

Cluster Analysis of the Productivity of Nurses' Work

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Abstract

Productivity is a measure of performance, including effectiveness and efficiency. The importance of work productivity for nurses includes its evaluation role in contributing to continuous improvement. The purpose of this study is to determine the classification of nurses in clusters based on work productivity in the inpatient room. It is an analytic study with a cross-sectional design. The study sample were 130 nurses in the inpatient room at the Bengkulu Provincial Hospital, selected using the proportional random sampling technique. A questionnaire was employed for the data collection. Data analysis was performed univariately, and multivariately with cluster analysis. The study results involved clusters I-III, which comprised nurses with high, medium and low work productivity. The variables of motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic, and work discipline have a significant effect on the formation of the cluster ($p < 0.001$). Cluster I comprised 69 nurses, cluster II 53 nurses and cluster III eight. A need is shown for clarity of organizational structure, job descriptions, the granting of authority and responsibility, creation of a work system that encourages innovation, provision of facilities, clarity of Nursing Care Standard (NCS), work guidelines, and Standard Operational Procedure (SOP).

Keywords: cluster analysis, nurses, work productivity

Abstrak

Analisis Klaster Produktivitas Kinerja Perawat. Produktivitas merupakan salah satu alat ukur kinerja, termasuk efektivitas dan efisiensi. Produktivitas menjadi penting bagi perawat karena menjadi tolak ukur dalam evaluasi untuk perbaikan yang berkelanjutan. Tujuan penelitian ini adalah untuk mengetahui klasifikasi perawat dalam klaster berdasarkan produktivitas kerja di ruang rawat inap dengan menggunakan jenis penelitian analitik dan desain studi cross-sectional. Sampel pada penelitian adalah 130 perawat pelaksana di ruangan rawat inap di Rumah Sakit Provinsi Bengkulu, diambil dengan teknik *proportional random sampling*. Pengumpulan data menggunakan kuesioner. Analisis data dilakukan secara univariat dan multivariat dengan analisis klaster. Hasil penelitian terdiri dari klaster I-III yang menunjukkan perawat dengan produktivitas kerja tinggi, sedang, dan rendah. Variabel motivasi, manajemen, lingkungan kerja, kesempatan berprestasi, iklim kerja, penghasilan, beban kerja, etos kerja, dan disiplin kerja berpengaruh signifikan terhadap terbentuknya klaster ($p < 0,001$), dan jumlah anggota klaster I adalah 69 perawat pelaksana, jumlah anggota klaster II adalah 53 perawat pelaksana, sedangkan jumlah anggota klaster III adalah 8 perawat pelaksana. Perlunya kejelasan struktur organisasi, uraian tugas, pemberian wewenang, dan tanggung jawab, dapat menciptakan sistem kerja yang mendorong inovasi, penyediaan fasilitas yang mendukung kinerja, kejelasan standar asuhan keperawatan, pedoman kerja, dan standar operasional prosedur.

Kata Kunci: analisis klaster, perawat, produktivitas kerja

Introduction

The contribution of nursing to the quality of health services depends on management, and one measure of the success of good nursing services is the level of nurses' productivity in

providing effective care to patients and their families. Awareness of patient safety is very important and influences positive attitudes towards hospitals (Nurumal et al., 2020). Productivity is a cultural, logical attitude to work and life, whose goal is to work smarter to achi-

even a better life (Iranzadeh & Tahouni, 2014). Productivity in nursing organizations is realized through the provision of nursing care, which guarantees quality and quantity based on predetermined standards, as well as effectiveness and efficiency (Siagian, 2013).

Nurses' work productivity is one of the biggest challenges for managers of health organizations and is aimed at improving service quality and reducing costs (Navidian et al., 2014). Productivity can be seen from two dimensions, namely the individual and organizational. The individual considers the productivity of nurses in relation to their individual personality characteristics that appear in the form of mental attitudes and imply the desires and efforts of individual nurses who are always trying to improve the quality of their knowledge. On the other hand, the organizational dimension considers the productivity of nurses within the framework of the technical relationship between inputs and outputs. From this point of view, an increase in work productivity in a hospital is not only seen from the quality aspect, namely the increase in the progress of nurses, but is also based on the satisfaction of patients, the recipients of services (Masram & Mu'ah, 2015).

The importance of nurses' work productivity is that it provides evaluation material to make continuous improvements to all hospital components, thus improving the quality of outcomes. A consequence of hospitals with low productivity will be a decrease in the number of patients due to the low quality of services provided, as patients will move to other hospitals that have higher work productivity and service quality (Siagian, 2013).

According to Sedarmayanti (2016), the factors that influence work productivity are motivation, income level, work environment, achievement opportunities, management, and nutritional status. Simanjuntak (2015) states that there are several factors that affect employee work productivity, namely training, the mental and physical abilities of employees, and the rela-

tionship between superiors and subordinates. The research of Putri et al. (2014) also shows that the work productivity of nurses is influenced by factors of motivation, training, work climate, and salary. Altakroni et al. (2019) also show that the work productivity of nurses can be influenced by marital status. Married nurses were associated with a 1.66 point decrease in productivity index scores compared to nurses who had never married.

The results of Hermansyah and Riyadi's (2018) research at RSUD Dr. M. Yunus Bengkulu show that the average work productivity score of nurses was 184.13, with a standard deviation of 20.230 (scores of 0 – 260); and that there was a relationship between work climate ($p = 0.008$), workload ($p < 0.001$), work ethic ($p < 0.001$), and work discipline ($p < 0.001$) with nurses' work productivity. Four factors affect the work productivity of nurses in hospital inpatient rooms: work support (37.72%), the reward system (15.55%), job demand (12.32%), and characteristic factor Individual such as age, education, length of work and training (8.36%). The most influential factor on the work productivity of nurses in the inpatient room of RSUD Dr. M. Yunus Bengkulu was that of job demands (OR = 2.280 (95% CI: 1.123 – 4.630)). The purpose of our study is to classify nurses in clusters based on work productivity.

Methods

A cross-sectional design was used. The research population was all the nurses at Hospital Y Bengkulu Province in 2019, a total of 240. The research sample amounted to 130 nurses, who were selected using the proportional random sampling technique. Data were collected using a questionnaire to measure the factors that affect work productivity (age, education, training, length of work experience motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic, and work discipline) using a rating scale of 0 – 10. The questionnaire was adopted from the research of Fajariadi (2014) and

Susanti (2014), and had been tested for validity and reliability. The calculated *r* value of all the statements on the questionnaire was greater than the value of the *r* table (0.44), meaning all the questionnaire items were valid. In the reliability test, Cronbach's alpha value was 0.966 > 0.8 (Fajariadi, 2014).

Data analysis was performed univariately, with multivariate analysis also conducted through cluster analysis on the variables of age, education, training, length of work experience, motivation, management, work environment, opportunity for achievement, work climate, income, workload, work ethic, and work discipline, all of which affect the work productivity of nurses. The research passed the research ethics test stage at the Research Ethics Committee of the Bengkulu Ministry of Health Poltekkes, and obtained a statement showing it to be free from research ethical problems, with the number DM.01.04/010/8/2019.

Results

Table 1 shows that the average age of the respondents is 35.68, which is in the productive age range, and their average length of education is 4.3 years, which shows that the education of the nurses is up to Bachelor of Nursing/*Ners* refer to work experience and training, average duration of training is 27.43 hours.

Table 2 shows the average management score is 120.04, the average work environment score is 109.58, the average work climate score is 152.37, the average work ethic score is 93.7, and the average score for the work discipline of

the nurse is 80.78. This value is very different from the mean value of the variable score, so it can be concluded that the nurse at RSUD Y Bengkulu Province has a very good opinion about the management, work environment, work climate, work ethic, and work discipline in the hospital.

Assumption Test. The sample taken can truly represent the existing population. The Kaiser-Mayer-Olkin test is conducted to determine the adequacy of a sample. If the KMO value ranges between 0.5 and 1, the sample can be said to represent the population or is a representative sample. The results of the analysis show that the KMO value = 0.775 > 0.5, meaning that the sample can represent the population and the variables can be used for further analysis.

Multicollinearity Assumption. Multicollinearity is the existence of a perfect or definite linear relationship between some or all of the variables. It is better if this does not occur and there is no multicollinearity between the variables. One way to identify the presence of multicollinearity is to calculate the variance inflation factor (VIF). Based on the results of the analysis, it was established that the VIF value for all the variables is < 10 and that they all have a tolerance value of > 0.10. This means that no variables indicate multicollinearity.

Table 3 shows that the variables of age, education, motivation, management, work environment, opportunities for achievement, work climate, income, workload, work ethic, and work discipline have the greatest average cluster distances in cluster 1; that the training variable has

Table 1. Distribution of Respondents Based on Characteristics (Age, Education, Length of Work Experience and Training)

Variable	Mean	Standard Deviation	Minimum	Maximum
Age	35.68	4.956	24	52
Education (years)	4.3	0.945	3	5
Length of Work (years)	10.86	4.345	3	30
Training (hours)	27.43	117.251	0	960

Table 2. Distribution of Respondents Based on Motivation, Management, Work Environment, Achievement Opportunities, Work Climate, Income, Workload, Work Ethic, and Work Discipline, and Work Productivity

Variable	Mean	Standard Deviation	Minimum	Maximum
Motivation	94.12	20.052	29	136
Management	120.04	24.523	16	231
Work Environment	109.58	18.3	32	130
Opportunities for Achievement	43.75	19.483	0	80
Work Climate	152.37	24.701	26	190
Income	32.39	11.701	0	50
Workload	57.2	15.057	12	80
Work Ethic	93.7	16.14	28	120
Work Discipline	80.78	13.728	14	100
Work Productivity	184.13	20.230	133	265

Table 3. Final Results of the Average Distance of Nurses' Work Productivity to the Clusters

Variable	Cluster		
	1	2	3
Zscore (Age)	0.11043	-0.11530	-0.18860
Zscore (Education)	0.06592	-0.03792	-0.31732
Zscore (Training)	-0.12938	0.20327	-0.23075
Zscore (Length of Work Experience)	0.01852	-0.07669	0.34831
Zscore (Motivation)	0.58291	-0.44839	-2.05707
Zscore (Management)	0.45881	-0.24854	-2.31061
Zscore (Work Environment)	0.42622	-0.16247	-2.59980
Zscore (Opportunity for Achievement)	0.68773	-0.76270	-0.87879
Zscore (Work Climate)	0.61813	-0.46791	-2.23145
Zscore (Income)	0.54738	-0.55922	-1.01637
Zscore (Workload)	0.15709	0.01930	-1.48273
Zscore (Work Ethic)	0.17483	0.03963	-1.77048
Zscore (Work Discipline)	0.22577	0.08716	-2.52469

an average large cluster distance in cluster 2; while the length of work variable has the largest average cluster distance in cluster 3. A negative value (-) means the data are below the total average, while a positive value (+) means the data are above the total average.

The average value in the cluster can be calculated based on the score of the average value of the distance to the center of the cluster, with the formulation: $x = \mu + z\sigma$, where x is the sample mean, μ is the population average, σ is the standard deviation, and z is the standardization value of the average distance to the cluster cen-

ter. This can be exemplified as follows:

Average age of cluster I: $35.68 + (0.11043 \times 4.956) = 36.23$.

Average age of cluster II: $35.68 + (-0.11530 \times 4.956) = 35.11$

Average age of cluster III: $35.68 + (-0.1888 \times 4.956) = 34.75$

The clusters can be interpreted as follows:

Cluster I. Cluster I contains nurses whose age, education, length of work, perceptions of motivation, management, work environment, achieve-

ment opportunities, work climate, income, workload, work ethic and work discipline are above the average population, but have had less training hours than the population average. Nurses who are in cluster I have high work productivity.

Cluster II. Cluster II contains nurses whose age, education, length of work, perceptions of motivation, management, work environment, opportunities for achievement, work climate, and income are below that of the average population, but whose hours of training, perceptions of workload, ethos work and work discipline are above the average population. Nurses in cluster II have moderate work productivity.

Cluster III. Cluster III consists of nurses whose age, education, training hours, perceptions of motivation, management, work environment, achievement opportunities, work climate, earnings, workload, work ethic and work discipline

are lower than the average population, but have longer working period than the average population. Nurses in cluster III are nurses have low work productivity.

Table 4 shows that the variables of motivation, management, work discipline have a value of $p = 0.000 < 0.05$, meaning that they significantly influence the formation of clusters. The largest F value is in the work climate variable (96.499), with a p value of 0.000, meaning that the perceptions of the nurses in the inpatient room of the work climate at Hospital Y Bengkulu Province are very different from the characteristics of the three clusters. It can be explained that the perceptions of the implementing nurses in the inpatient room of the work climate are very different from one cluster to another. A very small F value and p value of > 0.05 in the variables of age, education, training, and length of work indicate that these variables in the three clusters are very similar.

Table 4. Variable Differences in Each Work Productivity Nurse Cluster

Variable	F	p
Zscore (Age)	0.914	0.403
Zscore (Education)	0.587	0.557
Zscore (Training)	1.912	0.152
Zscore (Length of Work Experience)	0.649	0.524
Zscore (Motivation)	70.684	0.000
Zscore (Management)	56.101	0.000
Zscore (Work Environment)	70.799	0.000
Zscore (Opportunity of Achievement)	74.507	0.000
Zscore (Work Climate)	96.499	0.000
Zscore (Income)	34.617	0.000
Zscore (Workload)	11.179	0.000
Zscore (Work Ethic)	17.021	0.000
Zscore (Work Discipline)	47.065	0.000

Tabel 5. Number of Members in each Nurse Work Productivity Cluster

Cluster	Number of Members	Percentage (%)
Cluster I	69	53.1%
Cluster II	53	40.8%
Cluster III	8	6.1%
Total	130	100%

Table 6. Education Type Based on Nurses' Work Productivity Cluster

Variable	Cluster			Total	
	1	2	3		
Education	Health Nurse Senior High School (SPK)	0	1	1	2
		0.0%	50.0%	50.0%	100.0%
	Nursing Diploma 3/ (DIII keperawatan)	21	18	3	42
		50.0%	42.9%	7.1%	100.0%
Nursing Diploma 4 (DIV keperawatan)		2	1	0	3
		66.7%	33.3%	0.0%	100.0%
Nursing Bachelor/Nursing Profession (S1 kep/Ners)		46	33	4	83
		55.4%	39.8%	4.8%	100.0%

Table 7. Training Description Based on Nurses' Work Productivity Clusters

Variable	Cluster			Total	
	1	2	3		
Training	Never	48	34	6	88
		54.5%	38.6%	6.8%	100.0%
	Ever	21	19	2	42
		50.0%	45.2%	4.8%	100.0%

Table 5 shows that the number of cluster I members is 69 nurses, the number of cluster II members is 53 nurses and the number of cluster III members is 8 nurses. It can be seen that the most respondents are in cluster I, while the least respondents are in cluster III, with no missing variables. Thus, all respondents were 130 people, completely mapped to the three clusters.

Validation and Cluster Profiling of Nurse Work Productivity. The formed clusters were tested for their validity. A profiling process was then performed to explain the characteristics of each cluster based on a particular profile. In the research, a profile process was conducted with various other variables characterized by normal data, namely cross-tabulated education and training variables, formed by cluster results (QCL-1/Cluster).

Table 6 shows that for nurses with an SPK education, 1 half (50%) all members of clusters 2 and 3, with none in cluster 1; of nurses with DIII Nursing education, 50% were members of cluster 1, with the remainder in cluster 2 and 3; of nurses with DIV Nursing education, more

than half (66.7%) belonged to cluster 1, with the remaining one in cluster 2, but none in cluster 3. Finally, amongst the nurses with S1 Nursing/Nursing education, more than half (55.4%) belonged to cluster 1, with the remainder in clusters 2 and 3.

Table 7 shows that more than half (54.5%) of nurses who had never trained were members of cluster 1, with the remainder in clusters 2 and 3. With regard to nurses who had attended training, 50% were members of cluster 1, and the rest in clusters 2 and 3.

Discussion

Characteristics of the Nurses. Age is one of the personnel factors that affects work productivity (Ilyas, 2014). The results show that the average age of the respondents was 35.68, with a standard deviation of 4.956 years. This is in line with Fajariadi's (2014) research, in which 40% of the nurses were between 31 and 40 years old. However, the figure differs with the research of Putri et al. (2014), who showed that most (77.5%) nurses were 20 – 30 years old.

The results show that the average length of all education of the respondents was 4.3 years, with a standard deviation of 0.945 years. According to Siagian (2013), the higher a person's education, the greater their desire to utilize their knowledge and skills. According to Kurniawan (2016), continuing education is very important and that it is the responsibility of hospital leaders to provide opportunities for their staff to obtain higher education in accordance with their professional needs, which will have an impact on hospital services. The results show that the average length of service of the respondents was 10.86 years, with a standard deviation of 4.345 years. According to Siagian (2013), the length of work will affect a person's experience; the longer they work, the more experience they will have, meaning that work productivity can increase. The results of this study are in line with Fajariadi's (2014) research, in which more than half (56.7%) of nurses had 5 years of service. The results also show that the average length of the respondents' training was 27.43 hours, with a standard deviation of 117.251 hours. Training is part of the educational process to acquire knowledge and skills (Notoatmodjo, 2011).

Cluster Analysis of Nurses' Work Productivity in the Hospital Inpatient Room. Based on the results of determining the cluster center using the K-means cluster method, it was found that the variables of age, education, motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic, and work discipline had the highest average cluster distance that is 4.05522 in cluster 1. The training variable had the highest average cluster distance in cluster 2, while the length of work variable had the highest average cluster distance in cluster 3. The results also show that cluster I contained nurses who had above average age, education, length of work, perceptions of motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic and work discipline, but had fewer hours of training than the population average. From the characteristics of cluster I, it can be assumed that the nurses in

this cluster are ones with high work productivity.

Cluster II contained nurses whose age, education, length of work, perceptions of motivation, management, work environment, achievement opportunities, work climate, and income were lower than the population average, but who had training hours, perceptions of workload, work ethos and work discipline above the population average. From the characteristics of cluster II, it can be assumed that the nurses in the cluster have moderate work productivity.

Cluster III contained nurses whose age, education, training hours, perceptions of motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic and work discipline were lower than the population average, but who had longer working period. Work above the population average. From the characteristics of cluster III, it can be assumed that the nurses have low work productivity.

The results show that the variables of motivation, management, work environment, achievement opportunities, work climate, income, workload, work ethic, and work discipline had a significant effect on the formation of clusters ($p = 0.000$). They also show the F value of the work climate 96.499 ($p = 0.000$), which means that the perceptions of nurses in the inpatient room of the work climate at Hospital Y Bengkulu Province greatly differentiate the characteristics of the three clusters (the highest F value). this can be explained by the fact that the perceptions of the nurse in the inpatient room of the work climate at Hospital Y Bengkulu Province are very different from one cluster to another. Nurses' perceptions of the work climate in cluster I (high work productivity) are very good, while in cluster 2 they are good, and in cluster III not good. The results of this study are different from those of Hermansyah and Riyadi (2018), which showed that the most influential factor on the work productivity of nurses in the inpatient room of Hospital RSUD Dr. M. Yunus

Bengkulu was the factor of job demands (OR = 2.280 [95% CI : 1.123 – 4.630]).

The very low F and p-values of > 0.05 for the variables of age, education, training and length of work indicate that these variables in the three clusters are very similar. With this composition, with cluster I being the largest, it is indicated that making changes and improving service quality can be focused on this group.

In the profiling process, cross tabulation between education and training variables, and the variables formed as cluster results (QCL-1/Cluster), was performed. In the table cross between education and clusters, if we consider the number of respondents per column, cluster I is dominated by nurses with DIV Nursing education, cluster II by nurses with DIII Nursing education and cluster III by nurses with SPK education. Therefore, if we want to improve the service quality and performance of the nurses in the inpatient room, the educational levels in each cluster could be focused on. In the cross table between training and clusters, if considering the number of respondents per column, there are more nurses who have never attended training in clusters I and III, while cluster II it is dominated by nurses who have attended training. Consequently, to improve the quality of service and performance of nurses in in the inpatient room, focus could be on providing training to nurses who have never attended training in clusters I and III.

Conclusion

The findings of this study indicate that making changes and improving the quality of service could be achieved by increasing the level of education and training for nurses. As a result of their enhanced knowledge and skills, the quality of services provided should improve.

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