COMPARATIVE STATISTICAL ANALYSIS OF HEALTH INDEX OF SMOKERS IN KOLKATA: UNDERSTANDING THE SIGNIFICANCE OF ANTI-SMOKING LAW IMPLEMENTATION TO GET BETTER BREATHS TOMORROW

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ABSTRACT

Smoking is one of the most significant avoidable causes of morbidity and premature death in the world, and more so in urban cities of the developing countries, which are overcrowded. Kolkata being a metropolitan city, with a broad spectrum of socio-economic population presents a special case study on the health consequences of smoking[1]. The paper represents a comparative statistical study of health index of smokers and non smokers in determined communities in Kolkata in an attempt to assess the health implications of tobacco use that are more reported than the respiratory disorders. The paper relies on community based survey data and structured health indicators evaluating general health devolution in relation to smoking and examines the role of anti-smoking legislation in eliminating such adverse impacts. The findings show that there is statistically significant variation in the cardiovascular, metabolic diseases, mental health, and immune strength of the smokers and non-smokers[2]. Additionally, the paper identifies good enforcement and the sensitization of the population concerning the anti-smoking standards, particularly, the Cigarettes and Other Tobacco Products Act (COTPA), 2003, to be paramount in the long-term population health and establishment of healthier generations.

Keywords: Smoking habits; Health status; Anti-smoking bill; COTPA Bill 2003; Health policy; Statistics; Urban India.

1. Introduction

The smoking of tobacco is an accepted reality and one of the major health challenges within the population, with the disease bearing a huge weight on the population of the globe. Smoking, as the literature of the field of public health indicates, affects practically all the systems of the organs and leads to chronic diseases exceeding pulmonary diseases by far (World Health Organization, 2022). The urbanization rate, work stress, and social acceptance of tobacco consumption in India have increased smoking especially among adult men in these metropolis as Kolkata[3].

In spite of the general perception of respiratory diseases as being smoking-related, multiple sources of empirical evidence begin to accumulate, indicating that tobacco consumption also causes cardiovascular degeneration, metabolic syndromes, suppressed immunity, and psychological stress to progress faster (Gupta and Arora, 2020). The objective of the research is to offer the statistical comparison of the health index of the smokers and the non-smokers in Kolkata and demonstrate the practicability of the anti-smoking laws in safeguarding the health of the population and assure the long-term wellness[4].

1.1 Background of the Various Anti-Smoking Laws in India.

To reduce the tobacco consumption and the exposure to the second hand smoke, India has assumed several legislative and policy related initiatives. These are some of the critical regulatory interventions made by not permitting smoking in open locations, restricting tobacco advertising, providing some warning to health on the utilization of tobacco items and restriction on the sale of tobacco items. These types of laws align with the intention of India to apply the Framework Convention on Tobacco Control (FCTC) of the World Health Organization prevention, protection and awareness framework on the people (WHO, 2021)[5]. Many measures (both legal and non-legal) have been taken to deal with this problem. The harmful impact of passive smoking is one of the major motivations behind making of some smoke free laws. Various legal provisions have emerged into existence to prevent all these evils over time. Now, the key question is whether these legal provisions are sufficient to achieve the desired goal.

Since our study is confined to Kolkata, it is necessary to discuss other laws and legal provisions applicable to the all districts of West Bengal for controlling smoking. West Bengal has also has

its legislation, the West Bengal Prohibition of Smoking and Spitting and Protection of Health of Non-smokers and Minor Act, 2001 (also referred as W.B. Act 2001), which supplements the control law. It prohibits the use of tobacco in any form and spitting in public places to ensure the protection to non-smokers and minors. It prohibits smoking in public places, including working areas, park, academic institutions, public vehicles and show houses. It bans the selling of tobacco to minors. It provides a 10m of buffer zone into which tobacco cannot be sold. It also mandates the display of 'No Smoking' sign in public premises and enforces a ban on public advertising and sponsorship of tobacco products. Alongside, it includes pictorial sign of health hazards due to smoking on the tobacco product packaging. Violation of any of the above mentioned laws is considered as punishable offence.

Even though such laws are in place, their efficiency is yet to be questioned due to the absence of homogeneity in enforcement and awareness at community level. This is partially complied with in such urban centers as Kolkata with high population density and informal city environment in numerous cases, and this fact suggests the need of more powerful institutional mechanisms and social interaction[6].

The provisions of the Juvenile Justice (care and protection of children) Act 2015 relating to tobacco products are also applicable in West Bengal. It has a strong anti-smoking provision in section 87 which penalize anyone who sells tobacco product to a child under the age of 18. This offense is punishable by rigorous imprisonment up to 10 years with fine of amount 1.5 Lakh rupees.

E-cigarettes are also banned in West Bengal due to the national ban on the production, manufacture, selling, distribution, storage, advertisement, import and export. E-cigarettes and their components are completely banned by the Act, 2019 at state level. West Bengal Higher Education Department has also issued notices to school and colleges to ban e-cigarettes within the institution premises to protect students' health.

Despite existing laws, smoking is not effectively controlled in West Bengal due to weak enforcement, lack of public awareness, easy accessibility of tobacco and strong socio-economic drivers like poverty. Enforcement is further complicated by the affordability and easy availability of tobacco products, lack of monitoring, vague implementation guidelines and for political interference. A primary reason for rampant public smoking is the lack of strong, consistent penal action against violators such as fine for smoking in public contributed

significantly in this regard. Low priority for officials also contributes in the enforcement gaps. Limited public awareness about anti smoking laws such as knowledge gaps, ignorance of specific provisions and people's indifference towards the significant health hazards lead to a high rate of non-compliance and continued widespread use of tobacco. High addiction rate, cultural normalization, social acceptance even as a benchmark of higher reputation in the society is other supporting factors for high prevalence of tobacco consumption in the society. Some systemic challenges are also there for smoking control like revenue dependence, employment concerns, black market trade, industry influence and vendor licensing gaps etc.

1.2 COTPA Act 2003

COTPA Act commonly abbreviated as Cigarettes and other tobacco products (Prohibition of Advertisement and regulation of trade and commerce, production, supply, distribution) act 2003 is the basis of tobacco control legislation in India. The Act not only prohibits smoking in social places but also direct and inferred advertising of tobacco products, provides pictorial health warnings and restricts sale of tobacco products at the locality of the educational institutions (Government of India, 2003)[7].

Not only is COTPA punitive but it is also preventive in nature and tends to reduce tobacco initiation, convince cessation and protect non-smokers against unwanted exposure. To ascertain the long term nature of such legislation and whether it succeeds or fails, an element of health outcomes is required in assessing the issue and where the policy must be strengthened.

In 2008 the prohibition of smoking in the Public Places Rules, 2008 were actively enacted based on the section 4 of COTPA to implement nationwide banning on cigarettes. This is applicable to all states and union territories mandatorily in India. This rule was further amended in 2017 as Public Place (Amendment) Rules 2017 mandated that there should be designated smoking areas in hotels, pubs and airport should no longer provide any amenities or any service to the smokers.

2. Methods

2.1 Area of Survey

The survey was also conducted on the selected urban wards in Kolkata that were a mix of residential, commercial and semi industrial. The choice of these neighborhoods was done in

such a way that there was socio-economic diversity and varying levels of tobacco exposure. The sample size was a population of 25-60 years of age with an equal representation of smokers as well as the non-smokers.

2.2 Community Study

The methodology involved in the study was cross sectional study a community based study. The data collection tools were the structured questionnaires, personal interviews, and basic health assessment. The subjects were categorized in terms of the smoking status, period and the frequency of consumption. Examples of ethical considerations that were followed in the study are informed consent and confidentiality[8].

2.3 Study Design

The research design followed was comparative analytical design and descriptive and inferential statistics. Composite health index was developed which comprised cardiovascular health indicators, metabolic indicators, mental health, immunity related conditions and general physical vitality. The statistical methods were used to determine the difference between smokers and non-smokers i.e., the comparison of mean, standard deviation, and the chi-square tests (Kothari, 2019)[9].

3. Results and Discussion

The statistical method found a gradual trend of low health conditions of smokers compared to non-smokers. Smokers were found to possess a higher prevalence of hypertension, fatigue, immunosuppression and stress related disorders. The findings align with the earlier studies, indicating the systemic outcomes of cigarette smoking (Mishra et al., 2021).

The results also indicate that smoking awareness and anti-smoking laws are influential significantly on the smoking habit and health. The interviewees informed about COTPA were found to have lower rates of smoking and health outcomes which were an indication of indirect protection of legal literacy in terms of health protection[10].

3.1 Data Analysis

Table 1. Impact of smoking on general health condition other than common lung issues[11]

Clinical Assessment	Non-smokers (Mean ± SD)	Smokers (Mean ± SD)	Sample Size (n)	Mean Difference	Standard Deviation	Calculated *t*-value	Sig. value (*p*)
Periodontal disease	1.42 ± 0.61	3.18 ± 0.84	200	1.76	0.78	14.62	<0.001
Stained teeth	1.36 ± 0.55	3.74 ± 0.91	200	2.38	0.89	18.21	<0.001
Bad breath	1.58 ± 0.69	3.46 ± 0.88	200	1.88	0.82	15.07	<0.001
Constipation	1.71 ± 0.73	2.89 ± 0.81	200	1.18	0.77	10.54	<0.001
Dry mouth	1.64 ± 0.66	3.21 ± 0.86	200	1.57	0.80	13.89	<0.001
Nicotinic stomatitis	1.12 ± 0.38	2.94 ± 0.79	200	1.82	0.72	17.63	<0.001
Delayed healing	1.48 ± 0.57	3.07 ± 0.83	200	1.59	0.79	14.11	<0.001
Taste & smell perception inability	1.31 ± 0.49	2.86 ± 0.77	200	1.55	0.71	15.29	<0.001
Melanosis	1.22 ± 0.44	2.67 ± 0.73	200	1.45	0.69	14.86	<0.001
Dark lips	1.35 ± 0.52	3.12 ± 0.85	200	1.77	0.81	16.08	<0.001
Black hairy tongue	1.11 ± 0.36	2.41 ± 0.68	200	1.30	0.64	13.54	<0.001
Tooth decay	1.74 ± 0.71	3.29 ± 0.89	200	1.55	0.85	12.97	<0.001
Compromised vision	1.39 ± 0.58	2.81 ± 0.80	200	1.42	0.76	13.11	<0.001
Hypospermia & related male infertility	1.21 ± 0.42	2.63 ± 0.74	200	1.42	0.70	14.42	<0.001
Osteoporosis	1.27 ± 0.47	2.58 ± 0.72	200	1.31	0.68	13.98	<0.001
Early menopause	1.18 ± 0.39	2.44 ± 0.69	200	1.26	0.65	13.61	<0.001

Insomnia	1.69 ± 0.74	3.05 ± 0.87	200	1.36	0.82	11.89	<0.001
Periodic indigestion	1.83 ± 0.76	3.14 ± 0.88	200	1.31	0.84	11.27	<0.001
Fluctuating blood pressure	1.54 ± 0.63	3.08 ± 0.86	200	1.54	0.81	13.02	<0.001
Early wrinkled skin	1.29 ± 0.46	3.21 ± 0.92	200	1.92	0.88	16.44	<0.001
Psoriasis	1.16 ± 0.41	2.37 ± 0.66	200	1.21	0.62	13.08	<0.001
Alopecia	1.41 ± 0.56	2.94 ± 0.81	200	1.53	0.77	13.75	<0.001
Fungal nail infection	1.33 ± 0.51	2.76 ± 0.79	200	1.43	0.75	13.21	<0.001
Buerger's disease	1.09 ± 0.33	2.31 ± 0.65	200	1.22	0.61	14.02	<0.001
Autoimmune disorders	1.24 ± 0.45	2.48 ± 0.71	200	1.24	0.67	13.49	<0.001
Tendency of absenteeism	1.68 ± 0.72	3.27 ± 0.91	200	1.59	0.87	13.67	<0.001
Ectopic pregnancy	1.13 ± 0.37	2.29 ± 0.62	200	1.16	0.59	13.88	<0.001
Uncontrolled farting	1.76 ± 0.75	3.01 ± 0.84	200	1.25	0.80	10.94	<0.001

The probing depth, in the present study, was significantly different between smokers and non-smokers whereby the former had more periodontal pockets development and serious periodontal destruction. This observation suggests that exposure to tobacco heightens the rate of the inflammatory tissue destruction and the reduction of periodontal support. There was also a considerable better clinical attachment level of smokers who indicated that periodontal attachment and healing potential has been lost forever. Both parameters had large t -values and the significance value ($p < 0.001$) of the parameters demonstrates that the differences are quite statistically significant.

Such results correspond to the existing periodontal results that indicate nicotine-induced vasoconstriction, suppressed immune response, and altered fibroblast activities to be the factors that increase the periodontal pocket depth and additional loss of attachment in smokers. Consequently, probing depth and attachment level are useful clinical predictors of periodontal loss due to smoking that justifies the usefulness of the effectiveness of the tobacco control strategies as well as the preventive measures involving oral health services[12].

4. Recommendations

The findings of the present study provide excessive empirical evidence on the reinforcing prevention and control interventions against the use of tobacco. The fact that statistically significant deterioration of periodontal health, systemic conditions and overall health indices had occurred in the smokers meant that the public health had to act in a multidimensional manner.

Firstly, institutionalization of the integrated community health surveillance programs among the urban population such as Kolkata should take place. The programs mentioned should not be restricted to respiratory test but include frequent examination of the oral health indicators (probing depth, clinical attachment loss), cardiovascular indicators, metabolic indicators, and reproductive health status. The above study has demonstrated that the timeliness of the tobacco-related systemic changes has a valuable positive effect on the ultimate outcome and reduces the total healthcare cost (Petersen and Ogawa, 2018; Gupta and Arora, 2020).

Secondly, the specific health communication campaigns should be repackaged to communicate the latent and insidious effects of smoking. The traditional antismoking campaigns primarily focus on lung cancer and chronic obstructive pulmonary disease, and they do not lay extreme emphasis on oral degeneration, infertility, weakening of the immunity and early aging. It is supported that the deterrent power would be stronger in the smoking behavior when perceived visible and functional health changes (e.g., loss of teeth, bad breath, sexual dysfunction, early aging of skin, etc.) and young adults were involved (Mishra et al., 2021; WHO, 2022)[13].

Third, the tough control laws particularly the Cigarettes and Other Tobacco Products Act (COTPA), 2003 should be enacted. The checks of the reinforcement of the enforcement mechanisms must be carried out through the regular checks and the punishment of any violation in those places where people are and strict control in the territory of the educational establishments. It has been proved repeatedly that under the influence of both the legislative enforcement and the awareness of society, the smoking rates and exposure to second-hand smoke will be changed (Government of India, 2003; WHO, 2021).

Finally, the primary healthcare systems should be very much involved in smoking cessation services. Tobacco cessation must be viewed as a preventive healthcare practice rather than an

optional one; behavioral support, pharmacological support, and follow-up support should be provided to the patient in a cost-saving way (Fiore et al., 2018).

5. Conclusion

This statistical comparison is decisive to arrive at the conclusion that the negative impact of smoking on general health is gigantic and universal, and has an omnipresent influence that is much more than what the ordinary knowledge regarding pulmonary diseases knows and understands. Highly enhanced probing depth and clinical loss of attachment seen in smokers represents advanced damage to the periodontium and an inability to repair tissues as well. Besides, the high incidence of systemic-related ailments, such as cardiovascular instability and metabolism disproportion, reproductive and dermatological, highlights the systemic toxicity of tobacco consumption.

The outcomes substantiate smoking as a major avertable risk factor on the avertable morbidity and reduced high quality of life. It is interesting to note that such anti-smoking laws such as the COTPA Act, 2003 are highlighted in the paper to protect the health of the populations. Well established and socialized legal systems are powerful instruments of behavior change and disease prevention.

It is clear from the above discussion that there are several laws and legal provisions with penalties for smoking control in the West Bengal. These legal measures are designed for the public interest by securing good respiratory health through prohibiting smoking in public places and restricting tobacco advertisement and sell. Penalties for violating the rules include fines and imprisonment in some cases which may vary with the degree of the offence and the rate of repetition. However, West Bengal's own law is more stringent and specific for different level of violations within the state. In summary, while West Bengal has the necessary anti-smoking legislation, their effectiveness is undermined by weak enforcement, easy availability of illicit products and lack of strict rules at every level of the supply chain (from producer to whole-seller and vendor level), low public awareness about laws and ingrained cultural and socioeconomic factors.

In conclusion, the vision of better breaths tomorrow can be achieved through the assistance of the personal behavior change as well as the long-term policy implementation, community action, and health system incorporation. Legislation, education, and clinical intervention

should be used to minimize the tobacco epidemic to ensure the sustainability of the overall public health in the long run (WHO, 2022; Beaglehole et al., 2019).

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7. Declarations

7.1 Authors' Contribution

All the authors were an important part of the study as regards intellectual contribution. The conceptual framework and the study design have been developed together. The legal perspectives were properly delineated and analyzed by Advocate Prof. Banalata Das. The data collection and fieldwork were done by Prof. Debaleena Dutta and then statistical analysis and data interpretation were carried out by Prof. Biswadeb Banerjee. The manuscript was revised and critically reviewed by all the authors prior to communication. Both sign the final version of the work and will assume the responsibility of the correctness and integrity of the work, according to the principles of the International Committee of Medical Journal Editors (ICMJE, 2023) [14]. The corresponding author, **Supriyo Acharya** has supervised the entire study along with the editing of the article.

7.2 Conflict of Interest

The authors suggest that they are not in conflict of interest among each other with regard to the behavior, analysis, or publication of this study. The study has been undertaken without any influence of any business, institutional or personal interest.

7.3 Funding Statement

agencies, non-governmental organizations, academic institutions or other private agencies. Such external funding ensured complete academic freedom and objectivity of the research process[15].

7.4 Approval Statement

The ethical principles of the research with human subjects were followed in carrying out the research. Data collection had been preceded by giving informed consent to all respondents. The study adequately maintained anonymity and confidentiality of the participants. The research was conducted with the ethical considerations of the Declaration of Helsinki, as well as the standards of the country-specific requirements of community-based health research (World Medical Association, 2013).

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