Original Article

Journal of Cardiovascular Medicine and Surgery
Volume 8 Number 1, January - March 2022
DOI: http://dx.doi.org/10.21088/jcms.2454.7123.8122.1

Effect of Smoking on Cardiovascular System: A Review

Anjali Bhatt[1], Anjum Abbasi[2], S P Subashini[3]

How to cite this article:
Anjali Bhatt, Anjum Abbasi, S P Subashini / Effect of Smoking on Cardiovascular System: A Review /J Cardiovasc Med Surg.2022;8(1): 9-15.

Author's Affiliation: [1]Student, [2]Assistant Professor, [3]Dean, Departments of Nursing, Galgotias University, Greater Noida, Gautam Buddh Nagar, Uttar Pradesh 201310, India.

Corresponding Author: Anjum Abbasi, Assistant Professor, Department of School of Nursing, Galgotias University, Greater Noida, Gautam Buddh Nagar, Uttar Pradesh 201310, India.

E-mail: anjum.abbasi@galgotiasuniverity.edu.in

Received on: 23.04.2022

Accepted on: 24.05.2022

Abstract

The article presents the state of cardiovascular system of smokers with different period of tobacco smoking. From, the result of our studies, we can conclude that smoking tobacco results in a significant increase in heart rate, systolic blood pressure, a significant reduction in P, PQ and QT times, an insignificant increase in diastolic blood pressure and a decrease in QRS duration.[1]

Background: Tobacco smoking is one of the most important risk factors of coronary heart disease (CHD). Hence, smoking cessation is considered pivotal in the prevention of CHD. The current study aimed to evaluate smoking cessation patterns and determine factors associated with smoking cessation in patients with established CHD.

Keyword: Heart, Blood pressure[1], Atrial systole, Ventricular excitation[5], Cardiovascular, Tobacco, Smoking, Nicotine[3], Biostatistics, Arterial Pressure, Arrythmia[10], Atherogenesis, Nicotine replacement therapy[3].

Introduction

Today, tobacco production is one of the main branches in the economy of more than 20 countries in the world. Moreover, the tobacco industry is a source of high income and jobs for the population.

Tobacco-plantation cover an area over 3 million hectares. More than 4 million tons of raw material of the cultivated tobacco are harvested every year. The tobacco industry was established in Russia in the second half of 19th century.[8] Tobacco is not a drug; however, not everyone succeeds in freeing themselves from an addition. Tobacco does not suppress consciousness and does not cause hallucination, like drugs. However, it damages the brain in case of prolonged use.

According to WHO, up to one-third of world's adult population are the tobaccosmoking consumers. In addition to damage caused by tobacco consumption to the health of the younger generation, this habit inhibits their growth and development.[6]

National Academy of Medical Science of India reports that smoking is the cause of annual death up to 500 thousand people of India. The first place in mortality in India is occupied by cardiovascular pathologies and cancer, which should be attributed mainly to active or passive consumption of nicotine.

The main factor to avoid or even prevent the start

of smoking is the preference for a healthy lifestyle. The degree of the parental control and participation in life plays an important role in preventing a child or an adolescent from smoking tobacco. Issue related to the prevention and quitting smoking are acute in educational organization. Students should be made aware of the benefits of a healthy lifestyle. An important prevention of tobacco smoking among young people should be given such a measure of influence as given to understand and properly realize the damage caused by tobacco consumption to the organism's health.[11]

The cardiovascular system is one of the most important parts of the body, therefore, determining its condition is smokers is an essential aspect. The composition of tobacco leaf contains more than 4000 chemical components, about 5 million people die each year due to disease caused by smoking worldwide. Therefore, an identification of changes in the functional activity of the body in the smokers is of great importance.

Material and Methods

To identify indicators of cardiovascular system performance in male smokers, we have carried 20 healthy men aged from 20 years to 45 years old. The men subjects were divided in 4 groups of 5 people each. The reference group considered of non-smoking men and smoking men with period under 2,5,10 years.

To determine blood pressure and heart rate, we used a sphygmomanometer and pulse rate meter. The collected experimental data were statistically processed using the biostatistics.

Smoking and Respiratory Disease

The respiratory system extends from the nose and upper airway to the alveolar surface of the lungs, where gas exchange occurs. Inhaled tobacco smoke moves from the mouth through the upper airway, ultimately reaching the alveoli. As the smoke moves more deeply into the respiratory tract, more soluble gases are adsorbed and particles are deposited in the airways and alveoli. The substantial doses of carcinogens and toxins delivered to these sites place smokers at risk for malignant and non-malignant diseases involving all components of the respiratory tract including the mouth.

1. Smoking can cause lung diseases which can be COPD, emphysema and chronic bronchitis
2. Cigarette is the main factor of lung cancer.
3. If you are suffering from any lung disease tobacco smoking can trigger an attack.

Although the lung has ways to protect itself from injury by inhaled agents, these defences are overwhelmed when cigarette smoke is inhaled repeatedly over time. After years of exposure to cigarette smoke, lung tissue becomes scarred, loses its elasticity, and can no longer exchange air efficiently.[1]

COPD

Lung injury from tobacco smoke leads to the development of COPD, the nation's third largest killer. People with COPD have damaged airways and slowly die from lack of oxygen. Eight out of 10 cases of COPD are caused by smoking. The number of Americans suffering from COPD is increasing and there is no cure for this disease. Recent studies show that risks for COPD are increasing, especially in women. Their risk for COPD is now similar to the risk among men. Women smokers in certain age groups are more than 38 times as likely to develop COPD, compared with women who have never smoked. Also, more women are dying from COPD than men, and women appear more likely to develop severe COPD at younger ages.[9]

Smoking and Immune System

Smoking activates the immune system and increases white blood cell count and the level of neutrophils, lymphocytes and monocytes. As nicotine is known to be immunosuppressive that can lead to decrease neutrophilic phagocytic activity as well as affect chemotaxis and cell signalling.[7] Smoking leads to profound changes within the immune system characterized by mixed inflammation and suppression throughout the body. Although carcinogens within tobacco and cigarettes are to blame for the increased risk of cancer, numerous other compounds act as pro-inflammatory and immunosuppressive agents, including nicotine, formaldehyde, ammonia, carbon monoxide, benzopyrenes, tar, acetone, hydroxyquinone, cadmium and nitrogen oxides.[3]

Of these, nicotine is known to be immunosuppressive that can lead to decreased neutrophilic phagocytic activity as well as affect chemotaxis and cell signalling, in addition to inhibiting the release of reactive oxygen species (ROS) thus impairing the ability of neutrophils to kill pathogens.

Coronary Heart Disease

The link between smoking and CHD was first demonstrated by a 50-year cohort study of British

doctors which found that CHD mortality was around 60% higher in smokers and 80% higher in heavy smoker compared to non-smokers.[1] Smoking has a direct effect on the heart causing inflammation of the myocardium leading to systolic and diastolic disfunction and arrythmia. However, the main effect of smoking is the enhanced formation of atheroma.

Cigarette smoke contain carbon monoxide which combines with haemoglobin to form carboxyhaemoglobin which prevent the uptake of oxygen leading to cellular hypoxia and possible coronary artery spams and ventricular arrythmias.

Other tobacco toxins, including nicotine directly affect the endothelium, leading to coronary vasocontraction and increase blood coagulation.[3]

Result and Discussion

The heart rate is 90,100, beats per minutes, higher in smokers with smoking period under 10 years as against non-smokers having 62 beats per minute. The blood pressure is 130/90 mmHg under 5 years of smoking, 138/95 mmHg under 10 years of smoking4. Smoking tobacco for long time causes an increase in heart rate value by 3% and blood pressure by 5%.

The high level of indicators of cardiovascular system performance in smoking is due to greater activity of adrenal gland under the influence of nicotine. Even a small concentration of nicotine in the body leads to an increase in the release of adrenaline, raised heart rate and blood pressure. The heart rate value in smokers, increasing, reaches 80-90 beat per minute. Smoking tobacco contributes to the production of hormones by adrenal medulla that increase blood pressure. The enhanced activity of cardiovascular system is due to increase in norepinephrine. The effects of nicotine include an increased production of hormones by adrenal gland, stimulation of the respiratory centre, increased heart rate, hypertension.[9]

The reason responsible for an increase in indicators of cardiovascular system performance in smoker are as follow: spasm of blood vessels, high blood viscosity, aggregation of blood cells, deposition of fat on the wall of blood vessels. The heart begins to work in an extremely high mode under the influence of these hormone. Thus, due to smoking, the hormone of adrenal cortex set the heart to unbearable heart rate and in order to cope with the given load and the heart is forced to use all the its capabilities.

The heart driven by high rhythm in its performance cannot cope with permanent overloading and as a result following disturbance in its activity occur: increased arterial blood pressure, angina pectoris, myocardial infraction, various rhythm disorder.[12]

Chronic Bhronchitis

Chronic bronchitis is defined by symptoms of cough together with frequent and increased production of sputum or phlegm. It is diagnosed when these symptoms are present for three months in each of two successive years[1]. Chronic bronchitis is associated with inflammation in the large and small bronchial airways, which results in the enlargement of mucus-producing glands and remodelling (thickening) of the airway walls.[2] People with chronic bronchitis have more frequent respiratory infections. In persons who also have chronic obstructive pulmonary disease (COPD), symptoms of chronic bronchitis increase the risk of death from respiratory infections.[4]

Chronic bronchitis often co-occurs with COPD, but it does not influence airflow limitation unless the inflammation extends into the small airways. Having symptoms of chronic bronchitis is associated with an accelerated decline in lung function as seen in COPD. It was previously thought that chronic bronchitis was a necessary first step in the development of COPD. However, since then research has shown that airflow limitation can develop without symptoms of chronic bronchitis. Also, in people with normal lung function, the presence of chronic bronchitis does not increase their likelihood of developing COPD.[5]

Smoking is a long-recognised cause of chronic

Indications	Non-Smokers Under 10 Years	Smoking Under 2 Years	Smoking Under 5 Years	Smoking Under 10 Years
Heart rate (per beat per min)	63	72	79	82
Systolic pressure (mmHg)	120	128	132	138
Distolic pressure (mmHg)	80	84	86	90

bronchitis. A meta-analysis of 101 studies from 2011 found that current smokers have a 3.4-fold higher risk of chronic bronchitis compared to non-smokers. Symptoms of chronic bronchitis decrease by one to two months after smoking cessation, and the population prevalence of cough and phlegm returns to the level of never smokers within five years. In people with severe COPD, chronic cough associated with chronic bronchitis is more likely to persist after smoking cessation.[7]

Coronary Heart Disease

The link between smoking and CHD was first demonstrated by a 50 years cohort study of British doctors which found that CHD mortality was around 60% higher in smokers and 80% higher in heavy smoker compared to non-smokers. Smoking has a direct effect on the heart causing inflammation of the myocardium leading to systolic and diastolic disfunction and arrythmia. However, the main effect of smoking is the enhanced formation of atheroma.[4]

Cigarette smoke contain carbon monoxide which combines with haemoglobin to form carboxyhaemoglobin which prevent the uptake of oxygen leading to cellular hypoxia and possible coronary artery spams and ventricular arrythmias. Other tobacco toxins, including nicotine directly affect the endothelium, leading to coronary vasocontraction and increase blood coagulation.[5]

Pathophysiology of Cardiovascular Disease Risk

Cigarette smoking has multiple adverse effects on the cardiovascular system that promote atherogenesis and trigger acute cardiovascular events. Cigarette smoke induces CVD through endothelial injury, formation of atheroma and a superimposed prothrombotic influence.[3] The effects of cigarette smoking on CVD are mediated through three principal constituents: nicotine, carbon monoxide (CO), and oxidant gases. Nicotine binds to nicotinic cholinergic receptors in the brain and acts as a sympathomimetic agent. It stimulates the release of catecholamines, leading to increases in heart rate, blood pressure, and myocardial contractility that increase myocardial work and oxygen demand. Nicotine also induces vasoconstriction through its action on alpha-adrenergic receptors and by inducing endothelial dysfunction.[4] This results in a reduced coronary and cerebral blood flow. Carbon monoxide is produced by combustion and is found in cigarette smoke. It binds more avidly than oxygen to haemoglobin and decreases oxygen supply to organs in the body. It results in relative hypoxaemia that can precipitate ischaemic events. In addition, in response to hypoxaemia, red blood cell mass increases and lead to hyper viscosity, which contributes to hypercoagulation in smokers. Cigarette smoke contains high levels of oxidant gases such as oxides of nitrogen and free radicals. These induce inflammation, endothelial dysfunction, and oxidation of lipids, which are mediators in the pathogenesis of CVD.[5] They also contribute to platelet activation, thrombogenesis, and enhance coagulability through increase in plasma fibrinogen. Other components of cigarette smoke, such as metals and polycyclic aromatic hydrocarbons, also damage endothelial cells and contribute to atherosclerosis. The increase in risk of CVD associated with smoking is also mediated though other cardiovascular risk factors such as an increase in low density lipoprotein cholesterol and triglyceride, a decrease in high density lipoprotein cholesterol, an increased risk of type 2 diabetes, and possibly an increase in blood pressure.[10]

Interventions

Multiple randomized controlled clinical trials demonstrated the benefits of counselling patients with cardiovascular disease on smoking cessation. In contrast, relatively few clinical trials tested the safety or efficacy of pharmacotherapy for treating smokers with CVD. Researchers raised concerns about the safety and sustained-release bupropion in patients with CVD, because both agents can have sympathomimetic activity and can theoretically increase myocardial work, and NRT might also reduce the myocardial oxygen supply through coronary vasoconstriction by aggravating endothelial dysfunction.[3]

Counselling

Several randomized controlled clinical trials demonstrated the efficacy of counselling for patients hospitalized with cardiovascular disease. The most successful counselling interventions for cardiac inpatients include high-intensity baseline counselling with sustained contacts after discharge for prevention of relapse. However, even with the most successful counselling interventions, at least 40 percent of smokers who have cardiac disease resume smoking within one year. Guidelines for smoking cessation recommend the addition of pharmacotherapy to counseling.[10]

Nicotine Replacement Therapy

NPT helps smokers stop smoking and also reduces nicotine withdrawal symptoms, which begin a few hours after the last cigarette is smoked and can last up to four weeks. The typical withdrawal

syndrome is characterized by agitation, anxiety, depressed mood, difficulty concentrating, increased appetite, insomnia, irritability, restlessness, and an intense craving to smoke. Most smokers who stop smoking relapse to smoking within the first week, when withdrawal symptoms are strongest. Nicotine directly affects the cardiovascular system by multiple mechanisms.[4] The various effects lead to increased heart rate, blood pressure, myocardial contractility, and reduced coronary blood flow. Nicotine may also contribute to insulin resistance and development of a more atherogenic lipid profile. The nicotine dose in nicotine replacement therapy products is usually lower than the dose from smoking, but there have been concerns about the safety of NRT in patients with cardiovascular disease.[10]

Other Pharmacotherapy

Varenicline, a partial agonist of the α4β2 nicotinic acetylcholine receptor, has been marketed for the treatment of tobacco dependence but its use in smokers with cardiovascular disease has not yet been studied. The drug produces approximately 50 percent of the receptor stimulation provided by nicotine, but it blocks the effects of any nicotine taken in from cigarette smoking. Clinical trials have found it superior to bupropion in promoting smoking cessation, and prolonged administration has been shown to reduce relapse in smokers who had been abstinent 12 weeks after initial therapy.[10]

Diet

Regarding the dietary habits of the population, changes have occurred in different areas. For example, the intake of salt and saturated fats has been reduced in most societies. The food industry has reduced the presence of trans fatty acids in different food items; this has been promoted by regulatory initiatives in some communities. However, the potential to prevent CVD through dietary adaptations is still poorly implemented. Adherence to a balanced diet is generally limited; the control of elevated blood pressure, dyslipidaemias and dysglycaemia can largely be improved through changes in lifestyle. Achieving better adherence with dietary recommendations requires the understanding of the determinants of poor compliance. At the population level, structural measures such as product information, and consumer friendly nutrition labelling may improve health friendly choices. Energy dense, nutrient-deficient foods are generally highly accessible and inexpensive; the marketing of such foods could be limited and taxed. On the other hand, fruits and vegetables tend to be more expensive; the subsidising of their costs may be useful.[2]

At the clinical level, general practitioners have an opportunity to provide counselling about diet for the management of coronary risk factors. However, barriers to that were reported related to time limitations, knowledge and perceived efficacy. The extent to which physicians are familiar with a healthy dietary pattern (i.e., DASH, Mediterranean diet)[2] and with translating that information into practical recommendations may be limited. A multidisciplinary approach including nutritionists and dieticians may help but needs improved reimbursement coverage.

At the individual level, new strategies may help to improve patient self-management and to induce sustainable behaviour change. Many apps and devices are available that provide data that can be useful for lifestyle changes and patient self-management.

Nursing Care

Nursing care of the patient with acute pulmonary edema focuses on relieving the pulmonary effects of the disorder. Interventions are directed toward improving oxygenation, reducing fluid volume, and providing emotional support.

Diagnoses, Outcomes, And Interventions

Promoting effective gas exchange and restoring an effective cardiac output are the priorities for nursing and interprofessional care of the patient with cardiogenic pulmonary edema. The experience of acute dyspnea and shortness of breath is terrifying for the patient; the nurse is instrumental in providing emotional support and reassurance.

Nursing Management

- Ensure airway patency. A patent airway is absolutely vital for pulmonary function, including ventilation and gas exchange.
- Assess the effectiveness of respiratory efforts and airway clearance. Pulmonary edema increases the work of breathing. This increased effort can lead to fatigue and decreased respiratory effort.
- Assess respiratory status frequently, including rate, effort, use of accessory muscles, sputum characteristics, lung sounds, and skin color. The status of a patient in acute pulmonary edema can change rapidly for the better or worse.
- Place in high-Fowler's position with the legs dangling. The upright position facilitates

breathing and decreases venous return.

- Administer oxygen as ordered by mask, CPAP mask, or ventilator. Supplemental oxygen promotes gas exchange; positive pressure increases the pressure within the alveoli, airways, and thoracic cavity, decreasing venous return, pulmonary capillary pressure, and fluid leak into the alveoli.
- Encourage patient to cough up secretions; provide nasotracheal suctioning if necessary. Coughing moves secretions from smaller airways into larger airways where they can be suctioned out if necessary.
- Insert an indwelling catheter as ordered; record output hourly. Urine output of less than 30 mL/h indicates impaired renal perfusion due to severely impaired cardiac output and a risk for renal failure or other complications.[10]
- Keep accurate intake and output records. Restrict fluids as ordered. Fluids may be restricted to reduce vascular volume and cardiac work.

Result and Discussion

The heart rate is 90,100, beats per minutes, higher in smokers with smoking period under 10 years as against non-smokers having 62 beats per minute. The blood pressure is 130/90 mmHg under 5 years of smoking, 138/95 mmHg under 10 years of smoking.

Smoking tobacco for long time causes an increase in heart rate value by 3% and blood pressure by 5%.

The high level of indicators of cardiovascular system performance in smoking is due to greater activity of adrenal gland under the influence of nicotine. Even a small concentration of nicotine in the body leads to an increase in the release of adrenaline, raised heart rate and blood pressure. The heart rate value in smokers, increasing, reaches 80-90 beat per minute. Smoking tobacco contributes to the production of hormones by adrenal medulla that increase blood pressure. The enhanced activity of cardiovascular system is due to increase in norepinephrine. The effects of nicotine include an increased production of hormones by adrenal gland, stimulation of the respiratory centre, increased heart rate, hypertension.

The reason responsible for an increase in indicators of cardiovascular system performance in smoker are as follow: spasm of blood vessels, high blood viscosity, aggregation of blood cells, deposition of fat on the wall of blood vessels. The heart begins to work in an extremely high mode under the influence of these hormone. Thus, due to smoking, the hormone of adrenal cortex set the heart to unbearable heart rate and in order to cope with the given load and the heart is forced to use all the its capabilities.

The heart driven by high rhythm in its performance cannot cope with permanent overloading and as a result following disturbance in its activity occur: increased arterial blood pressure, angina pectoris, myocardial infraction, various rhythm disorder.

Conclusion

Tobacco smoking is the cause of significant increase in heart rate and systolic blood pressure, a significant reduction in the time of atrial systole time, in the excitation and ventricular contraction coverage in male smokers.

The heart rate values, gradually increase in smokers, reaches their maximum value of beat 82 beats per minute. The value of maximum blood pressure is 138/88 mm Hg higher in male smokers. The time of atrial contraction in male who smoke tobacco is 0.02s less than in non-smokers. Despite this unequivocal evidence, tobacco is often the forgotten cardiac risk factor, receiving less of a cardiologist's attention than is given to treating hypertension, hyperlipidaemia, or diabetes. This should change. Cardiologists must recognize that tobacco use has the characteristics of a chronic condition or chronic disease and deserves to be treated like one. Treating a smoker requires taking a long term management approach that is no different from other chronic diseases. Routinely identifying smoking status, advising cessation, and referring to resources to assist smokers in making a quit attempt should be standard practice and quality measures.[9] Cardiologists should also communicate to all patients the newer and less well-known information about SHS exposure as a risk factor for CVD. There is a nonlinear dose response between exposure to tobacco smoke and cardiovascular risk, with a sharp increase at low levels of exposure (including exposures from second hand smoke or infrequent cigarette smoking) and a shallower dose-response relationship as the number of cigarettes smoked per day increases. Cardiologists should routinely ask about SHS exposure, advise all patients to adopt smoke free policies for their homes and vehicles and recommend avoiding SHS exposure at work and in public places. Cardiologists can also contribute as role models and advocates. As role models, cardiologists should not use tobacco products themselves. Cardiologists can advocate with their

hospitals and healthcare systems to adopt smoke-free policies and make tobacco treatments available and affordable. Cardiologists in academic settings can advocate with medical schools and training programmes to teach tobacco treatment methods to the next generation of physicians. Finally, in their communities, cardiologists can support the adoption of comprehensive tobacco control public policies that are proved to reduce tobacco use.[11]

References

1. Centres for Disease Control and Prevention (CDC). Smoking-attributable mortality, years of potential life lost, and productivity losses–United States, 2000–2002
2. Robinson SH Smoking and drinking among adults, 2009: a report on the 2009 General Lifestyle Survey, 2011 Office for National Statistics H
3. Perk Scholte op Reimer WJ, Vrints C, Wood D, ZamoranoJL,Zannad F. European Guidelines on cardiovascular disease prevention in clinical practice (version 2012). The Fifth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of nine societies and by invited experts). Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR), \Eur Heart J, 2012, vol. 33 (pg. 1635-1701)
4. KotsevaK,WoodD,DeBackerG,DeBacquerD,Porala K, Keil U. Cardiovascular prevention guidelines in daily practice: a comparison of Euroaspire I, II, and III surveys in eight European countries, Lancet, 2009, vol 373(pg. 929-940)
5. Puranik R, CelermajerDS.Smoking and endothelial function, Prog Cardiovasc Dis, 2003 vol. 45(pg. 443-458)
6. WHO Report on the global tobacco epidemic, 2008: the mpower package, 2008 Geneva World Health Organization
7. Centers for Disease C. Prevention Current cigarette smoking among adults: United States, 2011, MMWR Morb Mortal Wkly Rep, 2012, vol. 61 (pg. 889-894)
8. Shinton G. Meta-analysis of relation between cigarette smoking and stroke, BMJ, 1989, vol. 298 (pg. 789-794)
9. Celermajer DS, Sorensen KE, Georgakopoulos D, Bull, Thomas O, Robinson J, Deanfield JE. Cigarette smoking is associated with dose-related and potentially reversible impairment of endothelium-dependent dilation in healthy young adults, Circulation, 1993, vol. 885 Pt 1(pg. 2149-2155)
10. Hoffman SJ, Mammone J, Rogers Van Katwyk S, et al. Cigarette consumption estimates for 71 countries from 1970 to 2015: systematic collection of comparable data to facilitate quasi-experimental evaluations of national and global tobacco control interventions.
11. Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, Cooney MT, Corra U, Cosyns B, Deaton C, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts) Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation.
12. Thompson S.C., Nedkoff L., Katzenellenbogen J.K., Hussain M.A., Frank Sanfilippo F. Challenges in Managing Acute Cardiovascular Diseases and Follow Up Care in Rural Areas.