Original Article

A Quasi-Experimental Study to Assess the Effectiveness of Self-Care Measures on Pulmonary Functions among Petrol Pump Workers at Selected Petrol Pumps, Muzaffarnagar

K. Nalini Devi[1], C. Susila[2]

[1]Professor cum Vice Principal, Muzaffarnagar Nursing Institute, Muzaffarnagar, Uttar Pradesh, India, [2]Principal, Billroth College of Nursing, Chennai, Tamil Nādu, India.

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ABSTRACT

Background: Petrol pumps in India instead of being self-serviced, employ workers, increasing the opportunity for ex-posture to petroleum vapors and vehicular exhaust. This causes various health problems, particularly within lungs.

Material and methods: Quasi Experimental with time series design was used to conduct this study, non-Probability convenient was adopted to select the petrol pump workers. 50 petrol pump workers were selected in experimental group and 50 petrol pump workers were selected in control group.

Result and findings: It is revealed that, FVC scores between the group (F=28.79, and p=0.001) and within the interventional group (F=61.80, and p=0.001) were statistically significant and in control group (F= 2.51, and p=0.11) were not statistically significant and FEV1 scores between the group (F=11.50, and p=0.001) and within the interventional group (F=58.17, and p=0.001) and within control group (F= 19.89, and p=0.001) were statistically significant. The findings indicated FVC and FEV1 among PPW, improved after the intervention. There was a significant association between selected demographic variables and pulmonary functions of PPW between the study and control group**.**

Conclusion: The comparison of pre & post test scores on pulmonary functions of experimental and control group showed that, in the experimental group the post test scores were increased. It proved that the SCM on pulmonary functions was effective.

Keywords: petrol fumes, pulmonary functions, Self-care measures, Petrol pump workers.

INTRODUCTION

Fast urbanization trends have resulted in an exceedingly tremendous rise within the range of transportation vehicles, thereby resulting in the raised want of fuel. This increase in demand of fuel has led to a gradual rise within the range of fuel pumps within the country.[1]

To meet current demand, there are numerous filling stations getting established and there is an increased recruitment of workers. At these filling station, like, foreign country, there is no facility of self-service and the fuel filling workers are employed to fuel the vehicles. These fuel dispensers work

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Corresponding author: K.Nalini Devi1, Professor cum Vice Principal, Muzaffarnagar Nursing Institute, Muzaffarnagar, Uttar Pradesh,India,

E.mail: mahathiraja2008@gmail.com

continuously for 8-12 hours each day without using any protective devices.[2]Apart from refueling vehicles, these workers also do all types of work like unloading of fuel and daily checking of fuel levels within the storage tanks, checking the pressure in vehicle tyres.[3]

Atmospheric concentration of gasoline vapor (approximately 2000 parts per million) is unsafe when inhaled even briefly. During fueling of vehicles, the concentration of gasoline vapor within the air is between 20 and 200 ppm.[4]The combined effects of the atmospherically concentration of hydrocarbon vapor and exhaust from vehicles could finish in accelerated decline of respiratory organ function.[5]

Review of literature revealed that lung function is decreased among petrol pump workers and have lack of knowledge on self-care measures to prevent respiratory problems due to occupational exposure to petrol. Many researchers suggested conducting awareness programmes of PPE. But interventions were not executed to find the effectiveness of PPE and diaphragmatic breathing on pulmonary functions among PPW. Therefore, the researcher felt that there was a need to implement self-care measures (SCM) like use of protective masks and diaphragmatic breathing exercise among Petrol Pump Workers (PPW) to scale back the impairment of pulmonary functions.

OBJECTIVES

1. To assess the level of pulmonary functions among PPW in both groups.
2. To assess the effectiveness of Self Care Measures on pulmonary functions among PPW
3. To find out the association of pulmonary functions among PPWwith their selected demographic variables in both groups.

HYPOTHESES

1. $\mathbf{H_1}$ -There will be a significant difference between pre-test and post-test score of pulmonary functions among PPW.
2. H_2 -There will be a significant association between selected demographic variables and pulmonary functions of PPW.

MATERIALS AND METHODS

Research Approach

Quantitative Research Approach

Research design

Quasi Experimental with time series design

Setting

The setting of the study is selected petrol pumps at Muzaffarnagar District.

Population

The population of the study is Petrol pumps workers.

Sample and Sample size

Sample

Petrol pumps workers who fulfil the sampling criteria are the samples.

Sample size

100 PPW who fulfilled inclusion criteria were allotted into 2 groups (50 PPW in Study group and 50 PPW in Control Group) conveniently.

Sampling technique

Non-Probability convenient sampling

Inclusion Criteria

- PPW who were available and willing to participate in study.
- PPW who had been working for more than one year and 8 -12 duty hours per day.
- PPW who knew Hindi to read, write, understand and speak.

Exclusion Criteria

- PPW who were not available and not willing to participate in study.

- PPW who had participated in pilot study.
- History of major cardiac, pulmonary and abdominal surgery
- History of Pulmonary tuberculosis and COVID-19
- History of chronic respiratory disease and cardiac disease
- History of smoking

Development of the tool

Tool for study were developed by personal and experts' opinions. A structured questionnaire, Spirometry and Pulse Oximetry were selected to assess the effectiveness of self-care measures on Pulmonary functions among petrol pump workers.

DESCRIPTION OF THE TOOL:

The tools used for the present study consist of three parts.

Part - I: Structured questionnaire for demographic variables

It includes Age, Gender, Education, marital status, Duration of work in years, Duty hours and Using of Personal Protective Equipments.

Part – II: Spirometry

Spirometry, a PFT, estimates a person's air exhalation rate and volume. The interpretation of spirometry data depends on two measurements particularly, **FVC** and **FEV1**, FVC reflects the amount of air that can be exhaled after taking a deep breath and measures the size of the lungs (in litres) and FEV1 measures the amount of air that can be expelled after a long intake in one second.

Table 1 : Gradation of the Severity according to American Thoracic society Guidelines

Severity	*FEV1*
Mild	>70%
Moderate	60% - 69%
Moderate to severe	50% - 59%
Severe	35% - 49%
Very severe	< 35%

The percentage of the lung volume that can be expelled in one second is represented by the FEV1/FVC ratio. Tables 1 and 2).

Table 2: Grading the severity of Restrictive Lung Disease

Severity	*FVC*
Mild	60% - 80%
Moderate	45% - 60%
Severe	<45%

According to the GOLD Guidelines, a ratio of FEV1/FVC < 70% (actual value) is termed as an Obstructive abnormality.

Part - III: Pulse oximeSEtry

Pulse oximetry is a noninvasive and painless test that measures the amount of oxygen being carried in blood, as a percentage.

Table- 3: Scores of Pulse Oximetry

Oxygen Saturation Level	
Interpretation	*SPO_2 %*
Normal	95 -100
Mild hypoxemia	91- 94
Moderate hypoxemia	86 -90
Severe hypoxemia	< 85

Validity of tool

The tool was validated after obtaining the valuable opinions and suggestions from the eight experts in the field of nursing and medicine.

Ethical Considerations

- Ethical clearance and permission were obtained from the institutional ethical committee, Bareilly international university.
- A written letter seeking permission to conduct the study was obtained from manager of petrol bank, Muzaffarnagar, Uttar Pradesh.
- A written informed consent was taken from participants for their participations in the study.
- Confidentiality was maintained.

Data Collection Procedure

The participants of researc04h study were explained about the purpose of research and objectives of the study. Written consent was taken from them for their participation in the study. In both groups structured demographic variables questionnaire, spirometry and pulse oximetry were administered to assess pre-test level of pulmonary functions. Self-care measures were demonstrated by researcher to study group through video assisted teaching for a week. After the intervention, follow up with reinforcement was given by the investigator every 15 days until post-test II till 6 months for study group. Control group did not receive any interventions throughout intervention period. The post-tests were carried out to study group and control study by the investigator at 3rd month and 6th month.

DATA ANALYSIS AND INTERPRETATION (Table 4 TO 7)

Table 4: Frequency and percentage distribution of baseline socio-demographic variables of PPW in the interventional group and control group (N = 100)

S. No	Socio-demographic VariableZs	Interventional group (n=100)		Control group (n=100)		Chi square (χ2) & p Value
1	**Age in years**					
	18-27	25	50.0	22	44.0	χ2=6.64 p=0.67 (NS)
	28-37	17	34.0	14	28.0	
	38-47	7	14.0	10	20.0	
	More than 47	1	2.0	4	8.0	
2	**Gender**					χ2=0.08 p=1.00 (NS)
	Male	48	96.0	48	96.0	
	Female	2	4.0	2	4.0	
3	**Education**					
	High School	26	52.0	27	54.0	χ2=3.62 p=0.45 (NS)
	Intermediate	20	40.0	20	40.0	
	Undergraduate	4	8.0	3	6.0	
4	**Marital status**					
	Married	39	78.0	36	72.0	χ2=1.76 p=0.77 (NS)
	Unmarried	10	20.0	13	26.0	
	Others	1	2.0	1	2.0	
5	**Duration of work in years**					
	≤ 5 Years	6	12.0	5	10.0	χ2=9.75 p=0.37 (NS)
	6-10	28	56.0	24	48.0	
	11-15	5	10.0	7	14.0	
	More than 15	11	22.0	14	28.0	

Continue table. 4.....

S. No	Socio-demographic VariableZs	Interventional group (n=100)		Control group (n=100)		Chi square (χ2) & p Value
6	**Duty Hours/day**					χ^2=10.49 p=0.31 (NS)
	<8	18	36.0	15	30.0	
	8-10	19	38.0	22	44.0	
	11-12	9	18.0	9	18.0	
	>12	4	8.0	4	8.0	
7	**Use of PPE**					χ^2=0.02 p =1.00 (NS)
	Yes	4 9	98.0	49	98.0	
	No	1	2.0	1	2.0	
8	**SPO2**	97.4 ± 1.0		97.1 ± 1.1		t=1.06, p=0.28(NS)
9	**Weight (Kgs)**	61.0 ± 10.6		59.5 ± 12.4		t=0.65, p=0.51(NS)
10	**Height (Cms)**	165.6±6.8		163.5±6.1		t=1.47, p=0.14(NS)

Table 5: Effectiveness of SCM on FVC gain scores among PPW in the interventional group and control group at Post-test 2 comparing with baseline. (N=100)

Groups	Assessment Time Points	FVC score Mean±SD	Mean differences in *FVC* gain score with 95% CI	Percentage of FVC gain score comparing with baseline
Interventional	Pre-test	76.5 ± 8.2	3.0 (3.6 2.4)	3.9% (4.7% - 3.1%)
	Post-test 2	79.5 ± 8.0		
Control	Pre-test	75.6 ± 6.5	0.4 (0.9 0.09)	0.5% (1.1% - 0.1%)
	Post-test 2	76.1 ± 6.3		

Table 5 shows that round 3.4% of the FVC gain score difference was found between the groups. The impact of SCM in improvement of the FVC score was more in the interventional group compared to that of control group.

Table 6: Effectiveness of SCM on FEV1 gain scores among PPW in the interventional group and control group at Post-test 2 comparing with baseline (N=100)

Groups	Assessment Time Points	FEV1 scores Mean ± SD	Mean differences in FEV1 gain score with 95% CI	Percentage of FEV1 gain score comparing with baseline
Interven-tional	Pre-test	77.4 ± 7.0	2.7 (3.2 2.2)	3.9% (4.7% - 3.1%)
	Post-test 2	80.1 ± 7.0		
Control	Pre-test	76.3 ± 7.6	1.1 (1.6 0.6)	1.4% (2.0% - 0.7%)
	Post-test 2	77.5 ± 7.8		

Table 6 shows that around 2.5% of the FEV1 gain score difference was found between the groups. The impact of SCM in improvement of the FEV1 score was more in the interventional group compared to that of control group.

Table 7: Repeated Measures of ANOVA on FVC at different time points among PPW in the interventional group and control group.

Study Time Points	N	Interventional group Mean ± SSD	N	Control group Mean ± SSD
Pre-test	50	76.5 ± 8.2	50	75.6 ± 6.5
Post-test 1	50	77.1 ± 8.3	50	75.7 ± 8.6
Post-test 2	50	79.4 ± 8.0	50	76.1 ± 6.3
Within the group *F* and *p* value		***F*=61.80, *p*=0.001 (S)**		***F*=2.51 *p*=0.11 (NS)**
Between the group *F* and *p* value		***F*=28.79, *p*=0.001 (S)**		

(p<0.05: Significant level) S: Significant, NS: Non-Significant

The findings of table 7, indicated Forced vital capacity (FVC) among petrol pump workers, improved after the intervention. Hence researcher accepted the research hypothesis (H1)

Table 8: Repeated Measures of ANOVA on Forced expiratory volume (FEV) at different time points among petrol pump workers in the interventional group and control group

Study Time Points	n	Interventional group Mean ± SD	n	Control group Mean ± SD
Pre-test	50	77.4±7.0	50	76.3±7.6
Post-test 1	50	78.1±7.3	50	76.4±7.7
Post-test 2	50	80.1±7.0	50	77.5±7.8
Within the group *F* and *p* value		***F*=58.17, *p*=0.001 (S)**		***F*=19.89, *p*=0.001 (S)**
Between the group *F* and *p* value		***F*=11.50, *p*=0.001 (S)**		

(p<0.05: Significant level) S: Significant, NS: Non-Significant

The findings of table 8, indicated Forced expiratory volume (FEV) among petrol pump workers, improved after the intervention. Hence researcher accepted the research hypothesis (H1)

Table 9: Association between Pre-test Pulmonary functions levels of FVC with baseline socio-demographic variables of PPW in the interventional group and control group

Socio-demographic Variables	Pre-test Pulmonary functions levels of FVC							
	Interventional group (n=50)			F & *P* value	Control group (n=50)			F & *P* value
	N	Mean	SD		N	Mean	SD	
Age in years				F=2.89, p=0.04(S)				F=5.20, p=0.004 (S)
18-27	25	78.2	6.9		22	77.8	4.6	
28-37	17	77.2	8.1		14	76.7	3.7	
38-47	7	70.4	9.8		10	73.1	8.1	
More than 47	1	63.0	--		4	66.2	10.9	
Gender				F=0.001, p=0.99 (S)				F=1.37, p=0.24 (NS)
Male	48	76.5	8.4		48	75.4	6.6	
Female	2	76.5	0.7		2	81.0	4.2	
Education				F=0.007, p=0.99 (NS)				F=0.54, p=0.58 (NS)
High School	26	76.4	9.6		27	75.0	6.7	
Intermediate	20	76.5	7.3		20	76.0	6.8	
Undergraduate	4	77.0	0.8		3	79.0	2.6	
Duration of work in years				F=45.0, p=0.001 (S)				F=21.90, p=0.001 (S)
≤ 5 Years	6	91.3	8.2		5	83.0	4.3	
6-10	28	77.6	1.0		24	77.8	2.1	
11-15	5	75.2	3.7		7	78.2	6.8	
More than 15	11	66.3	6.5		14	68.0	5.6	
Duty Hours/ day				F=1.08, p=0.36 (NS)				F=0.11, p=0.74 (NS)
<8	18	75.4	4.9		15	76.8	3.3	
8-10	19	79.0	8.9		22	76.2	8.6	
11-12	9	75.4	11.5		9	71.4	4.7	
>12	4	72.2	7.6		4	77.7	2.2	
(p<0.05 Significant level, S: Significant & NS: Non-Significant)								

Table 9 shows that,in Interventional group there was a statistically significant association (p<0.05) found between Pre-test Pulmonary functions levels of FVC with baseline socio-demographic variables like age in years, gender, and duration of work in years. In control group there was a statistically significant association (p<0.05) found between Pre-test Pulmonary functions levels of FVC with baseline socio-demographic variables like age in years and duration of work in years. Hence researcher accepted the research hypothesis (H_2)

Table 10: Association between Pre-test Pulmonary functions levels of FEV1 with baseline socio-demographic variables of PPW in the interventional group and control group

	Pre-test Pulmonary functions levels of FEV1							
Socio-demographic Variables	**Interventional group (n=50)**			**F & *P* value**	**Control group (n=50)**			**F & *P* value**
	N	**Mean**	**SD**		**N**	**Mean**	**SD**	
Age in years				F=4.6, p=0.006 (S)				F=15.56, p=0.001 (S)
18-27	25	79.3	5.5		22	79.3	5.1	
28-37	17	77.4	6.3		14	79.5	6.0	
38-47	7	73.0	8.9		10	71.1	5.5	
More than 47	1	59.0	---		4	62.0	5.7	
Gender				F=0.48, p=0.82 (NS)				F=0.47, p = 0 . 4 9 (NS)
Male	48	77.3	7.2		48	76.1	7.7	
Female	2	78.5	0.7		2	80.0	1.4	
Education				F=0.21, p = 0 . 8 0 (NS)				F=1.62, p=0.29 (NS)
High School	26	76.8	7.9		27	75.0	1.5	
Intermediate	20	77.8	6.6		20	77.2	1.6	
Undergraduate	4	79.0	2.1		3	82.6	2.9	
Duration of work in years				F=16.2, p=0.001 (S)				F=18.20, p=0.001 (S)
≤ 5 Years	6	84.6	6.0		5	79.8	5.3	
6-10	28	79.3	4.2		24	80.4	4.0	
11-15	5	76.8	5.7		7	77.4	8.9	
More than 15	11	68.7	6.1		14	67.5	4.9	
Duty Hours/day				F=1.06, p = 0 . 3 7 (NS)				F=1.76, p = 0 . 1 6 (NS)
<8	18	78.2	3.8		15	79.8	4.0	
8-10	19	78.4	7.4		22	75.6	7.8	
11-12	9	75.6	9.3		9	73.3	8.2	
>12	4	72.5	10.3		4	74.0	12.7	

(p<0.05 Significant level, S: Significant & NS: Non-Significant)

Table 10 shows that, in Interventional group there was a statistically significant association ($p<0.05$) found between Pre-test Pulmonary functions levels of FEV1 with baseline socio-demographic variables like age in years and duration of work in years**.** In control group there was a statistically significant association ($p<0.05$) found between Pre-test Pulmonary functions levels of FEV1 with baseline socio-demographic variables like age in years and duration of work in years. Hence researcher accepted the research hypothesis (H_2).

Recommendations for Future Research and Suggestion

Future research is needed to determine

- Authenticated survey to be done in India to find out the real statistics of impact on health effect related to petrol fumes among PPW.
- A study can be conducted to evaluate the effectiveness of SCM on pulmonary functions on large sample.
- Large scale prevalence study on pulmonary functions among PPW can be done in national level and global level.
- Similar study can be conducted by taking samples from two different settings like, urban and rural area.

CONCLUSION

The research's findings led to the following conclusions, which were presented. The comparison of pre & post test scores on pulmonary functions of experimental and control group showed that, in the experimental group the post test scores were increased. It proved that the SCM on pulmonary functions was effective. It was also seen that there was statistically significant association between pre-test score of FVC with baseline socio-demographic variables like age in years, gender, and duration of work in years in interventional group. In control group there was a statistically significant association ($p<0.05$) found between Pre-test score of FVC with baseline socio-demographic variables like age in years and duration of work in years. In Interventional group there was a statistically significant association ($p<0.05$) found between Pre-test score of FEV1 with baseline socio-demographic variables like age in years and duration of work in years. In control group there was a statistically significant association ($p<0.05$) found between Pre-test score of FEV1 with baseline socio-demographic variables like age in years and duration of work in years. It was determined that SCM on pulmonary function was effective among PPW.

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Conflict of Interest -Nil

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