Indonesian Journal of Applied Technology, Vol: 2, No 1, 2025, Page: 1-15

Analysis of Indonesian Public Health Factors 2023 with PCA Method and Factor Analysis

Sri Pingit Wulandari[1], Nadifa Permata Sari[2], Revina Aprili Ghina Imani[3]*

[123] Institute Technology of Sepuluh Nopember

DOI:
https://doi.org/10.47134/ijat.v2i1.3369
*Correspondence: Revina Aprili Ghina Imani
Email: revinagh@gmail.com

Received: 20-11-2024
Accepted: 20-12-2024
Published: 21-01-2025

Abstract: Indonesia is a developing country with a high population, which faces great challenges in maintaining public health, especially in the era of accelerating globalization. Public health is an important issue in the face of urbanization, economic growth, and increasing demand for livelihoods. This challenge requires not only the provision of medical services but also equitable access for the entire community, including those living in remote areas or with economic limitations. Based on Susenas 2023 data, around 26% of Indonesia's population experienced health complaints in the past month, although the Graph has decreased from 29.94% in the previous year. This study aims to identify factors that affect public health in each province in Indonesia, using the main component analysis (PCA) method and factor analysis. The research data comes from the Central Statistics Agency (BPS) with six variables, namely life expectancy, exclusive breastfeeding in infants <6 months, poverty percentage, prevalence of food inadequacy, number of medical personnel, and poverty depth index. Data processing is carried out with SPSS, the results are presented in boxplots and tables for easy decision-making. The results of the study show that most of the data characteristics, namely data tend to have great diversity and the data has met the normal assumption of multivariation, dependent data, data adequacy, and correlation between significant variables. In addition, two main factors that are formed in affecting public health are socio-economic conditions and food security.

Keywords: Factor Analysis, Principal Component Analysis, Public Health

Introduction

Indonesia is a developing country with a very high population. During an increasingly dynamic era of globalization, special attention to public health is very important so that people can live healthy and productive lives. These considerations are needed to face the major challenges posed by urbanization, economic growth, and increasing livelihood needs. Maintaining public health not only means providing health services but also ensuring fair and equal access for everyone, including those living in remote areas and those with economic limitations (Noviatiningsih, 2019). Factors such as access to health services, socioeconomic conditions, and living conditions. Access to health services is the main concern in efforts to maintain and improve the welfare of the community in each region.

Health is one of the fundamental aspects that has a direct impact on the quality of life of the community, so the availability and accessibility of adequate medical services is very important. Hospitals, as comprehensive medical service centers, play an important role in ensuring that people receive quality healthcare. However, although the role of hospitals is crucial, the challenge of achieving equitable and inclusive access to health services for all levels of society is still considerable. The gap in access to health facilities, both due to limited infrastructure, uneven distribution of medical personnel, and socio-economic factors, is still an obstacle that needs to be overcome (Dwi Binuko & Fauziyah, 2024).

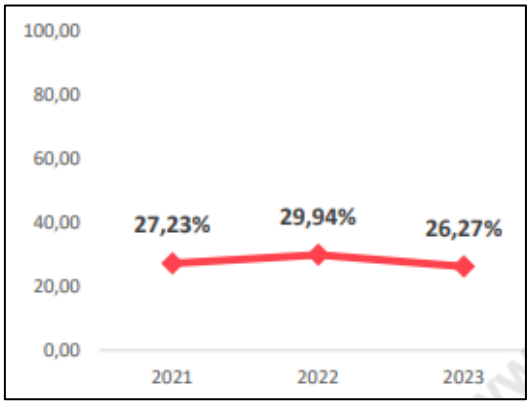

Figure 1. Percentage Of Residents Who Have Health Complaints in The Past Month
Source: (Indonesia, 2023)

Based on Susenas (National Health Survey) in Figure 1, about 26 out of 100 residents had health complaints in the last month in 2023, the percentage tended to decrease from 29.94% to 26.27%. Although the percentage has decreased, it still shows that public health conditions need attention because the decline is not drastic. So, it is necessary to conduct research on what factors affect public health by province in Indonesia so that public health in each region can be evenly distributed. The methods used are the main component analysis method and factor analysis (Saputri, 2023).

Principal component analysis (PCA) is a statistical technique that transforms most of the variables that were originally correlated into a new, smaller, independent set of variables and helps reduce the data, making it easier to interpret the data (Delsen et al., 2017). The analysis of the main components can be expanded into factor analysis. Factor analysis is a technique used to find factors that are able to explain the relationship or correlation between various independent indicators observed (Wardani, 2023). Therefore, this study uses the main component analysis method and factor analysis to find out what factors can affect the level of community welfare in Indonesia in 2023 (Wahid, 2022).

In this study, data was obtained through website The Central Statistics Agency (BPS) which uses 6 variables that affect public health in 34 provinces in Indonesia in 2023, namely life expectancy, the percentage of infants aged <6 months who receive exclusive breastfeeding, the percentage of poverty, the prevalence of food inadequacy, the number of medical workers and the poverty depth index (P1). The Life Expectancy Rate (AHH) is an estimate of the life expectancy of a population since birth assuming that the pattern of death does not change with age (Ramadhani et al., 2020). The percentage of babies aged <6 months

is breastfeeding only to babies up to 6 months without additional fluids or other foods (Sari et al., 2020). Poverty percentage is the percentage of inability to meet minimum standards of basic needs, including food and non-food needs (Aprilianti et al., 2022). Inadequate food consumption as a condition in which a person regularly consumes insufficient amounts of food to provide the energy needed for a normal, active and healthy life (See also, 2022). The number of medical personnel is the number of health workers whose main function is to provide high-quality health services to patients using procedures and techniques based on medical science and applied ethics and are people who can be responsible (Malingkas et al., 2018). The poverty depth index is a measure of the average gap between the expenditure of each poor person and the poverty line and provides an overview of the distribution of expenditure among the poor (Triono & Sangaji, 2023).

The data processing uses SPSS application software and the results presented are in the form of boxplots and tables so that decision-making will be easier. This research is also aimed at providing benefits, namely being able to provide useful recommendations for the improvement of national health policies, for the sake of improving the quality of life of the community.

Methodology

In this research, six factors that are suspected to affect public health in Indonesia in 2023 will be analyzed, namely life expectancy, percentage of infants aged <6 months who receive exclusive breastfeeding, percentage of poverty, prevalence of food inadequacy, number of medical workers and poverty depth index. These variables are in the form of secondary data obtained by searching for data on the official website of the Indonesian Central Statistics Agency, namely on the https://www.bps.go.id/id 34 provinces in Indonesia in 2023 with 34 data each. This research uses a factor analysis method with the aim of making complexity a simpler measure so that it is easier to explain. Factor analysis is one of the multivariate analyses designed to examine the nature of the relationship between variables in one device that basically shows a certain relationship pattern (Purwanto, 2018).

These factors will be analyzed using factor analysis in which there are methods of Principal Component Analysis (PCA). PCA or principal component analysis is a multivariate statistical technique used to reduce the dimensions or simplify a data without significantly reducing the characteristics of existing data by transforming the data linearly so that a new coordinate system with maximum variance is formed. The calculation of principal component analysis is based on the calculation of eigenvalues and vector eigens that state the distribution of data. The stages of PCA analysis are as follows (A. A. Miranda, 2008).

1) Calculating the covalent matrix

The arrangement of the covariance matrix is shown in the equation with the index

$$R_p = \begin{bmatrix} 1 & R_{12} & \cdots & R_{1p} \\ R_{21} & 1 & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ R_{p1} & R_{p2} & \cdots & 1 \end{bmatrix} \quad (2.1)$$

2) Calculating own value than own vector

The formula for calculating eigenvalue and vector eigens is shown in the equation with indices 2.2 and 2.3.

$$Determinan(A - \lambda I) = 0 \quad (2.2)$$

$$Ax = \lambda x \quad (2.3)$$

Information:

A = Matrix

L = Eigen value

I = Identity matrix

X = Eigen vector

3) Determining the number of key components

In determining the number of main components, it can be done using three ways, namely the following.

1. View the scree plot

   A scree plot is a plot of eigenvalue lines arranged sequentially from left to right of the plot. The number of factors on the horizontal axis of the curve indicates the significant number of factors that need to be extracted. An example of a scree plot is shown in Figure 2. (Lewith, Jonas, & Walach, 2010)

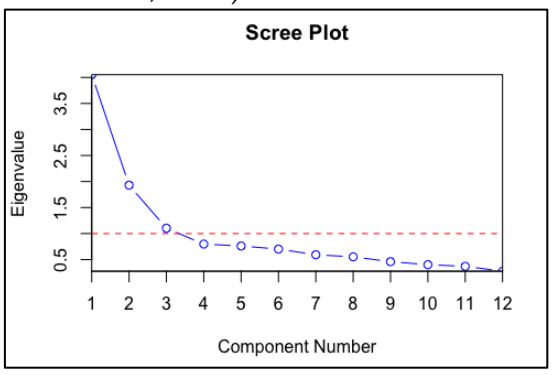

Figure 2. Example of Scree Plot

2. Using eigenvalues that ≥ 1.
3. Using the cumulative proportion of variance to total (80% diversity of data).

   Before conducting factor analysis, various assumption tests are needed so that the results of the analysis get accurate and precise conclusions. The assumption test used is the data normality test, this test is intended to show that the sample data comes from a normally distributed population. The multivariate normality in question is the multivariate normality of dependent variables in each population (group) (Andriani & Amal, 2018). The test of the assumption of the normal distribution of multivariate values was carried out using the value of T-Proportion. In addition to the normal

distribution of multivariates, it is necessary to test the dependency assumptions of statistical techniques used to evaluate whether there is a relationship between two variables. Dependency tests can be performed using the Bartlett test. The Bartlett test is based on the statistics of the Chi-square test and is generally used on normally distributed data with the following steps (Maulidya, 2007).

H_0: $\rho = I$ (Correlation matrices are identical to identity matrices or between independent variables)

H_1: $\rho \neq 1$ (Correlation matrices are not identical to identity matrices or between dependent variables)

Significant level: 5% or α = 0,05

Reject area: Reject H_0, if $\chi^2_{hit} > \chi^2_{(\alpha;df)}$ or P-value < α

Test statistics:

$$\chi^2 = (ln10)\{B - \sum_{i=1}^{n}(n-1)logs_i^2\} \quad (2.4)$$

$$B = (logs^2)\sum_{i=1}^{n}(n_i - 1) \quad (2.5)$$

$$s^2 = \frac{\sum_{i=1}^{n}(n_i-1)s_i^2}{\sum_{i=1}^{n}(n-1)} \quad (2.6)$$

Information:

n = amount of data

s_i^2 = variance data to-i

The following suspicion test is to check the ampleness of information utilizing the Kaiser Meyer Olkin (KMO) test. KMO may be a test that's carried out to decide the suitability of a calculate examination to be carried out. The KMO test scale ranges from to 1. On the off chance that the KMO value is lower than 0,5 at that point the calculate investigation isn't attainable. In the mean time, in the event that the KMO esteem is more prominent than 0,5 at that point the calculate examination is doable. As well as the final presumption test, to be specific the correlation examination between factors utilizing the anti-image relationship test calculation which appears many numbers that shape a corner to corner (which is stamped with 'a') showing the MSA (Degree of Examining Addequency) number of a variable. If the MSA number of a variable is underneath 0,5 the variable must be evacuated and the variable determination is additionally rehashed (Santoso, 2012).

Result and Discussion

1. Data Characteristics on Public Health Factors in Indonesia in 2023

Analysis of the characteristics of life expectancy data, percentage of infants <6 months aged exclusively receiving breast milk, percentage of poverty, prevalence of food consumption inadequacy, number of medical workers, poverty depth index (P1) by province in Indonesia in 2023 can be presented visually as follows

a. Life Expectancy Variable

The characteristics of life expectancy data by province in Indonesia in 2023 are presented through the boxplot in Figure 3 as follows.

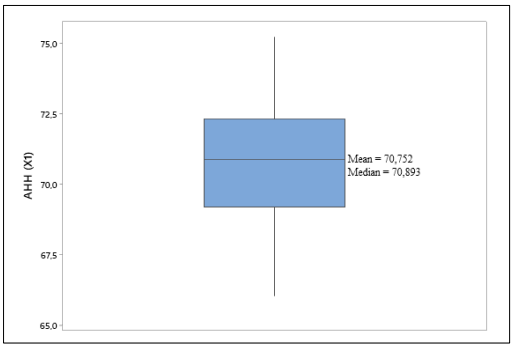

Figure 3. Boxplot Life Expectancy Numbers

Figure 3 shows that the life expectancy by province in Indonesia in 2023 has an average of 70,752 with 50% of the data at 70,893 and 50% of the data below 70,893. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, the life expectancy by province in Indonesia in 2023 has a large diversity of data seen from a wide field of boxplot.

b. *Percentage of Babies <6 Months Older Gets Exclusive Breast Milk Variable*

The characteristics of the data on the percentage of babies aged <6 months who receive exclusive breastfeeding by province in Indonesia in 2023 are presented through the boxplot in Figure 4 as follows.

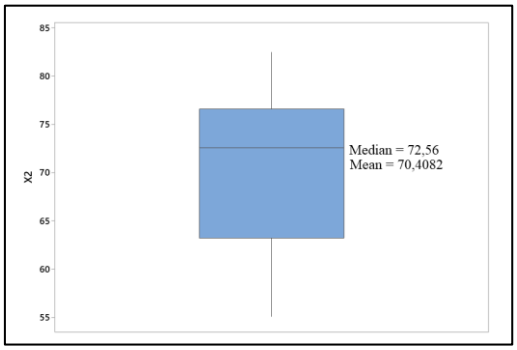

Figure 4. Babies <6 months who get exclusive breastfeeding

Figure 4 shows that the percentage of infants aged <6 months who receive exclusive breastfeeding by province in Indonesia in 2023 has an average of 70,408 with 50% of the data at 72,56 and 50% of the data below 70,56. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, the percentage of babies aged <6 months who receive exclusive breastfeeding by province in Indonesia in 2023 has a large diversity of data seen from a wide field of boxplots.

c. *Poverty Percentage Variable*

The characteristics of poverty percentage data by province in Indonesia in 2023 are presented through the boxplot in Figure 5 as follows.

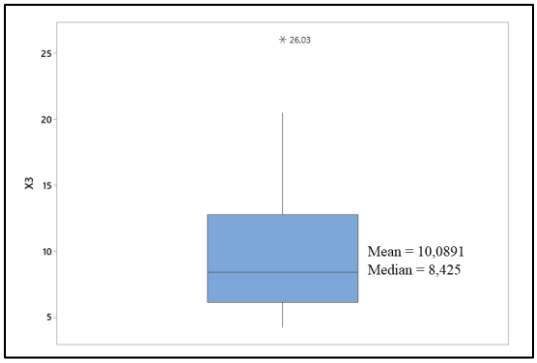

Figure 5. Poverty Percentage Boxplot

Figure 5 shows that the percentage of poverty by province in Indonesia in 2023 has an average of 10,08 with 50% of the data above 8,42 and 50% of the data below 8.,42. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, the percentage of poverty by province in Indonesia in 2023 has a large diversity of data seen from a wide field of boxplots. In the boxplot, there is also an outlier of one data of 26,03 which is owned by Papua Province. The high percentage of poverty in Papua is due to limited access to infrastructure and education.

d. Prevalence of Food Consumption Inadequacy Variable

The characteristics of food consumption inadequacy prevalence data by province in Indonesia in 2023 are presented through the boxplot in Figure 6 as follows.

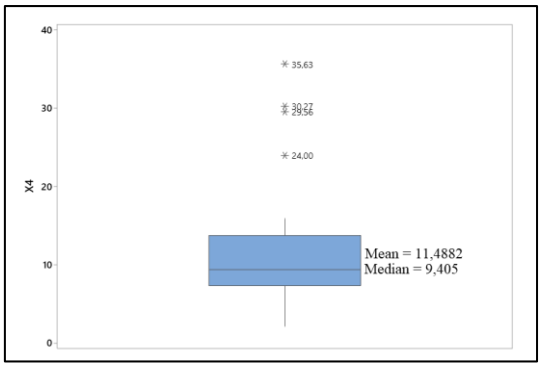

Figure 6. Prevalence of Food Consumption Inadequacy

Figure 6 shows that the prevalence of food inadequacy by province in Indonesia in 2023 has an average of 11,48 with 50% of the data at 9,045 and 50% of the data below 9,045. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, the prevalence of food consumption inadequacy by province in Indonesia in 2023 has a large diversity of data as seen from the field of boxplots that are not wide. In the boxplot, there are also four outliers of 35,63; 30,27; 29,56; and 24,00.

e. Number of Medical Workers Variable

The characteristics of the data on the number of medical workers by province in Indonesia in 2023 are presented through the boxplot in Figure 7 as follows.

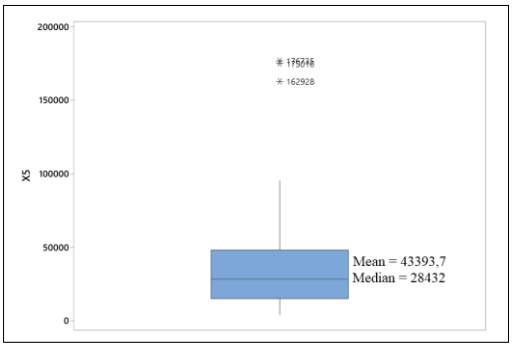

Figure 7. Prevalence of Food Consumption Inadequacy

Figure 7 shows that the number of medical workers by province in Indonesia in 2023 has an average of 43393,7 with 50% of the data being at 28432 and 50% of the data being below 28432. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, it can be known that the number of medical workers by province in Indonesia in 2023 has a large diversity of data seen from the wide field of boxplots. In the boxplot, there are also three outliers of data of 176735, 175016 and 162928.

f. Poverty Depth Index (P1) Variable

The characteristics of the poverty depth index data by province in Indonesia in 2023 are presented through the boxplot in Figure 8 as follows.

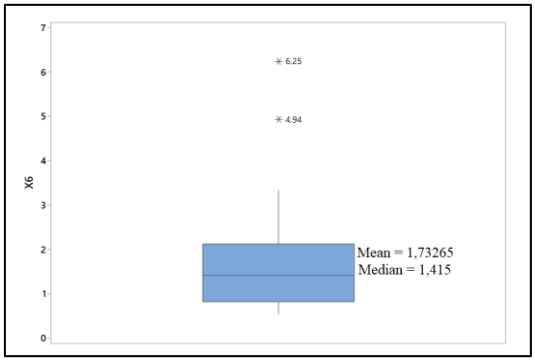

Figure 8. Prevalence of Food Consumption Inadequacy

Figure 8 shows that the poverty depth index by province in Indonesia in 2023 has an average of 1732 with 50% of the data at 1415 and 50% of the data below 1415. The boxplots in the image have an asymmetrical shape because the median line is not exactly in the center. In addition, the poverty depth index by province in Indonesia in 2023 has a large diversity of data seen from a wide field of boxplots. In the boxplot, there are also two outliers of data of 6,52 and 4,94.

2. Analysis of Examination and Testing of Assumptions on Public Health Factors in Indonesia in 2023

Assumption testing is needed before conducting factor analysis so that the results of the analysis are more accurate. Assumption testing is in the form of multivariate normal distribution testing, independence testing, KMO value analysis and Anti-Image correlation testing which are described as follows.

a. Normal Distribution of Multivariate

An examination of the assumption of a multivariate normal distribution of public health factors in Indonesia in 2023 can be presented visually in the Q-Q Plot in Figure 9.

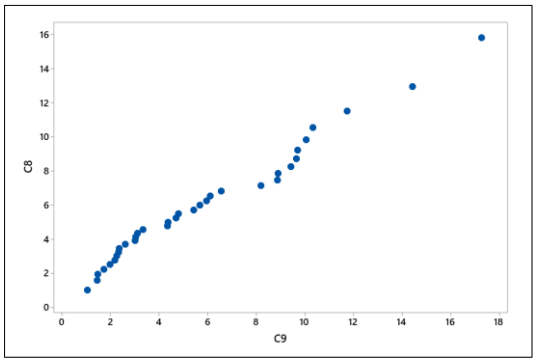

Figure 9. Q-Q Multivariate Normal Distribution Test Plot

Based on Figure 9, public health factors in Indonesia in 2023 are visually distributed normally multivariate because the plots in the image form or follow a linear line. Furthermore, a multivariate normal distribution test was carried out on public health factors in Indonesia in 2023.

Furthermore, to strengthen the results of the analysis visually, it is necessary to test the normal distribution of multivariate using the T-Proportion test on public health factors in Indonesia in 2023 to find out whether the data has met the assumption of normal distribution or not. The normal multivariate distribution test of public health factors in Indonesia in 2023 produced can be hypothesized as follows.

Hypothesis:

H_0 : Public health factors in Indonesia in 2023 are normally distributed multivariate

H_1 : Public health factors in Indonesia in 2023 are not normally distributed multivariate

The multivariate normal distribution test was carried out with a significant level of 0.05 having a rejection area if the T-Proportion was outside the range of 45% to 55%. The results of the statistical calculation of the test from the multivariate normal distribution test found that public health factors in Indonesia in 2023 had a proportional t value of 52,94% which was in the range of 45% to 55%, so it was decided to fail to reject, which means that the data of all variables is normally distributed multivariate (Sakundarno, 2014).

b. Correlation of Independence

The test of the assumption of independence was carried out using the barlett test to find out the homogeneity of the variety in the data on public health factors in Indonesia in 2023 with a confidence level (CI) of 95% can be written as follows.

Hypothesis:

$H_0 : \rho = I$ (The correlation matrix is identical to the identity matrix or the correlation between all variables is independent).

$H_1 : \rho \neq I$ (The correlation matrix is identical to the identity matrix or the correlation between all variables is dependent).

A significant level (α) of 0.05 is set with a rejection area of H0 if $\chi^2 > \chi^2_{(0,05;15)}$ or P-Value < 0.05 which will be proven by the test statistics in Table 1.

Table 1. Barlett Test Statistics

$\chi^2_{(0,05;15)}$	χ^2	P-Value
24,995	244,718	0,001

Table 1 shows that χ^2 244.718 is greater than 24.995 and is strengthened by a p-value of 0.001 where the value is smaller than alpha so that it can be decided to reject which means that the correlation matrix is identical to the identity matrix or the correlation between all variables is dependent. In this case, public health factors in Indonesia in 2023 meet the dependent assumption (Hasugian, 2023).

c. *Data Adequacy*

The KMO test is used to measure whether the sample used has been sufficient for further analysis or not. The KMO test on data on public health factors in Indonesia in 2023 with a confidence level (CI) of 95% obtained the following KMO values.

Table 2: Barlett Test Statistics

KMO Value
0,687

The KMO value in the data on public health factors in Indonesia in 2023 is 0,687 where the value is more than 0,5 so it can be decided that public health factors in Indonesia in 2023 can be further analyzed because it is enough to be factored.

d. *Correlation Between Variables*

Anti-Image Correlation or correlation between variables is seen through the MSA value with the aim of measuring the sufficiency of sampling of each variable. The condition for receiving Anti-Image Correlation is that if the MSA value is above 0.5, then the variable can be further analyzed. Meanwhile, if the MSA value obtained is below 0.5, then the variable cannot be analyzed further and the variable must be eliminated. Anti-Image Correlation on Public Health Factors in Indonesia in 2023 by Province in Indonesia in 2023 is presented in Table 3 as follows.

Table 3. Anti Image Correlation

Variable	MSA Values
Life Expectancy (X_1)	0,859
Percentage of <6-month-old babies who get exclusive breastfeeding (X_2)	0,617
Poverty Percentage (X_3)	0,604
Prevalence of Food Consumption Inadequacy (X_4)	0,871
Number of Medical Workers (X_5)	0,662
Poverty Depth Index (P1) (X_6)	0,616

Based on Table 3, all variables, namely X_1, X_2, X_3, X_4, X_5 and X_6, have an MSA value of more than 0,5 so that it can be known that all variables can be further analyzed without having to be eliminated.

3. Key Component Analysis (PCA) and Factor Analysis on Public Health Factors in Indonesia in 2023

Based on the results of the examination and testing of the assumptions in the previous section, it was obtained on factors affecting public health in Indonesia in 2023 that the assumptions have been met. The next step is to conduct a main component analysis and factor analysis.

a. Scree Plot

Scree plot is a figure to see the factors that are formed visually. The scree plot on factors affecting public health in Indonesia in 2023 is presented in Figure 10.

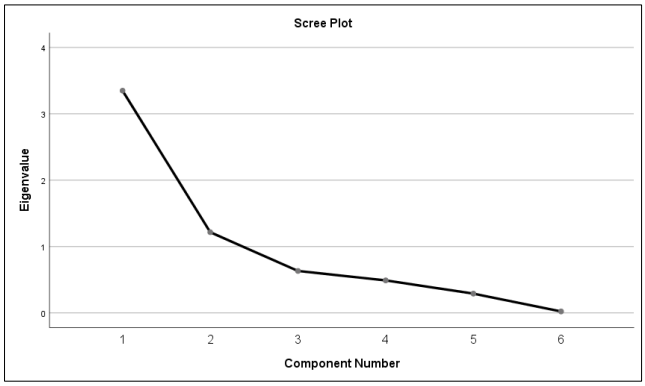

Figure 10. *Scree Plot*

Based on Figure 10, it shows that visually there are 2 components that have an eigenvalue of more than 1 so that the number of factors formed in the analysis of the main components is 2 factors.

b. Total Variance Explained

The results of the analysis of the eigenvalue value of each component are presented in the following Table 4.

Table 4. Total Variance Explained

Component	Total	%of Variance	%Cumulative
1	3,349	55,812	55,812
2	1,216	20,265	76,077
3	0,632	10,535	86,611
4	0,490	8,167	94,779
5	0,291	4,846	99,625
6	0,023	0,375	100

Based on Table 4, it shows that there are 2 components that have an eigenvalue of more than 1, namely components 1 and 2 with eigenvalues of 3,349 and 1,216 respectively and the cumulative proportion of variability explained by these 2 factors is 76,077%, which means that with only 2 factors it can explain the original variable of 76,077%.

c. Communalities value

The communalities value shows the percentage of variability in factors affecting public health in Indonesia in 2023 against the original variables presented in Table 5 below.

Table 5. Attraction Factor

Variable	Initial	Extraction
Life Expectancy (X_1)	1,000	0,669
Percentage of <6-month-old babies who get exclusive breastfeeding (X_2)	1,000	0,623
Poverty Percentage (X_3)	1,000	0,949
Prevalence of Food Consumption Inadequacy (X_4)	1,000	0,620
Number of Medical Workers (X_5)	1,000	0,744
Poverty Depth Index (P1) (X_6)	1,000	0,958

Based on Table 5, it shows that the percentage of variability that can be explained by X_1, X_2, X_3, X_4, X_5 and X_6 to the origin variable is 66,9%, respectively; 62,3%; 94,9%; 62,0%; 74,4% and 95,8%.

d. Component Grouping

The results of the grouping of components of factors that affect public health in Indonesia in 2023 with a rotated component matrix which aims to clarify the variables that fall into the steepest category, whereby looking at the resulting correlation, the larger one per variable is selected so that it is presented as follows.

Table 6. Rotated Component Matrix

Variable	Component	
	1	2
Life Expectancy (X_1)	-0,811*	0,106
Percentage of <6-month-old babies who get exclusive breastfeeding (X_2)	-0,575*	0,541
Poverty Percentage (X_3)	0,845*	0,485
Prevalence of Food Consumption Inadequacy (X_4)	0,787*	-0,042
Number of Medical Workers (X_5)	-0,492	0,708*
Poverty Depth Index (P1) (X_6)	0,886*	0,416

*=Correlation value on larger components variable

Based on Table 6, it shows that the one that has the largest factor loadings value in component 1 is the variables X_1, X_2, X_3, X_4, and X_6 which means it is included in factor 1. Meanwhile, the largest factor loadings value in component 2 is the X_5 variable which means it is included in factor 2.

e. Factor Naming

The factors that have been pre-formed will be named and grouped which are presented in Table 7 below.

Table 7. Factor Naming

Factor	Variable	Information
Social Welfare and Health	X_1	Life Expectancy Rate (AHH)
	X_2	Percentage of <6-month-old babies who get exclusive breastfeeding
	X_3	Poverty Percentage
	X_4	Prevalence of Food Consumption Inadequacy
	X_6	Poverty Depth Index (P1)
Access to Healthcare	X_5	Number of Medical Workers

Table 7 shows the name of factors and their constituent components. The first factor is named the welfare and social health factor because it is related to the X_1, X_2, X_3, X_4, and X_6. The second factor is named the health service access factor because it is related to the X_5 variable.

f. Component Transformation Matrix

The matrix transformation components on the factors or components formed in the main component analysis and factor analysis are as follows.

Table 8. Component Transformation Matrix

Component	1	2
1	0,847	-0,532
2	0,532	0,847

Based on Table 8, it shows that components 1 and 2 have a correlation value of 0,847 where the value is greater than 0,5 which means that the two factors formed are said to be appropriate in summarizing the 6 variables of public health factors in Indonesia in 2023.

Conclusion

Based on the results of the analysis and discussion that has been carried out, it can be concluded that the characteristics of the data using the boxplot show that the factors that affect public health in Indonesia in 2023, namely most of the variables, have a large diversity of data because the boxplot field is quite wide. The results of the examination and testing of the assumptions of factor analysis were obtained, namely that the data on public health factors in Indonesia in 2023 met the assumptions of normal distribution, dependent variables, data adequacy, and correlation between significant variables. The results of the main component analysis (PCA) and factor analysis were obtained, namely data on public health factors in Indonesia in 2023, showing that the factors formed were two factors, namely socio-economic conditions and general health and food security.

The suggestion for the next research is to use other variables or add variables that may be more relevant and in accordance with future conditions. In addition, for readers to be able to use the results of this research can be used as one of the guidelines for further research. Suggestions for relevant agencies can pay more attention to increasing or decreasing variables that affect the factors formed, namely socio-economic and general health conditions as well as food security in the community so that public health can be maintained.

References

A. A. Miranda, Y. A. (2008). New Routes from Minimal Approximation Error to Principal Components. Neural Processing Letters, Springer.

Andriani, A., & Amal, M. F. (2018). Uji Asumsi Normalitas Multivariat.

Aprilianti, R., Messakh, G. C., Asiah, S. N., & Nohe, D. A. (2022). ANALISIS REGRESI DATA PANEL PADA KASUS PERSENTASE KEMISKINAN DI KALIMANTAN TIMUR. *Prosiding Seminar Nasional Matematika Dan Statistika*, *2*.

Delsen, M. S. N. van, Wattimena, A. Z., & Saputri, S. (2017). PENGGUNAAN METODE ANALISIS KOMPONEN UTAMA UNTUK MEREDUKSI FAKTOR-FAKTOR INFLASI DI KOTA AMBON. *BAREKENG: Jurnal Ilmu Matematika Dan Terapan*, *11*(2), Article 2.

Dwi Binuko, R. S., & Fauziyah, N. F. (2024). Pengaruh Faktor Ekonomi dan Sosial Terhadap Akses Pelayanan Kesehatan di Rumah Sakit. *Jurnal Manajemen dan Administrasi Rumah Sakit Indonesia (MARSI)*, *8*(2), 123–134.

Hasugian, A. R. (2023). FACTORS AFFECTING INDONESIAN PUBLIC HEALTH CENTERS' HEALTH WORKERS' INCOME ADEQUACY. *Indonesian Journal of Health Administration*, *11*(1), 4–12. https://doi.org/10.20473/ijha.v11i1.2023.4-12

Indonesia, B. P. S. (2023). *Profil Statistik Kesehatan 2023*. https://www.bps.go.id/id/publication/2023/12/20/feffe5519c812d560bb131ca/profil-statistik-kesehatan-2023.html

Lewith, G. T., Jonas, W. B., & Walach, H. (2010). Clinical Research in Complementary Therapies: Principles, Problems and Solutions. Elsevier Health Sciences, 354.

Malingkas, V. V., Tulusan, F. M. G., & Londa, V. Y. (2018). *PENGARUH KUALITAS TENAGA MEDIS TERHADAP PELAYANAN KESEHATAN (Di Puskesmas Kecamatan Ratahan Kabupaten Minahasa Tenggara)*.

Maulidya. (2007). Perbandingan Analisis Diskriminan dan Regresi Logistik. UNS.

Noviatiningsih, A. (2019). Associated factors of anemia incidences in adolescent girls at guntung manggis public health center working area Banjarbaru City. *Indian Journal of Public Health Research and Development*, *10*(10), 832–835. https://doi.org/10.5958/0976-5506.2019.02922.X

Ramadhani, E., Salwa, N., & Mazaya, M. S. (2020). Identifikasi Faktor-Faktor yang Memengaruhi Angka Harapan Hidup di Sumatera Tahun 2018 Menggunakan Analisis Regresi Spasial Pendekatan Area. *Journal of Data Analysis*, *3*(2), Article 2.

Sakundarno, M. (2014). Risk factors for leptospirosis infection in humans and implications for public health intervention in indonesia and the Asia-Pacific region. *Asia-Pacific Journal of Public Health*, *26*(1), 15–32. https://doi.org/10.1177/1010539513498768

Saputri, V. V. (2023). FACTORS INFLUENCING PATIENTS' REVISIT INTENTION TO PUBLIC HEALTH CENTER DURING COVID-19 PANDEMIC. *Indonesian Journal of Health Administration*, *11*(1), 57–66. https://doi.org/10.20473/jaki.v11i1.2023.57-66

Santoso, S. (2012). Panduan Lengkap SPSS Versi 20. (Jakarta: PT Elex Media).

Sari, Y. R., Yuviska, I. A., & Sunarsih, S. (2020). FAKTOR-FAKTOR YANG MEMPENGARUHI PEMBERIAN ASI EKSKLUSIF PADA BAYI USIA 0-6 BULAN. *JKM (Jurnal Kebidanan Malahayati)*, *6*(2), Article 2.

Solana, A. (2022). Analisis Spasial Faktor-Faktor yang Mempengaruhi Prevalensi Ketidakcukupan Konsumsi Pangan di Indonesia Tahun 2020. *Seminar Nasional Official Statistics*, *2022*(1), Article 1.

Triono, T. A., & Sangaji, R. C. (2023). Faktor Mempengaruhi Tingkat Kemiskinan di Indonesia: Studi Literatur Laporan Data Kemiskinan BPS Tahun 2022. *Journal of Society Bridge*, *1*(1), Article 1.

Wahid, W. W. C. (2022). The Urban Environment and Public Health: Associations between COVID-19 Cases and Urban Factors in Semarang City, Central Java, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *1111*(1). https://doi.org/10.1088/1755-1315/1111/1/012067

Wardani, R. (2023). *Statistika dan Analisis Data*. Deepublish.