



Tobacco use and cardiovascular diseases - Evidence, interventions and primary prevention

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Abstract

Cardiovascular diseases (CVDs) are one of the major causes of mortality and morbidity in the world. Tobacco consumption forms a major preventable risk factor for CVDs globally. The main objectives of this review paper is a) to review the evidence linking tobacco consumption to various CVDs, b) argue in favor of starting young for primary prevention of CVDs by controlling tobacco use among adolescents, c) provide an overview of major adolescent tobacco control interventions and d) propose the possible role cardiologists can play in tobacco control.

We used SCOPUS, Ovid and PubMed databases using a predefined inclusion and exclusion criteria in order to find the evidence tobacco consumption and various CVDs and successful interventions to control tobacco use amongst adolescents. The evidence was then synthesized according to the objectives. The study concluded that prevention of tobacco is easier than cessation approaches due to the very addictive nicotine which is the main ingredient in tobacco products. Cardiologists in all countries are important stakeholders to be involved in all aspects of tobacco control including evidence generation, promoting prevention and cessation at all levels.

Key Words

- Tobacco
- Cardiovascular diseases
- Adolescents
- Tobacco Control
- Cardiologists

■ Introduction

Tobacco use is a growing worldwide epidemic.¹ It is one of the most important preventable causes of death and disease globally.² According to the World Health Organization (WHO) Report on the Global Tobacco Epidemic 2008, tobacco could kill one billion people during this century if effective measures are not taken.² Low and Middle Income Countries (LMICs) are projected to bear the largest brunt of this epidemic as 80% of tobacco related deaths are projected to be in LMICs.³ Tobacco consumption arguably is one of the most important preventable causes of Cardiovascular Diseases (CVDs), which constitutes almost one third of the total number of deaths according to WHO.

Tobacco use is one of the eight leading risk factors that account for 61% of deaths due to CVDs.⁴ The future prospects also does not look very encouraging as it is predicted that 30-45% of the total number of projected deaths in 21st century would be due to cardiovascular effects of smoking.² South Asian countries like India are unique due to widespread consumption of both smoking and smokeless forms of tobacco. In India, numerous varieties of commercial as well as locally manufactured tobacco products are available.¹ These countless varieties add to easy availability and affordability of tobacco products especially for children and adolescents.

This paper reviews the evidence linking tobacco consumption to CVDs and importance of preventing tobacco use in adolescents to reduce CVD incidence and premature mortality in adulthood. The paper then provides

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an overview of the global evidence of successful interventions to reduce tobacco use among adolescents and concludes by highlighting role of cardiologists in augmenting tobacco control and promoting cessation.

■ Background

Since release of US Surgeon General Report in 1964 suggesting association between smoking and lung cancer, there has been increase in evidence suggesting association and causal linkage between smoking and multiple diseases.⁵ Causal association in between smoking and various CVDs is well established; however current evidence is also highlighting association between smokeless tobacco use and CVD. This section highlights some of these conclusive causal relationships and associations, clearly establishing that tobacco use in any form substantially contributes to morbidity and mortality.

One of the major cardiac ailments of which tobacco use has been linked as a causal factor is Coronary Heart Disease (CHD). The US Surgeon General's Report, 2004 summarizes the evidence and concludes that there is now sufficient evidence to state that smoking is a causal factor of CHD.⁶ The INTERHEART study, a large case control study involving more than 15,000 people with Acute Myocardial Infarction (AMI) matched with equal number of age matched controls found that smokers have three times higher odds of developing AMI in comparison to non-smokers.^{7,8} Teo, et al. analysed the data from INTERHEART study and found that chances of suffering from AMI are larger in younger smoking population (OR 3.53, 95% CI 3.23-3.86) than older smoking population (OR 2.55, 95% CI 2.35-2.76).⁸ Dunn, et al. in their study on women less than 44 years of age found that women smoking 1-5 cigarettes a day have almost 2.5 times higher chances of having AMI.⁹ A prospective study by Wanameethee, et al. on middle aged British men found that smokers have two times higher risk of sudden cardiac death in comparison to non-smokers.¹⁰ A study by Thun, et al. assessed smoking to be one of the most significant predictors of developing CHD even after adjusting for potential confounders like use of aspirin, dietary fat, physical activity and alcohol consumption.¹¹

Smoking forms of tobacco through various studies have also been associated with haemorrhagic and ischemic stroke. Goldstein, et al. found that current smokers had a higher rate of stroke mortality than non-smokers in a cohort of Chinese adults.¹² Colditz, et al. in the Nurses Cohort study established that current women smokers (who smoked more than 25 cigarettes per day) had a higher risk of stroke (RR 3.7, 95% CI 2.7-5.1) than non-smoking

women and the risk increased with increase in number of cigarettes smoked.¹³ Smoking has also been established as one of the most amenable risk factor for Abdominal Aortic Aneurysm (AAA).¹⁴ Irribaren, in a cohort study of 100,000 people analysed that smoking three packs of cigarette a day was the most important risk factor for developing AAA (RR 6.6).¹⁵ Another study among British adults 65-79 years of age found smoking as one of the most important risk factor for developing AAA.¹⁶

Second Hand Smoke (SHS) also termed as Environmental Tobacco Smoke (ETS) or passive smoke is a combination of smoke that is emitted by puffs of burning tobacco (side stream smoke) and the smoke exhaled by the smoker (mainstream smoke).⁶ Many systematic and literature reviews have linked exposure to SHS to cardiovascular health. Almost a 30% higher risk of ischemic heart disease and myocardial infarction was found in people exposed to SHS, in a systematic review by Bonita and colleagues.¹⁷ In another systematic review of literature, He et al. analysed that the incidence of CHD increases by about 25% in people exposed to SHS.¹⁸ Recent evidence from INTERHEART study showed that non-smokers who were more exposed to second hand smoke (>21 hours per week) had a higher risk of suffering from AMI (OR 1.62, 95% CI 1.45-1.81) as compared to those who were minimally exposed (1-7 hours per week) to SHS (OR 1.24, 95% CI 1.17-1.32).⁷

Very few studies have tried to observe the association between smokeless tobacco use and the risk of various CVDs. Lee, et al. conducted a systematic review to collate and analyse the evidence linking smokeless tobacco use with circulatory diseases in Western populations. They found that smokeless tobacco use in non-smokers increased the risk of heart disease (RR 1.12, 95% CI 0.99-1.27) and stroke (RR 1.42, 95% CI 1.29-1.57).¹⁹ Another meta-analysis concentrated on reviewing evidence linking smokeless tobacco use and risk of myocardial infarction and stroke was carried out by Boffetta and Straif.²⁰ They found that the relative risk of ever use of smokeless tobacco products on myocardial infarction was 1.13 (95% CI 1.06-1.21). Similar results were obtained from the INTERHEART study where the odds of having AMI were found to be 2.23 times higher (95% CI 1.41-3.52) in people who were only smokeless tobacco users [7].⁷ A prospective study of Swedish construction workers assessed that use of snuff by 35-54 year old never smokers increased the risk of Ischemic Heart Diseases (RR 2.0, 95% CI 1.49-2.90), and stroke (RR 1.90, 95% CI 0.6-5.70).²¹

Based on the evidence stated above, it is quite evident that smoking tobacco has a well-established causal relationship

with CVDs and fulfills most of the criteria of causality given by Bradford Hill (namely temporality, strength of association, dose-response relationship, consistency and plausibility).²² Evidence linking smokeless tobacco to CVDs though is very less but is ever increasing and it can be inferred that a definitive association exists between smokeless tobacco and CVDs as well.

■ Starting young: Importance of promoting adolescent tobacco control

Adolescence is the most crucial stage for health in the life cycle of a person as individuals gain independence during this period in making personal and dietary choices.²³ In addition, health behaviours are established and habits are formed during adolescence which remains with an individual throughout life.²³ The most susceptible time for initiating tobacco use is during adolescence and early adulthood before the age of 18 years.²⁴ According to the Global Youth Tobacco Survey (GYTS), a school-based survey of students aged 13-15 years undertaken at 395 sites in 131 countries, globally, more than 10% of adolescents currently use tobacco in any form, with nearly 25% of them trying their first cigarette before the age of 10 and 19.1% susceptible towards initiating smoking during the next year.²⁵ India had both the highest and lowest rates of current use of any tobacco product (62.8% in Nagaland and 3.3% in Goa).²⁵ The GYTS data also provide information about the exposure of children towards Environmental Tobacco Smoke (ETS).²⁵

Almost half of the students (48.9%) reported that they were exposed to tobacco smoke at home and over 6 in 10 students (60.9%) reported of being exposed to tobacco smoke at public places.²⁶ This is a cause of worry as a causal association has been established between exposure to second hand smoke and prevalence of chronic debilitating conditions.

It is estimated that 5500 adolescents start using tobacco everyday in India, joining the 4 million young people under the age of 15 who already regularly use tobacco. If the patterns seen in developed countries are followed in developing countries than a lifetime of tobacco use will result in deaths of 250 million children and young people alive today. Most of the adolescents who initiate tobacco use during adolescence become regular users by early adulthood. Preventing smoking and smokeless tobacco use among young people is critical not only to reduce the prevalence of tobacco use but also to reduce death and disease caused by tobacco use in early adulthood.

The following section reviews the scientific literature on key policy, community and individual based tobacco

control intervention strategies that influence the onset and progression of tobacco use among adolescents.

■ Effective interventions for tobacco control among adolescents: The evidence

Policy level approaches

Laws prohibiting smoking in public-places and workplaces have proven to be effective in protecting adolescents and children by preventing initiation of smoking among them as well as motivating them to quit by providing them a smoke free environment at these places.²⁷ Akhtar, et al studied the effect of Scottish smoke free legislation on children's exposure to Second Hand Smoke (SHS) and reported that the legislation led to a significant reduction in exposure to SHS among children in their homes.²⁸ They also argued against the criticism of smoke-free laws which projects that they lead to 'displacement' of the smoking habit back in homes; thereby, increasing exposure of children to SHS.^{28,29} This evidence against 'displacement theory' was further substantiated by Jarvis, et al; who highlighted that a significantly higher number of children with smoking parents lived in smoke free homes in 2008 (48.1%) after the British smoke free legislation was enforced in comparison to 2007 (30.1%) and 2006 (35.5%).²⁹

Hammond studied the impact of health warnings on youth smoking and concluded that health warnings can augment smoking cessation and discourage youth initiation and uptake of tobacco products.³⁰ Overwhelming number of youth (>90%) in a Canadian national study stated that pictorial warnings on cigarette packages were very informative in conveying health effects of tobacco.^{31,32} Tobacco promotions and advertisements were identified as a major risk factor for tobacco initiation among youth. Hanewinkel, et al reported that high exposure of cigarette advertisements is a significant predictor of adolescent smoking initiation after controlling for baseline covariates (adjusted relative risk: 1.46 [95% CI: 1.08-1.97]; P < .05).³³ Sargent, et al. established exposure to movie smoking as an independent, primary risk factor for smoking initiation among very young adolescents in US (Attributable risk = 0.38; 95% CI: 0.20 - 0.56).³⁴ However, restricting access to minors has been identified as a population policy intervention with limited benefits.³⁵ Evidence substantiate that prevalence of current smoking among youth was significantly associated with tobacco outlet density.³⁶

Community level approaches

Youth engagement has been identified as imperative for

developing an effective and comprehensive tobacco control program. Holtgrave, et al, argued that involving youth with existing tobacco control campaigns is cost-effective and also reported that youth smoking declined by 22% as an impact of a social marketing campaign called TRUTH.³⁷ Thornton, et al. established that “Teens Against Tobacco Use” (TATU) program was popular among the youth as it provided them a participatory platform to address their individual health concerns engaging family and peer support.³⁸ Evidence also suggests that media strategies focused upon revealing industry tactics which maneuver young adolescents to initiate tobacco use and those demonstrating harms of Second-Hand Smoke (SHS) exposure to children and significant others; have been more effective than those providing educational health messages alone.³⁵ Families and communities play a crucial role in preventing uptake of risk behavior and promoting adoption of health promoting behaviors. No-tobacco use norms in families and communities, parental monitoring and expectations have substantial influence on promoting health behaviors among adolescents.³⁹ Farrelly, et al. found that high media exposure and school-community programs resulted in a 60% decrease in smoking prevalence amongst 11-12 year old adolescents.⁴⁰

Individual level approaches

Shelley, et al found that physician’s or dentist’s advice to quit tobacco use among current smokers (grade 6-12) was significantly correlated with 1 more quit attempt in the past 12 months.⁴¹ McCuller, et al reported that school students who were counseled at a tobacco cessation clinic were more likely to express higher motivation to quit tobacco use.⁴² SMART was a teen worksite based behavioral tobacco intervention model for teens 15-18 years of age. Hunt, et al tested the intervention in four intervention and five control grocery stores in Boston (USA).⁴³ Almost 84% of the adolescents recognized SMART as a tobacco cessation program at the end of intervention and barring 13% of the adolescents, everyone participated in either interactive or non-interactive activities. The authors concluded that SMART can be an effective program to reduce teen smoking. Similar results for the effectiveness of SMART programme were obtained from other studies.^{44,45} Wong, et al reported almost 50% of the smokers initiated a quit attempt within 1 month of a telephonic counseling intervention.⁴⁵

■ Role of cardiologists in adolescent tobacco control

Promoting policy change

Evidence establishes the imperatives for investing in tobacco control capacity building for management of health burden of escalating chronic diseases in Low and Middle Income Countries (LMICs). Engaging health-care professionals, especially cardiologists in community capacity building for promoting implementation of tobacco control interventions, provides essential sustainability to such efforts.⁴⁶ The World Heart Federation (WHF) recognized the imperative for helping the youth groups for deterring tobacco use among adolescents.⁴⁷ They initiated a Colombia Model Youth project where the WHF worked with active youth organizations in Argentina and Uruguay to advocate for a smoke-free Latin America.⁴⁷ This model provided for sustainable capacity building of the youth leaders for organizing youth forums to support tobacco control policies.^{47,48} They also provided a platform for reaching out to a large number of youth to provide them access to counseling and cessation facilities.^{48,49} Moreover, these coalitions can advocate for smoke-free hospitals and reimbursement for delivery of cessation treatment.^{50,51} Research suggests that expert advice particularly by those specializing in CVDs, has been effective in promoting cessation among tobacco users and also delaying initiation among young people.⁵²

Jabbour, et al highlighted that cardiologists have the credibility to become role-models for their patients and youth by quitting tobacco use.⁵³ Substantial evidence exists that healthcare facilities do not have systems in place to enable the identification of people who use tobacco and ensure that they receive evidence based treatments.⁵⁴ Recent Global Adult Tobacco Survey (GATS), India data highlighted that only 34.2% smokeless tobacco users were asked by the health care providers regarding their tobacco use and only 26.7% were advised to quit.⁵⁵ Cardiologists have a crucial role to play to advocate for up scaling structural capacity for tobacco cessation.⁵⁶ Thus, need exists to engage cardiologists in developing behavioral support strategies such as telephone, individual and group-based counseling through facility-based and community-based services to improve the chances of long term abstinence.⁵⁷

Generating community engagement for tobacco control

LMICs like India need to focus upon more pragmatic efforts that are cost-effective and have the highest impact upon decreasing morbidity and mortality due to tobacco. Schools and worksites provide for perfect settings where cardiologists can engage in training and orientation programmes organized by local heart foundations for building capacity of teachers and peer leaders.⁵⁸ Success of

tobacco prevention school programmes supported by physicians has been established in developed and developing countries context.⁵⁹⁻⁶¹ Cardiologists can prove to be valuable resource persons for school lectures and talks to convince adolescents and empower them with life skills education.⁶¹ Additionally, cardiologists can provide constructive leadership in implementation of policies and ensuring that opportunities and limitations of inequalities in access, quality of information and evidence-based care for tobacco cessation are addressed.⁶² Owing to the multi-sectorality of the tobacco epidemic, cardiologists can also contribute valuably by aiding in establishing linkages between the health care-providers, policy makers and community volunteers by making specific strategies that works to target CVD-related behaviors and outcomes and are of interest for each collaborating agency or stakeholder. Furthermore, the cardiologists can contribute towards developing health communication programmes with cross-cutting components such as individual skill building through providing knowledge; changing social norms and environment.⁶³

Providing cessation services

Physician supported counseling services have shown to have 3-5 times higher cessation rates than the normal cessation rate of 2% seen in the general population.⁶⁴ Research has substantiated that in the clinical setting youth are often cognizant of their health and are also more receptive to advice. This provides an opportunity for intervention to bring about behavioral change. Studies report that cardiologist-delivered counseling interventions for smoking cessation can be effective.⁶⁵ However, receiving skill-building training in counseling methods and a clinical system that assists in providing such services were reported as crucial adjuncts for such services. It would be important to build capacity of cardiologists to enable them to provide effective counseling and cessation services in order to mainstream tobacco control messages in their day-to-day practice.

Conclusion

Tobacco use is a well-established risk factor that contributes to burden of CVDs globally and more so in developing countries, where population is impacted during productive years of life. The literature linking SLTs and CVDs is very sparse; heuristic evidence points towards establishing SLTs as a causal risk factor for CVDs. Health effects of tobacco use start appearing at very young ages in developing countries like India and thus to reduce this burden, interventions have to focus on primary prevention. Policy level approaches operate at population level and

smoke-free policies in many part of developed world actually have shown to reduce rates of hospital admissions for MI.⁶¹ Smoke free policies, increase in tobacco taxation, pictorial health warnings on tobacco product packages have led to increase in quitting among smokers.⁶² Owing to highly addictive nature of nicotine; prevention of tobacco is easier than cessation approaches. School and community based prevention models have been recommended to enhance awareness and promote prevention and cessation both. Though quitting at secondary and tertiary level has been shown to be beneficial in reducing mortality due to CVDs but primary prevention is cost-effective and most beneficial is policy based intervention strategies. Cardiologists in all countries are important stakeholders to be involved in all aspects of tobacco control including evidence generation, promoting prevention and cessation at all levels.

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