A Path Analysis Model for Explaining Factors That Influence the Use of Masker among Commuting Workers Using KRL Commuter Line Bogor Jakarta

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Abstract

Jakarta is one of the most air polluted cities in the world, it can increase the risk of healthy of commuting worker. As one of the most air polluted cities in the world, Jakarta is at high risk of its commuting worker's health. They are at risk of being exposed to pollutant. This study aims to determine the factors influencing directly and indirectly to healthy behavior (using masker) for commuting workers who use the KRL Commuterline Bogor - Jakarta. A total of 155 respondents participated in the study and the collected data were then analyzed using descriptive and path analysis. Commuters are aware of the hazard potential related to air pollution during commuting were 137 people (88.4%). Commuters with good perception of pollution were 104 people (67.1%). Commuters used masker during commuting was 125 people (80.6%). Healthy behavior (using masker) in commuting worker using KRL Commuter Line were affected by some factors both directly and indirectly. Knowledge and commuting experience toward healthy behavior using masker were two variables with a significant direct influence on healthy behavior using masker, and knowledge was also the only mediated variable with a significant indirect effect of education to healthy behavior (using masker).

Introduction

Many studies concluded that there is incidence of work accidents due to commuting activitiesand health hazards due to exposure to pollutants. Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma, acute lower respiratory, chronic obstructive pulmonary disease, stroke, ischemic heart disease and lung cancer.[1] Meanwhile, exposure to air pollution in student can increase risk related to neurodegenerative processes of aging.[2]

Jakarta is one of the most air polluted cities in the world, it can increase the risk of healthy of commuting worker. Jakarta is one of the greatest air pollution city in the world, it can increase the risk of commuting worker's health. In Indonesia, the number of commuters continued to increase from 6 million to 7 million in 2014. They are at risk of being exposed toParticulate Matter (PM), the level of exposure is influenced by the mode of transportation used, such as research conducted by[3].Other dangerous pollutant exposure is Ultrafine Particles (UFPs) [4, 5], increased level ofUrinary 1-Hydroxypyrene (1-OHP)which is a biomarker of PHSs exposure in urine[6], pleural anthracosis[7], respiratory disorder due to air pollution [4] , ischemic heart disease due to transportation noise exposure. [8] Accordance with Health Belief Model theory that developed by Rosenstock (1994) that assumptions that an individual was affected by an illness would make themselves aware of a prevention and protection such as Personal Protective Equipment (PPE) and masker in workplace and or travel to work. Furthermore, healthy behavior at work is needed in reducing the risk of accidents or health risks at work. Lack of knowledge of hazards in the workplace could increase risks to workers health and safety.[9] States that low knowledge and estimation of hazard risks in the construction industry could cause catastrophic events. Previous research related to commuter workers using KRL Commuter Line is a description of the perception of inconvenience when traveling to

work. As many as 67.1% of respondents stated that they felt uncomfortable with air pollution while transporting to work.[10] Various studies have also been conducted on healthy behavior in working with various workplace settings.

But until now it has not been clear about the description or information related to factors that influence healthy behavior especially using maskerduring the trip to work at the commuting worker. This study aims to determine the factors that influence directly and indirectly to healthy behavior in commuting activities, especially using masker for commuter workers who use KRL Commuter line to work from Bogor to Jakarta. As already mentioned briefly, the aim of this study was to construct a path analysis model for explaining factors that influence the use of masker among commuting workers using KRL Commuterline Bogor to Jakarta.

Method

The initial model for explaining factors which influence the use of masker was constructed on the basis of several hypotheses :(H1)Knowledge to pollution hazardhas a direct effect on using masker, (H2) Experience using KRL Commuter Line has a direct effect on using masker, (H3) Level of income has a direct effect on using masker, (H4) Knowledge has an indirect effect on using masker mediated by inconveniences perception with pollution, (H5)Experience of using (KRL Commuter Line) has an indirect effect on using masker mediated by inconveniences perception with pollution, (H6) Level of education has an indirect effect on using masker mediated byinconveniences perception with pollution, (H7) Experience using KRL Commuter Line has an indirect effect on using masker mediated by knowledge and inconveniences perception with pollution, (H8)Education has an indirect effect on using masker mediated by knowledge and perceptions of discomfort with pollution, (H9) Education has an indirect effect on using masker mediated by knowledge.

This preliminary studyis part of the research on the quality of life (QOL) of commuting workers who use the KRL Commuter Line and Busway trans Jakarta from Bogor to Jakarta in 2018 with WHO QOL BREF questionnaire and some additional questions about knowledge of pollutant risk. This study applied cross sectional design with a total of 155 respondents of commuting workers using KRL Commuter Line Bogor to Jakarta in 2018. A pilot survey involving 30 pre-test subjects has been done to test the validity and reliability of the questionnaire. Then the questionnaire was distributed via Google Form. A brief assessment was conducted and the questionnaire which were answered incompletely were excluded from the study. Finally, 155 completed questionnaires which were qualified to be used in the analysis. The questionnaire consists of questions that is demographic characteristics (name, sex, education, job characteristics, salary, marital status), questions of experience using KRL, knowledge of pollutans risk exposure by mentioning what kinds of pollutans respondents know (vehicle emission, Polycyclic Hydrocarbon, Particulate Matter), use a mask when going to work or not). In this study, there are six variables which is used in an accordance with the hyphotesis.

The dependent variable was the use of masker. The independent variables were knowledge, commuting experience, education, income, and discomfort perception with pollution. Knowledge was the result of knowing that there is potential hazard related to air pollution during using KRL Commuter Line. Commuting experience was defined as commuter less and more than 2 years. Education was defined as the highest formal education attained by the commuter, less than equal to senior high school (SHS) and higher[10]. Income was defined as total income per month of commuter, using provincial minimum wage (less than equal 3 million/low and above 3 millions/high). Discomfort perception with pollution was defined as how commuters feel discomfort with pollution during commuting (measured of 1-10 scale, good is more than median score and vice versa).

Descriptive analysis was applied to explain the demography charateristics of the respondents (name, sex, education, job characteristics, salary, marital status). Then, it will conduct path analysis by using Lisrel 8.7. Path analysis is a useful tool for assessing direct and indirect effects of some variables on a specific target variable, which was healthy behavior in this present study. Direct effect meant having influence without intermediary variable to dependent variable (H1, H2, H3) while indirect effect had intermediary variable to dependent variable (H4, H5, H6, H7, H8, H9). The strength of a path is represented by a coefficient conceptually equal to standardized partial regression coefficients. A coefficient has a range from −1 to +1. The higher the coefficient, the greater the effect one variable has on another. In order to assess the significance of a path in a path analysis model, the *t* value which is the ratio of the unstandardized estimate to standard error is used. If $t > 1.96$, the path is significant at 0.05.

In addition to each path, the goodness of fit of a path analysis model can also be determined using indices available for such evaluations. These indices can be categorized into two main groups: absolute fit indices and comparative fit indices. Absolute fit indices outline how well the hypothesized model fits the data.[11] The model $\chi 2$ value, Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI) and Root Mean Square Residual (RMR) are some indices categorized in the group.[11]

The model $\chi 2$ value is very sensitive to the sample size and normally its value increases as the sample size increases. To fix this problem, proposed that the ratio of the $\chi 2$ value to the degree of freedom*(df)*should be used so that a ratio lower than 2 is indicative of a satisfactory model fit [11]. RMSEA is another absolute fit index, popular because of its sensitivity and informative and easy to interpret nature. This index is calculated using the model $\chi 2$ value, *df*, and sample size (*N*) (Equation (1))[12]. An RMSEA value lower than 0.07 indicates a good fit, values lower than 0.1 are indicative of mediocre fit and values higher than 0.1 represent unacceptable model fit [11]:

$$\text{RMSEA}=\frac{\sqrt{\chi 2-df}}{df\,(N-1)},(1)$$

Where is the RMSEA, root mean square error of approximation, $\chi 2$ is the Chi-square value of the model, *N* issample size.

In contrast, comparative fit indices, e.g., Normal Fit Index (NFI) and Comparative Fit Index (CFI), explain how close the hyphothesized model is to a baseline ideal model. Moreover, comparative fit indices with values higher than 0.95 indicate that a model is of good fit.[11]

Results

The data obtained from the questionnaire regarding characteristics of the studied groups are summarized in Table 1. All variables were made in two categories.

Table 1. Sample characteristics

Characteristics	N	%
Knowledge		
Good	137	88.4
Bad	18	11.6
Commuting Experience (Using KRL *Commuter Line*)		
< 2 years	23	14.8
≥ 2 years	132	85.2
Education		
≤ SHS	12	7.7
>SHS	143	92.3
Income		
Low	56	36.1
High	99	63.9
Discomfort Perception with Pollution		
Good	51	32.9
Bad	104	67.1
Healthy behavior (Using Masker)		
Good	125	80.6
Bad	30	19.4

Note: SHS (Senior High School)

Based on the assumptions of this study, it has been constructed a model based on path analysis. Table 2 presents the fit indices of the path model in the present study. From the table, the ratio of the $\chi 2$ value to

the degree of freedom *(df)* is lower than 2 (2.24/3 = 0.746), RMSEA < 0,07 (0.00), IFI > 0.95 (1.015), GFI > 0.95 (0.995), and CFI > 0.95 (1.000). It can be conclude that overall the fit indices are acceptable on the model.

Table 2. Various fit indices of the model

Model Fit Index	Estimation Result	Acceptable Level	Conclusion
X^2/df	DF = 3 X^2 = 2.24	< 2.00	Fit
RMSEA	0.00	< 0.07	Fit
IFI	1.015	> 0.95	Fit
GFI	0.995	> 0.95	Fit
CFI	1.000	> 0.95	Fit

Note: RMSEA (Root Mean Square Error Approximation), IFI:Incremental Fit Index; CFI: Comparative Fit Index; GFI: Goodness of Fit Index

From the model (Figure 1), it should be stressed that factors affected to use masker in nine different ways: (1) direct path from knowledge; (2) direct path from commuting experience (using KRL Commuter Line); (3) direct path from income; (4) indirect path from knowledge which was mediated by discomfort perception with pollution; (5) indirect path from commuting experience which was mediated by discomfort perception with pollution; (6) indirect path from education which was mediated by discomfort perception with pollution; (7) indirect path from commuting experience which was mediated by knowledge and discomfort perception with pollution; (8) indirect path from education which was mediated by knowledge and discomfort perception with pollution; and (9) indirect path from education which was mediated by knowledge.

The variable affects the use of masker in four different ways; (1) direct effect (H1, H2, H3); (2) the effect mediated by knowledge (H9); (4) the effect mediated by discomfort perception (H4, H5, H6); and (3) the effect mediated by knowledge and discomfort perception (H7, H8).As shown in the path model (Figure1), it is evident from the data that conclude as follows:

1. knowledge and commuting experience toward the use of masker were two variables with a significant direct effect (t value on H1 and H2 were >1.96), while income was not significant direct effect (p value on H3 was <1.96).
2. Knowledge was also the only mediated variable with a significant indirect effect of education to the use masker (t value on H9 was > 1.96), so education has indirect effect to the use of masker.

3. Discomfort perception is not intervening variable on the effect of knowledge, commuting experience, and education to the use of marker where the path on H4, H5, and H6 were not significant (t value <1.96). Interestingly, it was demonstrated that the influence of knowledge, commuting experience, and education toward the use of use masker were not mediated by inconveniences perception with pollution.
4. Knowledge and discomfort perception were not intervening variable on the effect of commuting experience and education to the use of marker where the path on H7 and H8 were less than 1.96. From this path, it has been concluded that commuting experience and education had not indirect effect to the use of masker mediated by knowledge and discomfort perception.

Table 3 presents all statistics about each path. This, along with model depicted in Figure 1, gives us the lead of the variable has the most significant direct impact on the use of marker, which is knowledge of the importance of wearing masker related pollutants hazard, it is then followed by commuting experience with KRL commuter line. Moreover, education has indirect effect to the use of masker mediated by knowledge. From the significant path coefficient, it can conclude that:

1. Direct effect of knowledge to the use of masker has the positive path coefficient of 0.309 (odds ratio (OR) = e^{309} = 1.36).
2. Indirect effect of commuting experience to the use of masker has negative path coefficient of -0.194 (OR= $e^{-0.194}$= 0.82).
3. Indirect effect of education to the use of masker mediated by knowledge (education à knowledge à the use of masker) has the coefficient effect of 0.224*0.309 = 0.069 (OR= e^{069}= 1.07).

Table 3. Significance level of each path in the models

Path		Standardized Path Coefficient	*SE*	*t*
From	To			
Commuting Experience	Knowledge	0.105	0.071	1.465
Education	Knowledge	0.224*	0.095	2.349
Knowledge	Discomfort perception with pollution	0.071	0.119	0.603
Commuting Experience	Discomfort perception with pollution	−0.110	0.106	−0.104
Education	Discomfort perception with pollution	−0.371*	0.142	−2.605
Knowledge	The use of masker	0.309*	0.095	3.245
Commuting Experience	The use of masker	−0.194*	0.088	−2.184
Income	The use of masker	−0.093	0.065	−1.436
Discomfort perception with pollution	The use of masker	−0.103	0.065	−1.600

Note: * (Significant) if t > 1,96

Using path analysis model, not only to quantify the direct effect but also able to quantify the indirect effects that variables have on each other. Table 4 presents these quantities for each variable in path coefficient column. As is evident from this table, knowledge was the variable with the highest direct effect on the use of masker (0.309).

Table 4. Direct, indirect, and total effects of the variables on using masker

Variable	Direct Effect	Indirect	Total Effect
Knowledge	−0.309	0.0005	0.3038
Commuting Experience with CL	−0.0194	−0.0084518	−0.0278
Education	-	-0.0255	−0.0255
Discomfort perception with pollution	0.0719	-	0.0719
Income	−.0934	-	−0.0934

Discussion

Currently the use of masker is very important during COVID-19 pandemic. The use of masker both in public transportation and workplaces has become the recommended health protocol procedures. This study produced 3 important findings related to the use of masks of commuter workers with Commuter Line transportation.

Factors that influence both directly and indirectly in the use of masker in this study are factors of knowledge, education, and perception of a risk. This finding in line with the factors affected workers/community that influence the use of masker during the COVID-19 pandemic.

Direct effect of knowledge to the use of masker has the positive path coefficient of 0.309 (odds ratio (OR) = $e^{0.309}$ = 1.36). So that commuter who knows the potential hazard related to air pollution has OR to use masker by 1,36 units higher than commuter who does not know the potential hazard related to air pollution during commuting using KRL Commuter Line.

Direct effect of commuting experience to the use of masker has negative path coefficient of -0.194 (OR= $e^{-0.194}$= 0.82). So that commuter with experience using KRL Commuter Line more than equal 2 years has OR to use masker by 0.82units lower than commuter with experience less than 2 years using KRL Commuter Line. In other words, commuter with experience using KRL Commuter line less than 2 years has OR to use masker 1.22 units higher than commuter with experience more than equal 2 years.

Indirect effect of education to the use of masker mediated by knowledge (education to knowledge to the use of masker) has the coefficient effect of 0.224*0.309 = 0.069 (OR= $e^{0.069}$= 1.07). So that commuter with education higher than SHS has OR to use masker by 1.07 units higher than commuter with education less than equal to SHS.

Healthy behavior is needed during work. Most of the research related healthy and safety behavior conducts in workplace[9, 13, 14]. However, there are also some research references that safety behavior is important in the commuting activity, especially in the transport activities industry.[(23)]In this study, the assessment of healthy behavior related using masker was taken for commuters in using KRL Commuter Line. The use of maskers is one of the indicators studied in relation to healthy behavior in this study. The use of masker to reduce the risk of exposure to various pollutants.[15, 16]

Previous studies state that the perception of risk is significant directly to healthy/or safety behavior.[18] However, this present study also demonstrates the fact that discomfort perception about pollution (bad and good) is not significant influence commuter to use masker both as direct effect and as indirect effect (intermediary factor) through knowledge, commuter experience, and education. In this study, the perception of pollution measured only bad and good. it is possible that the level of perception of risk of hazard (pollution) can affect commuter in healthy behavior so that is why bad perception of inconvenience feeling about pollution is not dangerous for them, especially in occupational health and safety perspective. There was a positive effect between perceived severity and preventive behavior and individuals with high perceived severity increased prevention behavior compared individuals with low

perceived severity. In summary, the model presented in this study provides important finding about how the effect on healthy behavior reflected by using masker is not intermediary by others variable such us discomfort perception about pollution.

Path analysis is a strong method for evaluating direct and indirect effects, but it has some limitations. Some of these limitations are discussed by Jeon. For example path analysis can only be used for explanation and not for prediction. [19](19) (18) Also this research needed qualitative studies to explore and validated healthy and safety behavior in more details. The bias may arise from distributed questionnaires, but this problem has been minimized by conducting the validity and reliability test of the questionnaire.

Despite the limitations of this study the finding contributes to the literature by the explains the important information about healthy behavior related using face mask/masker in commuting worker.

Conclusion

Healthy behavior (using masker) in commuting worker using KRL Commuter Line were affected by some factors both directly and indirectly. Knowledge and commuting experience toward healthy behavior using masker were two variables with a significant direct influence on healthy behavior using masker, and knowledge was also the only mediated variable with a significant indirect effect of education to healthy behavior (using masker).

Abbreviations

KRL = Kereta Rel Listrik;

NFI = Normal Fit Index;

RMSEA = Root Mean Square Error of Approximation;

SHS = Senior High School;

GFI = Goodness Fits Index;

(UFPs) = Ultrafine Particles;

IFI = Incremental Fit Index;

CFI = Comparative Fit Index;

RMR = Root Mean Square Residual;

Declarations

Ethics approval and consent to participate

The research questionnaire was approved in regards of ethical studies by the Directorate of Research and Community Service, Faculty of Public Health, Universitas Indonesia with Approval Number 296/UN2.F10PPM.00.02/2018.

Competing interest

The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

Availibility of data and materials

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Authors' contribution

D. Kusmawan was the principal investigator in the study. He managed data collection, controlled the framework and reporting. I. Gustina was in charge of statistical analysis and their interpretation. S. Andari was collaborating in writing the manuscript. Indri H Susilowati and M. Wirawan support grant for collecting data.

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Figures

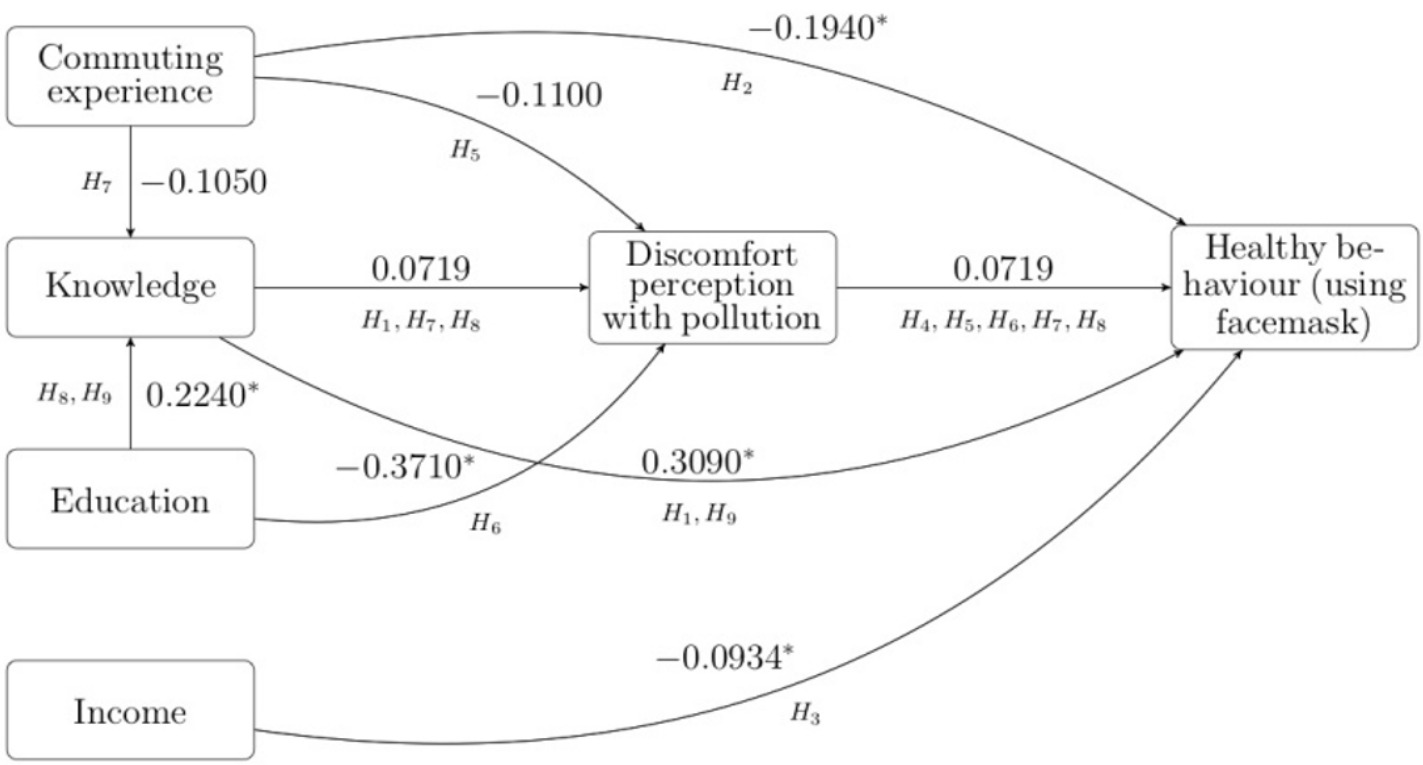

Figure 1

The path model for explaining factors to use masker (facemask) among commuting workers using KRL Commuter Line Bogor Jakarta