COST EFFECTIVENESS OF PRE-EMPLOYMENT PULMONARY FUNCTION SCREENING IN NEW HIRE FOR ELECTRONIC ASSEMBLY LINE WORK

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Approximately 179,400 production workers were employed in the United States in facilities that manufacture electronic components and accessories. (SIC 3672-3678).[1]

In the electronic component manufacturing industry, a wide variety of processed material are used. Mixed chemicals exposure and the by-products and synergistic actions effect biologically. Simultaneous exposure to more than one toxic agent such as III Trichloroethane, Acetone, Methylethylketone, Freon, Methylene Chloride, Lead, Flux, Tin, Thalate Esters, Epoxy Resins, Alcohol. These chemicals were used by assembly workers in different departments, like soldering, rework, touch up, plating, conforma coating, potting.

Not many in literature, but few authors, investigators postulate that the Small Airway Diseases (SAD) represents significant airway obstruction in peripheral bronchioles and as such may present an early manifestation of chronic obstructive lung disease, when it may be amenable to treatment.

Myint and Myint[2] postulated that the early findings of FEF_{25-75} impairment with mixed chemicals exposures in electronic industries.

Wright and Colleagues[4] stated that inflammatory process in small airway lining thus reduction in FEF_{25-75} volumes.

In this paper, the author discusses the findings of 275 new applicants' Pulmonary Function Tests (PFT) who were hired for electronic assembly work. Morbidity data on small airway diseases, obstructive lung diseases were analyzed. In addition, the results of visual acquity examination as to perform government contract, applicant must meet government visual standard in near, distant, depth, color and field of vision.

MATERIAL AND METHOD

During the early part of 1987, pre-employment physical examinations were done by certified occupational health physician. Besides hands-on physical, pulmonary function tests were performed by qualified and trained technician and used Jones Pulmonar II in standing position with good effort and cooperation. The standard criteria of the American Thoraxic Society 1979 was used. Results obtained were FVC, FEV_1, FEF_{25-75} and FEV_1/FVC ratio. Predicted values of Knudson were preferred. Due consideration was given to ethnic factor calculation. Seventy-five percent of the predicted value readings was taken as the normal range. The values were corrected to BTPS. The best of at least three spirograms was chosen.

The vision test was performed by Titmus vision, color test was performed by Ishihara plate, field of vision test.

RESULTS

Among 275 applicants, the majority of them were between the age group of 19–39. Non-cigarette smokers were also majority as shown in Table I, 61.81% non-smokers and 38.18% were smokers. Also Table I analyzed number of smokers and non-smokers in each group.

Table II shows abnormal pulmonary function performances: Among 170 of non-smokers 18% had small airway impairment; this could probably be from previous impairment.

Job exposure to mixed chemicals, smokers have higher incident of small airway impairment 33.33%. There were I4 mild and moderate chronic obstructive lung diseases and eight of them were disqualified for assembly work.

Figure 1 illustrates the normal pulmonary function tests (PFT). Higher numbers were observed in younger age group 19–39. As the age gets older with longer exposure history PFT abnormal findings were characteristic.

As the government contract, minimum visual acquity is 20/40 with no defect in color, depth and field of vision using the Titmus Machine. Interestingly, many applicants were not aware of their defective vision. The abnormal vision test was done with and without glasses. Author is concerned about chronic toxic solvent exposure effecting color and field of vision with toxic chemicals which have been reported in United States and European literature. Table III shows the younger age group as having high prevalence of defective distant vision, where other age group has both near and distant vision defect.

DISCUSSION

There is scarcity in literature about cost-effectiveness of Pre-employment Pulmonary Function Tests (PFT).

Table I

Pulmonary Function Testing in Different Age Groups in Pre-employment Screening of Electronic Assembly Workers, Tampa, Florida

AGE GROUP	NON CIGARETTE SMOKERS	CIGARETTE SMOKERS
19 - 29 91	55 60%	36 39.56%
30 - 39 98	68 69.38%	30 30.61%
40 - 49 54	25 46.38%	29 53.70%
50+ 32	22 68.75%	10 31.25%

Table II

Prevalent of Abnormal Pulmonary Function Performances in Cigarette Smokers and Non Smokers in Pre-employment Screening of Electrnic Assembly Workers, Tampa, Florida

AGE GROUP	FEF25-75	FVC	FEV1/FVC RATIO	PREVIOUS HISTORY OF EXPOSURE TO MIXED CHEMICAL SOLVENTS & SPRAY PAINTS
NON SMOKERS 170 61.81%	32 18%	6 3.5%	4 2.3%	
SMOKERS 105 38.18%	35 33.33%	8 7.61%	14 13.33%	TOTAL 70 41.17%
TOTAL 275	67 24.36%	14 5.09%	18 6.54%	

As mentioned in literature, small airway disease is an early indication of mixed chemical exposure; the pre-employment PFT screening is constantly worth considering.

At present litigation scenario many legal battles have been lost because claimants suffer from hypersensitivity pneumonitis due to chemical exposure. Also, claimant has been awarded because of small airway impairment because of working on assembly line in electronic industry.

High stake workers compensation expenses have been paid on Permanent Partial Disability due to Chemical Induced Lung Diseases.

Recent study indicated small airway is a sensitive parameter in early detection of expiratory airflow obstruction. Potential high risk employees could be considered for early treatment and job placement.

It is a good documentation of previous existing condition of PFT abnormal findings. As we commonly see in workers compensation scenario, "I never had my lung test abnormal, I have worked with these chemicals and nobody told me about it." The disadvantage factor is under Workers Compensation Law aggravation from present job exposure become compensable and the present employer is liable.

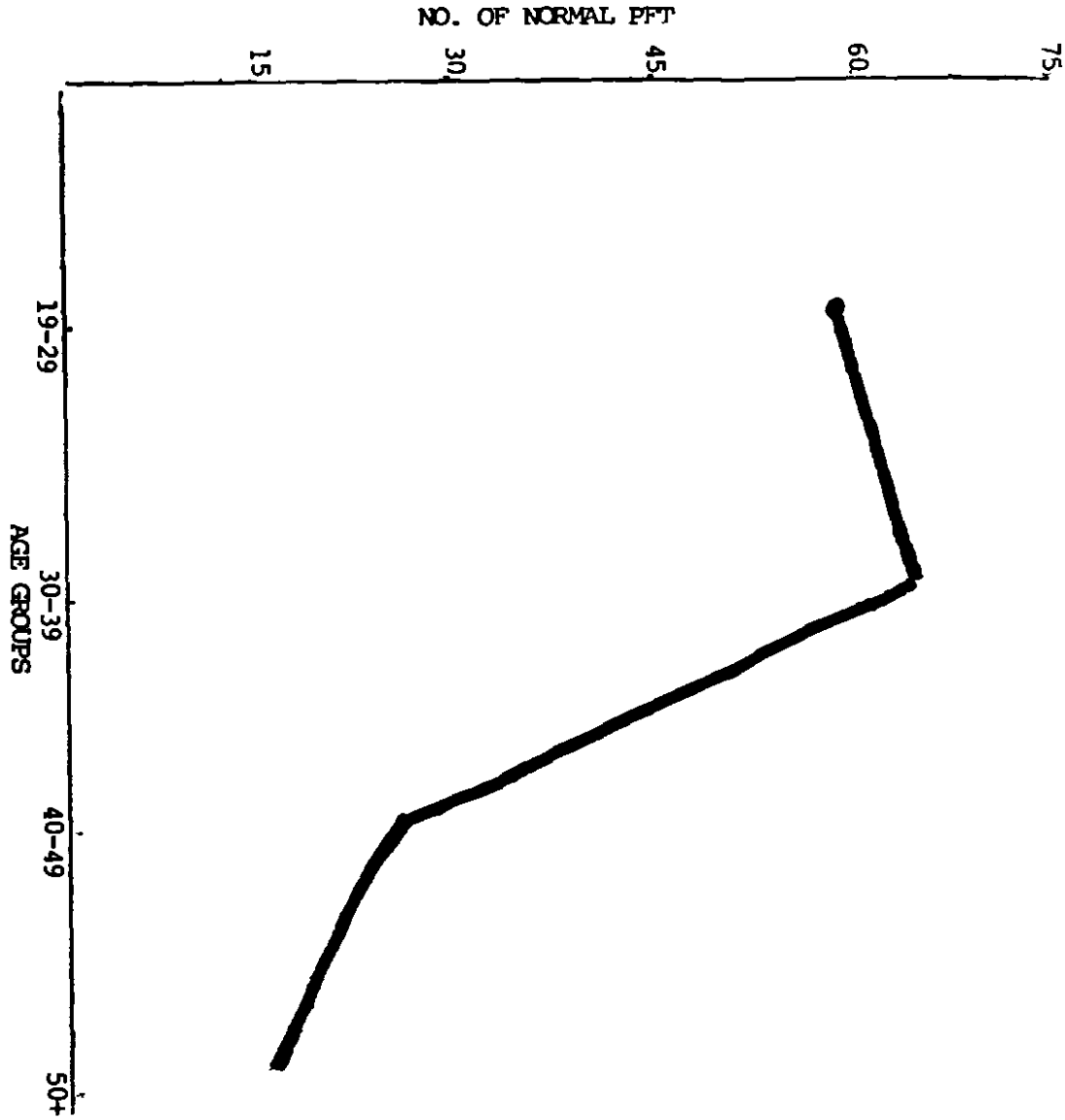

Figure 1. Normal PFT decline with age.

Table III

Visual Defects in 275 Applicants' Physical for Electronic Assembly Plants, Tampa, Florida

AGE	TITMUS VISION TESTS = ABNORMAL		ISHIHARA COLOR VISION	FIELD OF VISION
	NEAR	DISTANT		
19 - 29 91	8	20	1	0
30 - 39 98	16	21	2	3
40 - 49 54	22	21	1	1
50+ 36	17	15	1	3

However, early sign of sensitivity, early sign of bronchitis with baseline PFT value from pre-employment is surely valuable in decisionmaking for the betterment of employer, employee and workers compensation carrier.

Many adverse effects from chemical exposure and cigarette smoking have been reported. If baseline PFT results are available, further education to employee and proper job placement could prevent many problems in the future.

This study is a signal parameter involved therefore future epidemiologic studies can be undertaken with a large population.

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