Multimedia Based Chronic Lung Disease Test Management Model

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Abstract— The early detection of the diseases profoundly helps to treat and overcome accurately. Secondly, the right treatment identification relies on the procedure that is used to diagnose the disease from its symptoms and Signs [1][3]. Multimedia Based Chronic Lung Disease Test Management Model (CLD-TM) provides the management of industrial/operational workers suffering from Chronic Lung Disease on the basis of Personal History, Physical Examination and Pulmonary Function Test (P.F.T.). The CLD-TMM was developed for producing the different Scenarios that are suggestive to industrial/operational workers having CLD, for betterment of their Quality of Life (QOL) and for generating the understanding of how different risk factors effects the health of an industrial/operational worker over time. The proposed Multimedia Based CLD-TM would be particularly useful for researchers in this field, medical practitioners and developers of clinical decision support systems (CDSS)[2].

Keywords—**Multimedia**, *CLD, CDSS, QOL*

INTRODUCTION

Kodgule and Salvi [5] estimated about half the world's population burn biomass fuel (wood, crop residues, animal dung and coal) for cooking and heating purposes that caused poor lung growth in growing children, the risk of developing respiratory tract infections (both upper as well as lower) was greatly increased, Women cooks developed chronic obstructive lung disease, asthma, respiratory tract infections, including tuberculosis and lung cancer. The authors concluded that exposure to biomass smoke was a major contributor to morbidity and mortality among children, women and the elderly people. Kumar [6] assessed the impact of air pollution due to increase in urbanization, vehicle density and industrial smoke emission on the respiratory disease in a critically polluted city Mandi Gobindgarh of northern India. Cross-sectional household survey was conducted in "exposed" and "reference" population. The author concluded that adult population of Mandi Gobindgarh had significantly more chronic respiratory morbidity due to the level of Total Suspended Particulate (TSP) matter in the ambient air was observed to be more than permissible limit. A relevant set of lung function parameters, derived from spirometry, flow-volume curves, diffusion capacity and bodyplethysmography, to discriminate Asthma from COPD was established via logistic regression analysis by Goedhart, Zanen and Lammers [7].

The proposed CLD-TM Model provides the Multimedia Based management of industrial/operational workers suffering from Chronic Lung Disease on the basis of Personal History, Physical Examination and Pulmonary Function Test (P.F.T.).[4] The Chronic Lung Disease Test Management (CLD-TM) Model is based on following procedure:

Step1: To distinguish normal from abnormal Spirometry Test results, observe the readings of Forced Vital Capacity (FVC) and the Forced Expiratory Volume in one second (FEV1) to determine if it is within the normal limits. If both FVC and FEV1 are normal, then no further investigation is needed for the subject.

Step 2: If FVC and/or FEV1 are low, then the

presence of Lung Disease in the industrial/operational subject is highly likely.

Step 3: If the percentage predicted for FEV1/FVC is 88%-90% or higher, then the industrial/operational subject under consideration has a Restricted Lung Disorder. In Restricted Lung Disorders the chest expansion is restricted. Therefore, FVC decreases while FEV*1* is normal.

Step4: If the percentage predicted for FEV1/FVC is 69% or lower, then the industrial/ operational subject under consideration has an Obstructed Lung Disease and need further testing to confirm. In obstructive disorders, inspiration is normal but expiration is obstructed, therefore, FVC is normal while FEV_1 decreases.

After initial screening of 1378 industrial/operational workers (subjects) from Manufacturing Companies/ Industries and family members of employees of Banks, 482 subjects suffering from Chronic Lung Disease were selected for further Medical investigations and management at Bio Medical Engineering Research (BMER) Lab of Faculty of Engineering, Dayalbagh Educational Institute, Dayalbagh, Agra; Dr. Sakshi Baijal Clinic, Allergy and Asthma Center, near Hari Parvat Crossing, Agra and Heart, Chest and Allergy Research Laboratory, New Agra, Dayalbagh Road, Agra. Out of 482 selected subjects, 356 subjects responded for Medical investigations and remaining subjects did not turn up due to own circumstances.

A detailed personal history consisting of name, address, age, smoking, alcohol abuse, physical activity per day and the information regarding past medical tests (Reference Values of Diagnostic Tests Attached in Table 1) of all the responded subjects was taken and then a complete physical examination like Height, Body Weight, Blood Pressure and Pulse was done in all the subjects.

The P.F.T. (Figure 1 and Figure 2) was performed on all the responded 356 subjects using COSMED Computerized P.F.T. System and Computerized Spirodoc® System. PFT can help in early detection of the presence of obstructive and restrictive lung disease before symptoms are apparent to the industrial /operational worker exposed to dusts, metal fumes, chemical vapors, and gases.
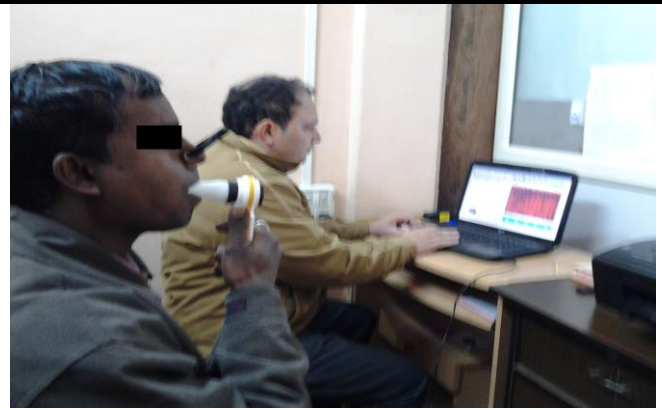

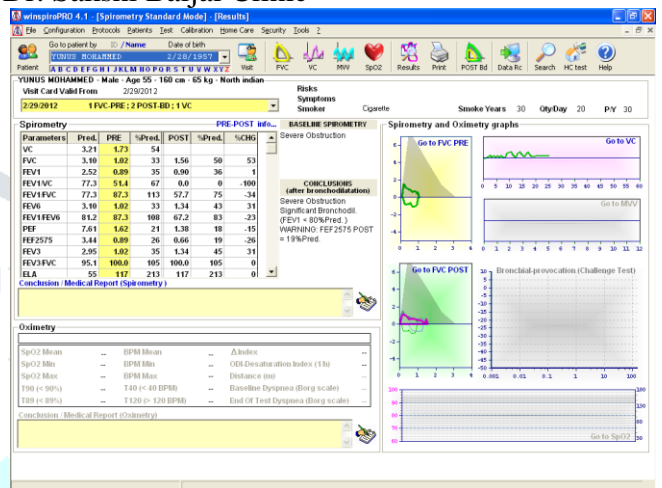Figure 1: Subject undergoing Spirometry at Dr. Sakshi Baijal Clinic

Figure 2: Spirometry of the subject at Dr. Sakshi Baijal Clinic

All tests are stored and a patient data card is automatically created with a preview of the spirometry curve that helps to evaluate it for the presence of obstructive or restrictive lung disease. Dr. Varun Chaudhry, Dr. Meetwar, and Dr. Sakshi Baijal were involved in interpreting P.F.T. results (Figure 3).
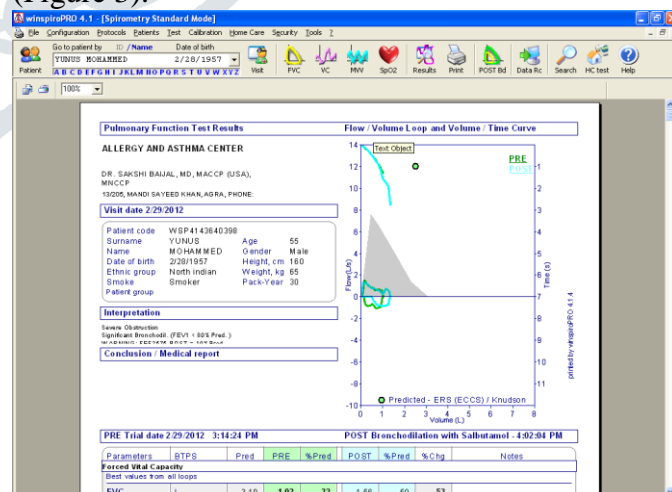

Figure 3: Pulmonary Function Test Results of the subject at Dr. Sakshi Baijal Clinic

WORKING OF CLD-TM MODEL

The Personal History of the industrial/operational workers (subjects) suffering from semi structured/unstructured Chronic Lung Diseases

coming to Clinical Decision Making and User (CDMU) Desk for Lung Disease Management, is displayed on Central Medical Vision Navigator (CMVN) Board as Management Protocol: MP# 0. On the basis of Chronic Lung Disease Test Management (CLD-TM) Model, the test results of Pulmonary Function Test (P.F.T) are displayed on CMVN Board as Management Protocol MP # 1. On the basis of Management Protocol: MP# 0 and MP# 1 on CMVN Board, the System Users, Medical Professionals and Experts, Bio-Medical Students, General Internists and Practitioners, Medical Decision Makers, Super Specialists, Research Communities and Healthcare Workers can take a managerial decision regarding further advanced specialized medical tests and treatments to improve the Quality of Life (QOL) of the industrial/operational workers suffering from semi structured/unstructured Chronic Lung Diseases (Figure 4).
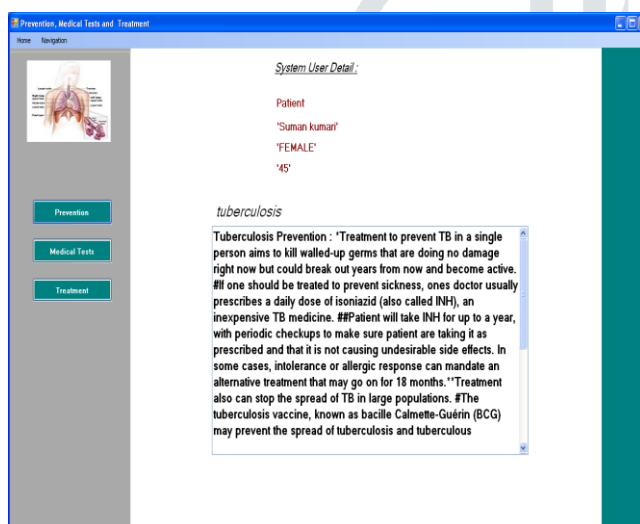

Figure 4: Medical Tests and Treatments to Improve the QOL of the Lung Subject

QUERIES AND DECISIONS

Chronic Lung Disease Management Model provides several Queries and Decisions for: Fourteen main Chronic Lung Diseases: Asbestosis, Asthma, Bronchitis, Byssinosis, Emphysema, Histoplasmosis, Hypersensitivity Pneumonitis, Influenza, Lung Cancer, Mesothelioma, Pneumoconiosis, Pneumonia, Silicosis, and Tuberculosis using Multimedia Based Chronic Lung Disease Test Management (CLD-TM) Model.

Queries:
The Chronic Lung Disease Management Model helps in answering the following types of Medical Queries (MAN-Q):

MAN-Q 1: What are the different test values that can be obtained from a "PFT"?

Answer 1: A PFT (Spirometry) can show the following values regarding ones lung condition : FVC, FEV1, FEV1/FVC%, FEV3, FEV3/FVC%, FEV6, FEV1/FEV6%, PEF, FEF25%, FEF50%, FEF75%, FEF25%-75%, FET, Estimated Lung Age.

CONCLUSION

Chronic Lung Disease Management Model supporting Multimedia Based Clinical Decision Support System for the Management of Chronic Lung Diseases is designed and developed for Disease Management of industrial/operational workers suffering from Chronic Lung Disease.

Chronic Lung Disease Management Model using a specially graphically designed Interactive Interface in Microsoft Visual Basic .Net 2005 for Strategic Medical Planning (SMP), Medical Management Control and Tactical Medical Planning (MMC and TMP), Operational Medical Planning (OMP), and Transaction Medical Processing (TMP) of industrial/operational workers.

Disease Management result of the Chronic Lung Disease Management Capsule will be displayed on CMVN Board through DiM System which will help in improving the Quality of Life (QOL) of industrial/operational workers.

FUTURE SCOPE

The research contained only an attempt to identify the Chronic Lung Disease from the vast field of medical sciences using some of the Optimization and Artificial Intelligence Techniques. The present research work may be extended in a number of directions and applications. It is not possible to include all possible extensions exhaustively; however, some specific ideas and suggestions in improvement of the present CLD-TM are as follows:

- The Case Base Reasoning Desk [3] (CBR-Desk) can be enhanced by increasing the database.
- Other chronic diseases, like Cancer, HIV, and AIDS can be incorporated.

Other Optimization techniques and Artificial Intelligence Techniques like Neural Network, Fuzzy Set Theory, Fractional Programming, etc. can be incorporated to analyse the data base and strengthen the diagnosis of the patients.

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TABLE 1: REFERENCE VALUES OF DIAGNOSTIC TESTS:

S.No.	Parameter	Detail	Unit	Normal	Medium	Serious
1	Blood Pressure	Systolic	mm of Hg	120-140	140-200	>200
2	Blood Pressure	Diastolic	mm of Hg	80-90	90-100	>100
3	Sputum Test	Mycobacteria		negative	marginal	Positive
9	Hemoglobin		%gm	>12	10 to 12	<10
10	Peak Expiratory Flow		%	80-100	50-79	<50
11	FVC		%	90-100	80-89	<80
12	FEV1		%	>85	65-85	<65
13	FEV6		%	>85	65-86	<65
14	FEV1/FVC		%	>75	50-75	<50
15	FEF	25-75	%	>50	25-50	<25
16	MEF	75	%	>75	50-75	<50
17	MEF	50	%	>50	25-50	<25
18	MEF	25	%	>25	15-25	<15
19	EVC		%	>80	60-80	<60
20	ERV		%	40-50	20-40	<20
21	MVV		%	>85	70-85	<70