidity influences on their growth. Poor quality of kitchen ventilation limits the air circulation and trigger an indoor air pollution²⁷. Kitchen smoke is trapped in the kitchen room, and increased the burden of chemical exposure. This condition stimulates irritation of the respiratory tract mucosa and facilitates infection²⁸. The solid fuel use and organic material combustion will produce smoke which causes indoor air pollution²⁹, inspirable particulate materials (PM_{2.5}) and several chemical compounds such as carbon monoxide, nitrogen oxides, formaldehyde, benzene, 1,3-butadiene, polycyclic aromatic hydrocarbons (PAHs), and other harmful gases²⁸. Wood smoke aerosol causes a high level of PM_{2.5} and CO gas exposure, and stimulates health effects such as ARI and lung function³⁰. The habit of holding children while cooking allows simultaneously exposure to these pathogens and harmful material and chemical compounds. Although mountainous areas have a relative healthy natural environment, but poor kitchen ventilation, physical of house and behavior cause a serious indoor air pollution. The low air quality (due to pathogens, PM_{2.5}, and chemical compounds) was trapped in the kitchen room and exposed children for a long time and repeatedly. This condition is indicated by the fact that 90.9% of under 5 children with ARI come from families using wood fuel, and 95.5% of them were held during the cooking activity.

Conclusion.

This study finds the significant association of ARI with the poor quality of wall and floor, kitchen ventilation, the use of wood fuel and holding a child while cooking simultaneously. Further study is necessary conducted to understand the occurrence and risk factors of severe ARI or pneumonia among under 5 children.

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Submission Letter & Editor Acknowledgement



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Manuscript Submission

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Dear Editor-in-Chief
Pakistan Paediatric Journal

Attached is a manuscript entitled: **Prevalence and Risk Factors of ARI among Under Five Children in Mountainous Area, Indonesia**, to the **Pakistan Pediatric Journal** as an Original Article. I am looking forward to hearing your favorable reply.

Best regard,
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Thanks for your interest in the Pakistan Pediatric Journal. Now Pakistan Pediatric Journal launched a website (www.ppj.org.pk). Please send your article along with requisite documents such as undertaking, IRB and conflict of interest proformas.

With regards

NAZIR AHMAD
C/O PROF HUMAYUN IQBAL KHAN

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>

26 Juni 2022 pukul 22.06

Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

How is the progress of our article entitled PREVALENCE AND RISK FACTORS OF ARI AMONG UNDER FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA?

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

16 Agustus 2022 pukul 17.25

Respected Sir

Journal office has not yet received the revised article. Please do as soon as possible.

Note: Sent by logon

With regards

NAZIR AHMAD
C/O PROF HUMAYUN IQBAL KHAN

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>
Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

17 Agustus 2022 pukul 12.22

Attached is our revised version of the article entitled "**RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA**"

". We have made a revision according to the reviewer's suggestion on the title and limits of acute respiratory infection.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

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60K

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

17 Agustus 2022 pukul 17.22

Received with thanks.

NAZIR AHMAD
C/O PROF HUMAYUN IQBAL KHAN

[Kutipan teks disembunyikan]

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

6 Oktober 2022 pukul 15.12

Respected Sir/Madam

Journal office sent your article dated 6-9-2022 by login. We have not received any reply by your side. Please reply as soon as possible.

With regards

NAZIR AHMAD
MANAGER, PPJ

[Kutipan teks disembunyikan]

Revised-version manuscript

Sayono Sayono <say.epid@gmail.com>

6 Oktober 2022 pukul 18.24

Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

We have revised the manuscript based on the reviewer's comments (yellow highlighted). The revised version is attached herewith.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]



27-08-2022+ARI-Pak-Pediatr-J-rev-061022.docx

61K

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

8 Oktober 2022 pukul 13.24

Kepada: Sayono Sayono <say.epid@gmail.com>

Thanks, I have received it.

NAZIR AHMAD
C/O PROF HUMAYUN IQBAL KHAN

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>

26 Oktober 2022 pukul 15.14

Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

Dear Mr Nazir Ahmad,

Please allow us to know the progress of our manuscript entitled "**RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA**". Was the last revision sufficient?

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

31 Oktober 2022 pukul 16.14

Kepada: Sayono Sayono <say.epid@gmail.com>

Respected Sir/Madam

Your article is under process. Please wait

With regards

NAZIR AHMAD

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>

31 Oktober 2022 pukul 17.03

Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

Ok, Mr. Nazir Ahmad. Thank you very much for the information.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>
Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

28 November 2022 pukul 09.36

Dear Mr. Nazir Ahmad,

How is the progress of our article entitled "**RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA**"?

We hope there has been good news.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

31 Desember 2022 pukul 15.01

Respected Sir

PPJ office not yet received the article for final approval. Please check on login site and send back urgently.

With regards

NAZIR AHMAD

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>
Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

31 Desember 2022 pukul 17.13

Dear Mr. Nazir Ahmad,
I have difficulty in login PPJ. My username & password were not working. I have reset the new password, but still can not able to log in. Please help me.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>
Kepada: Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>

31 Desember 2022 pukul 17.36

We sent the final approval on December 28th, 2022 at 03.59 am (a screenshot of the approval is attached).

Resubmision of Revised-version

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

2 lampiran



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74K



PPJ final approval - screenshoot uploading.docx
58K

Pakistan Paediatric Journal Journal <pakpaedjournal@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

2 Januari 2023 pukul 13.57

Noted with thanks.

NAZIR AHMAD

[Kutipan teks disembunyikan]



Corresponding discussion

Sayono Sayono <say.epid@gmail.com>

[PPJ] New notification from Pakistan Pediatric Journal

2 pesan

Nadeem Ahmad <nadeemsh12304@gmail.com>
Balas Ke: "Prof. Dr. Sajid Maqbool" <maqbool84@gmail.com>
Kepada: Sayono Sayono <say.epid@gmail.com>

27 Agustus 2022 pukul 17.02

You have a new notification from Pakistan Pediatric Journal:

You have been added to a discussion titled "REVISED ARTICLE ACCORDING TO YOUR COMMENTS" regarding the submission "PREVALENCE AND RISK FACTORS OF ARI AMONG UNDER FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA".

Link: <http://ppj.org.pk/index.php/ppj/authorDashboard/submission/20>

Prof. Dr. Sajid Maqbool

[Pakistan Pediatric Journal](#)

Sayono Sayono <say.epid@gmail.com>
Kepada: "Prof. Dr. Sajid Maqbool" <maqbool84@gmail.com>

27 Agustus 2022 pukul 19.39

Dear Sir,
We have revised the manuscript according to the notes of the reviewer's comments. Attached are the revised and the old version of the manuscript

Sayono
Department of Epidemiology and Tropical Diseases
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Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

2 lampiran

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58K

 **Previous version 17-08-2022+ARI-Pak-Pediatr-J.docx**
59K



Editor Decision

Sayono Sayono <say.epid@gmail.com>

[PPJ] Editor Decision

1 pesan

Nadeem Ahmad <nadeemshl2304@gmail.com>

25 Juli 2022 pukul 19.14

Kepada: Faculty of Public Health of Universitas Muhammadiyah Semarang <mifbakhuddin@yahoo.com>, "General Hospital of PKU Muhammadiyah of Temanggung, Central Java Province, Indonesia" <nidhaaufa@gmail.com>, Ratih Sari Wardani <ratihsw@unimus.ac.id>, Sayono Sayono <say.epid@gmail.com>

Faculty of Public Health of Universitas Muhammadiyah Semarang, General Hospital of PKU Muhammadiyah of Temanggung, Central Java Province, Indonesia, Ratih Sari Wardani, Sayono Sayono:

We have reached a decision regarding your submission to Pakistan Pediatric Journal, "PREVALENCE AND RISK FACTORS OF ARI AMONG UNDER FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA".

Our decision is: Revisions Required

[Pakistan Pediatric Journal](#)

Editor Decision



Sayono Sayono <say.epid@gmail.com>

[PPJ] Editor Decision

4 pesan

Nadeem Ahmad <nadeemshl2304@gmail.com>

4 Agustus 2022 pukul 19.04

Kepada: Faculty of Public Health of Universitas Muhammadiyah Semarang <mifbakhuddin@yahoo.com>, "General Hospital of PKU Muhammadiyah of Temanggung, Central Java Province, Indonesia" <nidhaaafa@gmail.com>, Ratih Sari Wardani <ratihsw@unimus.ac.id>, Sayono Sayono <say.epid@gmail.com>

Faculty of Public Health of Universitas Muhammadiyah Semarang, General Hospital of PKU Muhammadiyah of Temanggung, Central Java Province, Indonesia, Ratih Sari Wardani, Sayono Sayono:

We have reached a decision regarding your submission to Pakistan Pediatric Journal, "PREVALENCE AND RISK FACTORS OF ARI AMONG UNDER FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA".

Our decision is: Revisions Required

[Pakistan Pediatric Journal](#)

Sayono Sayono <say.epid@gmail.com>

5 Agustus 2022 pukul 09.18

Kepada: Nadeem Ahmad <nadeemshl2304@gmail.com>

Thank you very much for the important information. We will finish the manuscript revision soon.

[Kutipan teks disembunyikan]

Sayono Sayono <say.epid@gmail.com>

17 Agustus 2022 pukul 12.25

Kepada: Nadeem Ahmad <nadeemshl2304@gmail.com>

Resubmission the revised-version

Attached is our revised version of the article entitled "**RISK FACTORS OF AIRWAY DISEASE AMONG UNDER-FIVE CHILDREN IN MOUNTAINOUS AREA, INDONESIA**". We have made a revision according to the reviewer's suggestion on the title and limits of acute respiratory infection.

Sayono
Department of Epidemiology and Tropical Diseases
School of Public Health of Universitas Muhammadiyah Semarang
Jalan Kedung Mundu Raya 18, Semarang, 50273
Indonesia

[Kutipan teks disembunyikan]

 **Pak-Pediatr-J.docx**
60K

Nadeem Ahmad <nadeemshl2304@gmail.com>

17 Agustus 2022 pukul 15.32

Kepada: Sayono Sayono <say.epid@gmail.com>

ok received thanks

[Kutipan teks disembunyikan]

Risk factors of ARI among under 5 children in a mountainous area

Abstract

Introduction: Acute respiratory infection (ARI) is a common communicable infection among under-5 children. The disease occurrence is different based on geographic and altitude of the areas. This study aims to assess the occurrence and its associated factors of ARI among under-5 children in the mountainous region of Temanggung district, Central Java, Indonesia.

Methods: This cross-section study was conducted in Kentengsari village, Candiroto sub-district, Temanggung district, Central Java Province, Indonesia involved 49 under-five children who were selected randomly from each sub-village. Questionnaire based interviews on individual characteristics, behavioral factors, and ARI occurrence, and observations of the physical environment of houses were carried out in data collection. Data were analyzed descriptively and analytically by using the SPSS 16.0 version.

Results: As many as 51% of under-five children were female and 71.4% were toddlers. The physical condition of houses showed dusty-floors (36.7%), non-waterproof walls (53.1%), and poor kitchen ventilation (40.8%). The behavioral factors indicated the use wood fuel (53.1%) and often hold their child while cooking (44.9%). ARI occurred among 69.4% of under-five children, and it was significantly associated with the condition of house wall ($p=0.032$), house floors ($p=0.001$), kitchen ventilation ($p=0.022$), and the use of wood fuel ($p=0.008$) and held child while cooking ($p=0.001$), respectively.

Conclusion: This study finds 69.4% of prevalence of ARI among under 5 children. It was associated with physical of house and behavioral factors.

(Keywords. Acute respiratory infection; under-five children; mountainous area; indoor aerosol)

Introduction

ARI is a frequent infectious disease among under 5 children which is currently a global public health problem^{1,2}. The global prevalence of ARI is estimated to be 13%¹ with a mortality rate of 9.8%. Geographically, ARI occurrence varied among African³⁻⁵, Asian⁶⁻⁸, and American⁹ countries. National data on the incidence of ARI in Indonesia is estimated at 20.6%, but a number of studies in Java¹⁰, Sumatera¹¹, and Papua¹² showed a variation in the occurrence of the disease.

Mostly, studies on ARI reveal the incidence of this disease based on urban and rural areas, as well as sanitation aspects. Several risk factors of ARI were identified including under-nutrition^{7,13-15}, low birth weight¹³, wood and biomass fuels⁷, holding children while cooking^{3,16}, poor ventilation and passive smoking^{13,16}, household poverty^{16,17}, wood and mosquito coil smoke, ARI history in the family^{14,18}, household density and public transport use¹⁸, cow dung use and mother literacy¹⁵. In Indonesia, the risk factors of ARI were parental education and knowledge, family income, occupancy density, the presence of smokers in the family¹⁰, floor type and use of mosquito coils, room lighting and ventilation¹⁰, infant birth weight and exclusive breastfeeding¹¹.

There are no specific studies on the occurrence of ARI among under 5 children and risk factors in mountainous areas in Indonesia, and similar studies in other countries are also limited. Studies in Nepal and Columbia reported that ARI was found in the mountains¹⁹, with lower morbidity rather than in the low elevations^{9,20}. Factors associated with the ARI occurrence in these regions were the use of firewood²⁰, family history of ARI, race, economic status, malnutrition, and high humidity⁹. Mountainous areas are found in Indonesia, including parts of the Temanggung district. Data for 2020 showed the 20,291 cases of ARI in the district, but there is no specific analysis of the risk factors for ARI in this mountainous area. This study aims to assess the association of physical and behavioral factors and the ARI occurrence among under-five children in the mountainous region of Temanggung district, Central Java, Indonesia.

Methods

The cross-sectional study was conducted in Kentengsari village, Candiroto subdistrict, Temanggung district, Central Java Province, Indonesia where the ARI occurrence was highest among 14 villages in the subdistrict. The altitude average of the village is 1,061 m above sea level and at the geographical coordinates of 7.2300°S and 110.0301°E with air temperature ranges of 18 – 29 °C to sign the informed consent voluntarily. The sample size was determined by the Cochran's formula²¹ to estimate the proportion (occurrence) of disease: $n = Z_{1-\alpha}^2 pq/e^2$; where $Z_{1-\alpha}$ is statistic for a 95% of level confidence = 1.96; p is an expected prevalence = 0.9685; q = 1-p = 0.0315; and e is the level of precision = 0.05. The population density of the village was 775 people/km², including the low category. There were 153 under 5 children in this village accessed the Integrated Health Services (IHS) in the period 1-31 December 2018. As many as 49 under 5 children were randomly selected and the parents asked. Data was collected using questionnaire and field observation. The questionnaire consists of individual characteristics, behavioral factors (smoker in family, opening house ventilation, using wood fuel), and the existence of child/children with ARI in the last three months. Field observation covers physical factors (house ventilation, kitchen ventilation, lighting intensity, temperature, and humidity) based on the requirements of house sanitation²². House and kitchen ventilation were categorized into poor (<10% of floor area) and proper ($\geq 10\%$ of floor area) and the existence of chimney above the kitchen. Air temperature and humidity were measured 24 hours by a hygrometer (HAAR-SYNT HYGRO), and recorded the lowest and highest values. Air temperature was categorized into unhealthy (<22 or >30 °C) and healthy (22–30°C), while the humidity was categorized into unhealthy (<40 or >60 %) and healthy (40-60 %). Indoor (room) lighting was measured by lux meter (DX-100 Digital Lux meter, Takemura Electric Works Ltd), and the results. were categorized into unhealthy (<60 lux) and healthy (≥ 60 lux) groups. Opening house ventilation was measured by the frequency of opening doors, windows and other ventilation a week for air change' and the results was categorized into rarely (0-3 days/week) and often (4-7 days/week). Smoker(s) in family is categorized as father or other family member(s). Interviews were conducted with parents followed by inspection of house for physical factors. Statistical analysis was done using SPSS 16.0 version. The descriptive and analytic analysis results were presented in figures and tables. Strength of the risk factors association was determined by the value of the prevalence ratio (PR) and reinforced by the 95% confidence interval. The protocol of this study was reviewed and obtained ethical approval from the Ethics Committee of Health Research of Public Health Faculty, Universitas Muhammadiyah Semarang number 220/KEPK-FKM/Unimus/2018.

Results

In total, male participants were more than female, and the majority were under 36 months. In the last three months, as many as 69.4% of under-five children having ARI onsets with an average of 1.44 times, equivalent to 5.76 episodes/child/year (Table 1 and Table 3). Smoking behavior was found in all families with an intensity of 8-9 cigarettes per day. The majority of smokers are fathers (Table 3).

Table 1. Descriptive statistics of individual characteristics, ARI occurrence, and physical factors of house in mountainous area

Nu.	Variables	Minimum	Maximum	Mean	Std deviation
1.	Under-five children age (month)	1	56	28.20	15.65
2.	Ventilation area (% of floor area)	2.4	20.8	9.15	4.91
3.	Daily cigarettes smoked	2	16	8.63	4.05
4.	Frequency of ARI	0	2	1.00	0.79
5.	Indoor Air temperature (°C)	21	23	22.29	0.54
6.	Indoor Air humidity (%)	60	85	73.94	4.01
7.	Light intensity in room (lux)	30	130	72.55	24.51

The majority of houses have a poor ventilation and unhealthy humidity, although most of them have healthy lighting and air temperature range. The physical condition of the houses showed that more than 50% have non-waterproof walls, 36.6% have dusty soil and cement plaster floors, about 40% have unhealthy kitchen ventilation and only about 55% of houses with good lighting. Almost 96% of the houses have a good temperature, but only 4.1% of houses have healthy humidity ranges (Table 1 and Table 2).

In the context of healthy behavior, almost one third of the families rarely open the house ventilation, more than 53% use wood fuel, almost 45% of households often carry children when cooking (**Table 3**). **Table 4** showed the risk factors that were significantly associated with the incidence of ARI, namely the type of house wall ($p=0.032$, $PR=5.042$ and $95\%CI=1.316-19.317$), floor conditions ($p=0.001$, $PR=1.938$ and $95\%CI=1.378-2.724$), kitchen ventilation ($p=0.022$, $PR=7.312$ and $95\%CI=1.427-37.469$), use of wood fuel ($p=0.008$, $PR=9.266$ and $95\%CI=1.805-47.769$), and the habit of holding children while cooking ($p=0.001$, $PR=22.615$ and $95\%CI=2.652-192.878$).

Table 2. Physical factors of houses in settlements in mountainous area.

No.	Variables	n	%
1	Type of house wall		
	Non-water proof	26	53.1
	Water proof	23	46.9
2	Condition of house floor		
	Dusty	18	36.7
	Clean	31	63.3
3	Kitchen ventilation		
	poor	20	40.8
	Proper	29	59.2
4	Light intensity (lux)		
	< 60	22	44.9
	≥ 60	27	55.1
5	Air temperature ($^{\circ}C$)		
	<20 or >30	2	4.1
	22 – 30	47	95.9
6	Humidity (%)		
	<40 or >70	47	95.9
	40 – 70	2	4.1

Table 3. Characteristics of person and health behavior among family members in mountainous area

No.	Variables	n	%
1	Sex		
	Male	25	51.0
	Female	24	49.0
2	Age group (years)		
	1 – 3	35	71.4
	4 – 5	14	28.6
3	Occurrence of ARI		
	Yes	34	69.4
	No	13	30.6
4	Opening ventilations of house		
	Rare	16	32.7
	Always (daily)	33	67.3
5	The use of wood fuel		
	Yes	26	53.1
	No	23	46.9
6	Holding the child when cooking		
	Often	22	44.9
	Rare	27	55.1
7	The smoker(s) in family		
	Father	40	81.6
	Other family member	9	18.4
8	Number of cigarettes was smoked in one day		

7 or more	36	73.5
0 – 6	12	26.5

Table 4. Bivariate analysis of risk factors of ARI among under 5 children in mountainous area

No.	Risk factors	Occurrence of ARI				p	PR	95% CI
		Yes		No				
		n	%	n	%			
1	Sex of under-5-children							
	Male	16	64.0	9	36.0	0.599	0.593	0.173 – 2.034
	Female	18	75.0	6	25.0			
2	Age group (years)							
	1 – 3	25	71.4	10	28.6	0.735	1.389	0.372 – 5.181
	4 – 5	9	64.3	5	35.7			
3	Type of house wall							
	Not water proof	22	84.6	4	15.4	0.032*	5.042	1.316 – 19.317
	Water proof	12	52.2	11	47.8			
4	Condition of house floor (type)							
	Dusty (soil and cement)	18	100	0	0.0	0.001*	1.938	1.378 – 2.724
	Clean (tile)	16	51.6	15	48.4			
5	Kitchen ventilation							
	Poor	18	90.0	2	10.0	0.022*	7.312	1.427 – 37.47
	Proper	16	55.2	13	44.8			
6	Light intensity (lux)							
	< 60	18	81.8	4	18.2	0.164	3.094	0.820 – 11.672
	≥ 60	16	59.3	11	40.7			
7	Air temperature (in Celsius degree)							
	<20 or >30	2	100	0	0.0	1.000	1.469	1.208 – 1.786
	22 – 30	32	68.1	15	31.9			
8	Humidity (%)							
	<40 or >70	33	70.2	14	29.8	0.523	2.357	0.138 – 40.402
	40 – 70	1	50.0	1	50.0			
9	Opening house ventilation(s)							
	Rarely	14	87.5	2	12.5	0.097	4.550	0.884 – 23.407
	Always (daily)	20	60.6	13	39.4			
10	The use of wood fuel							
	Yes	20	90.9	2	9.1	0.008*	9.266	1.805 – 47.769
	No	14	51.9	13	48.1			
11	Hold child when cooking							
	Often	21	95.5	1	4.5	0.001*	22.615	2.652 – 192.88
	Rarely	13	48.1	14	51.9			
12	The smoker(s) in family							
	Father	29	72.5	11	27.5	0.427	2.109	0.477 – 9.328
	Other family member	5	55.6	4	44.4			
13	Number of cigarettes consumed a day							
	7 or more	26	72.2	10	27.8	0.500	1.625	0.428 – 6.171
	0 – 6	8	61.5	5	38.5			

PR = prevalence ratio

* = significantly associated (p<0.05)

Discussion

This study reports for the first time an analysis of risk factors for the incidence of ARI in mountainous areas in Indonesia. Literature search found only four studies that explicitly analyzed the occurrence and risk factors for ARI at high altitudes^{9,21,22,24}. This study provides an additional information of ARI problem at the specific area so that appropriate problem-solving efforts can be made. In general, ARI in study site showed a prevalence rate of 69.4%, equivalent to 5.76 episodes/child/year. It was different

with the other studies that found 3.27 and 8-9 episodes of ARI/child/year^{23,24}. This prevalence was also lower than the District Health Office report, similar to the study reports in Nepal and the Republic of Columbia where the prevalence of ARI decreases with increasing the altitude of the area, although the range of ARI prevalence in both countries is lower^{9,22}. The result was also lower than the occurrence of ARI at mountainous areas of Vietnam²⁵. Even though Temanggung is a mountainous area, the highest altitude is only 1061 m asl so that the condition of environmental physical factors is still within the range of health requirements, and is also exposed to sunlight 12 hours per day. This condition can inhibit the growth of pathogens, including the cause of ARI.

The occurrence of ARI in children has been reported world-widely¹. Studies on ARI analyzes the disease occurrence based on geographic conditions and focuses on aspects of the home environment, population behavior, and health history of under-five children. This study found five associated factors that were significant with the prevalence of ARI in mountainous area, namely condition of walls and floors, kitchen ventilation, the use of wood fuel, and holding children while cooking. The wood-fuel-use factor is in line with the finding in Columbia⁹, whereas the other factors such as smoking behavior, room lighting and ventilation, under-nutrition, low birth weight, history of ARI, and low education and health literacy are found at low elevation areas^{10,15-17}.

This finding indicated that less than 50% of houses were made of permanent walls and waterproof. The walls of most houses were made of bamboo or wood, so they become damp during the rainy season because of the high humidity. This condition supports the growth of bacteria and viruses in indoor air so that it provides a higher opportunity for infection, including ARI. More than 36% of houses use soil and cement plaster floor which they were dusty and hard to be cleaned. Moist wall and dusty floor allowed pathogens to survive longer and give a greater risk of infection. ARI is caused by several types of viruses and bacteria²⁵ where the humidity influences on their growth. Poor quality of kitchen ventilation limits the air circulation and trigger an indoor air pollution²⁷. Kitchen smoke is trapped in the kitchen room, and increased the burden of chemical exposure. This condition stimulates irritation of the respiratory tract mucosa and facilitates infection²⁸. The solid fuel use and organic material combustion will produce smoke which causes indoor air pollution²⁹, inspirable particulate materials (PM_{2.5}) and several chemical compounds such as carbon monoxide, nitrogen oxides, formaldehyde, benzene, 1,3-butadiene, polycyclic aromatic hydrocarbons (PAHs), and other harmful gases²⁸. Wood smoke aerosol causes a high level of PM_{2.5} and CO gas exposure, and stimulates health effects such as ARI and lung function³⁰. The habit of holding children while cooking allows simultaneously exposure to these pathogens and harmful material and chemical compounds. Although mountainous areas have a relative healthy natural environment, but poor kitchen ventilation, physical of house and behavior cause a serious indoor air pollution. The low air quality (due to pathogens, PM_{2.5}, and chemical compounds) was trapped in the kitchen room and exposed children for a long time and repeatedly. This condition is indicated by the fact that 90.9% of under 5 children with ARI come from families using wood fuel, and 95.5% of them were held during the cooking activity.

Conclusion.

This study finds the significant association of ARI with the poor quality of wall and floor, kitchen ventilation, the use of wood fuel and holding a child while cooking simultaneously. Further study is necessary conducted to understand the occurrence and risk factors of severe ARI or pneumonia among under 5 children.

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