REVIEW ARTICLE

Gender based Differences in Tobacco Cessation initiatives: A Bibliometric Review Analysis

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ABSTRACT

Introduction: As per the Global Action to end smoking report in 2022, India had 253 million tobacco users, ranking second globally. According to NFHS-5 (2019-21), tobacco use was highest among males aged 50-64 (52.8%). Men and women exhibited similar quit attempts, but women were 31% less likely to succeed due to factors like post-cessation weight gain and Varenicline response differences. This study assesses global research and academic literature trends on gender differences in tobacco cessation. **Methods:** Bibliographic data were collected from PubMed using search terms related to tobacco cessation and gender differences. 483 publications were analyzed using VOSviewer 1.6.19 and RStudio 4.4.0. Key data included publication years, authors, country, keywords, and citation count. Co-authorship and keyword networks were visualized to identify key themes and collaborations. **Results**: Publication growth was slow until 2006 but rose sharply from 2012 onward, peaking between 2018-2022 before declining in 2023-24. The USA and Canada led research output, with the University of Michigan and University of California as top contributors. “Tobacco use cessation devices” gained prominence from 2015-2021, while “smoking cessation” and “tobacco products” were terms frequently used from 2017-2022. **Conclusion**: This bibliometric analysis highlights research trends in tobacco cessation, emphasizing the need for intervention-focused studies to address gender disparities globally. While descriptive studies remain valuable, intervention research is needed to bridge gender gaps in tobacco cessation outcomes.

KEYWORDS

Gender; Tobacco; Bibliometric; Review; Cessation

INTRODUCTION

Tobacco use continues to display clear gender-linked patterns worldwide, with men typically using tobacco at substantially higher rates than women.(1) In India, this disparity is particularly visible. The 2022 Global Action to End Smoking Report estimated that 253 million Indians aged 15 and above consumed some form of tobacco-around 2 million men and 53.5 million women—placing India second globally in overall tobacco use.(1,2) According to NFHS-5 (2019–21), tobacco use peaks among men aged 50–64 years (52.8%) and among women above 65 years (18.6%).(3)

Gender differences in tobacco use and quitting behaviour arise from biological characteristics, health beliefs, social norms, and broader psychosocial influences. Neurobiological research demonstrates that men and women respond differently to nicotine and stress. Cosgrove et al reported that men with lower cortisol responses were more prone to relapse, whereas women with higher cortisol responses showed a stronger risk of

returning to smoking(4). A study by Al'Absi et al.(5) suggested that nicotine-containing cigarettes reduce withdrawal more effectively in men, while women experience comparable relief from nicotine-free cigarettes, implying reduced nicotine-related reward. Craving patterns also vary by gender—women often experience stress-induced cravings, whereas men react more strongly to environmental cues.(6,7). These distinct triggers require gender-tailored cessation interventions.

A multi-country cohort study across the UK, USA, Canada, and Australia found that although men and women attempted quitting at similar rates, women were 31% less likely to maintain abstinence.(8,9) Concerns about weight gain after quitting are a significant barrier for women and must be addressed during cessation counselling.(10,11,12). Among pharmacological responses, while varenicline shows strong short-term effectiveness in women, long-term quit rates remain similar across sexes.(13,14) Combined varenicline–bupropion therapy appears less effective in women.(15) Collectively, these findings highlight the need for gender-responsive cessation strategies.

Research examining gender in tobacco cessation has grown, but substantial gaps persist. Meta-analyses indicate that women often experience lower long-term quit success than men in cessation programs, although outcomes vary by region and social context.(16,17) Faster nicotine metabolism among women, partly due to hormonal influences, may reduce the impact of nicotine replacement therapy(NRT).(18) Evidence also suggests that women benefit less from NRT and bupropion, whereas varenicline remains equally or slightly more effective.(13,14,19)

Broader psychosocial influences shape cessation behaviour. Women more frequently report using tobacco for stress management, emotional regulation, and weight control, while stigma around female tobacco use—especially in low- and middle-income countries—limits access to cessation support.(10,20) Care responsibilities, time constraints, and fear of judgment by healthcare providers further restrict service use. Stress-driven cravings are more common among women, whereas men tend to relapse in response to contextual cues such as presence of smokers or certain environments.(6,7)

In India, gender differences are especially pronounced due to the dual burden of smoked and smokeless tobacco (SLT). Men predominantly smoke, while women disproportionately use SLT products such as khaini, gutkha, and mishri.(21) Indian women's cessation attempts are hindered by limited awareness of cessation services, social restrictions on mobility, and insufficient availability of gender-sensitive counselling.(22) Moreover, most cessation programs are designed for smoked tobacco, although SLT is the primary form used by women. This mismatch creates a major gap in national cessation strategies.

Maternal and reproductive health services also lack systematic integration of tobacco screening and cessation counselling, despite well-documented risks such as stillbirth, preterm birth, and neonatal complications. Few programs target women of reproductive age, indicating the need for a life-course approach to cessation.

Cultural and psychosocial contexts add further complexity. Many Indian women use SLT to cope with domestic stress or economic hardship.(22) Unlike Western settings where weight concerns frequently hinder women's quitting attempts, Indian women face challenges rooted in social invisibility, cultural acceptance of SLT, and low recognition of associated harms.

From a policy standpoint, India's National Tobacco Control Programme (NTCP) and cessation clinics provide foundational support but remain insufficiently gender-responsive. Women are under-represented among callers to national quit lines, reflecting broader issues in digital access and awareness. Outreach to rural women—where SLT use is especially prevalent—is limited(23).

To address persistent gender disparities, there is a need for research that describes gender-specific and culturally adaptable interventions. Priorities include randomized controlled trials focusing on SLT dependence among women, community-based cessation programs utilizing ASHAs and ANMs, and integration of tobacco cessation into reproductive and maternal health services. Tailored behavioral counseling, family-centered approaches, and context-appropriate pharmacotherapy trials may substantially improve outcomes for Indian women.

This bibliometric analysis was conducted with the following objectives:

- To examine global research trends showing gender differences in tobacco cessation .
- To analyze publication patterns, methodologies, and geographical distribution over time on gender differences in tobacco cessation.
- To assess the evolution of gender-focused research on smoking cessation, identify its thematic concentrations, and highlight gaps that warrant further investigation.

MATERIAL & METHODS

This study employed a bibliographic analysis to examine gender differences in tobacco cessation

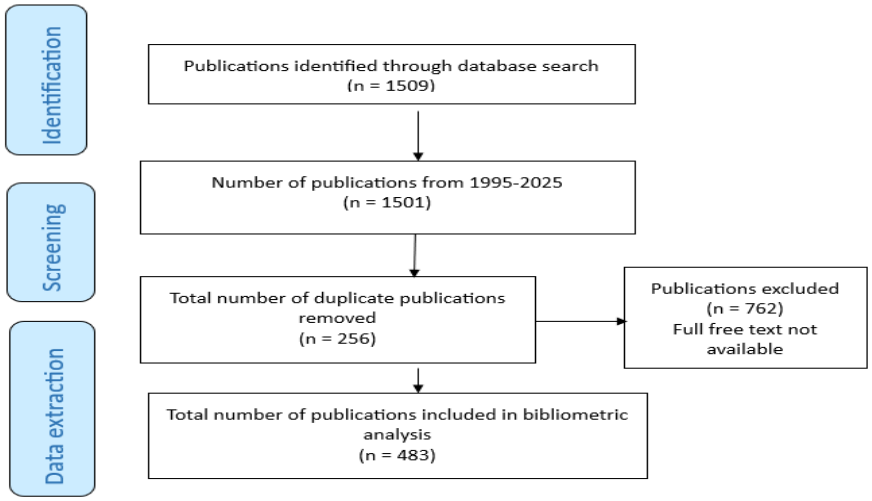
research. Bibliographic analysis is a quantitative method used to analyze academic literature, allowing for the identification of key themes, trends, and patterns within a given field. The analysis focused on peer-reviewed articles, conference proceedings, and review papers related to tobacco cessation and gender differences.

Data Source and Search Strategy: The bibliographic data was collected from the academic database PubMed between the years 1995-2025. This bibliometric analysis study relies exclusively on PubMed metadata due to its specialized focus on biomedical, clinical, and public health literature, which aligns directly with the study's theme of gender-based differences in tobacco cessation initiatives. PubMed offers standardized and high-quality metadata, including MeSH (Medical Subject Headings), which allow for accurate retrieval of gender- and tobacco-related studies. Its open access nature ensures transparency, reproducibility, and ease of data handling. PubMed's domain-specific precision, reliability, and curation by the National Library of Medicine make it the most appropriate and academically rigorous choice for this health-centered bibliometric analysis.

A comprehensive search strategy was developed using a combination of relevant keywords and Boolean operators. The primary search terms included "tobacco cessation," "smoking cessation," "gender differences," "sex differences," and related synonyms. Truncation symbols and wildcard characters were used where appropriate to ensure broad coverage of relevant literature. The search was limited to articles published in English.Studies were excluded if they did not explicitly address gender differences, were commentaries or editorials, or focused on non-human subjects.

Data Extraction and Management Data was extracted using a structured data extraction form. Key bibliographic information collected included title, authors, year of publication, journal name, keywords, country of origin, and the number of citations. Additionally, thematic content related to gender differences in tobacco cessation was extracted to facilitate qualitative analysis.

Figure 1 PRISMA Flow Diagram



Ethical Considerations: Ethical approval was granted by the Institutional Ethics Committee, PGI Chandigarh (Approval No. PGIIEC/2025/EIC000349, dated 19/02/2025). All procedures adhered to established standards for data confidentiality and management. No identifiable personal information was utilized

RESULTS

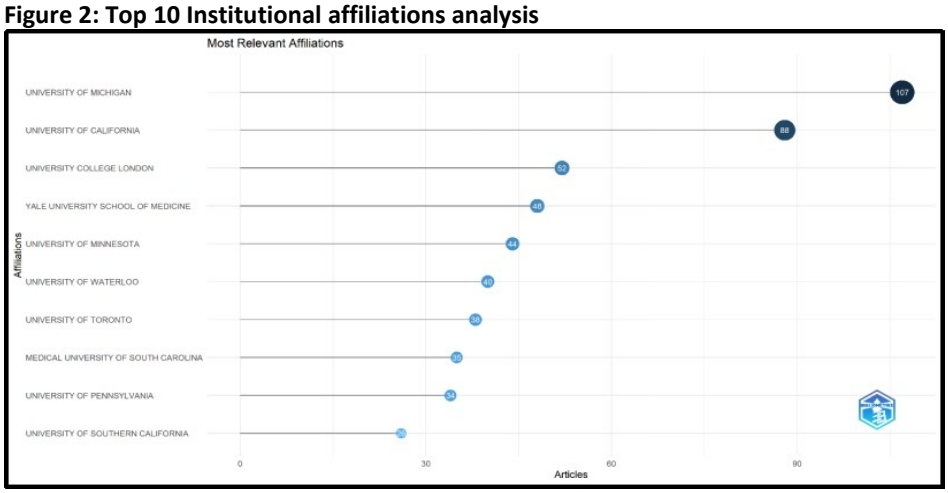
Data Analysis: The analysis was conducted using bibliometric software, such as VOSviewer (version 1.6.19) and RStudio (version2024.12.1+563). Descriptive statistics were used to summarize publication trends, including the number of publications by year, country, and author. Co-authorship networks, keyword co-occurrence networks, and thematic clusters were visualized to identify key research themes and collaborations.

Quality Control and Reliability: To ensure the reliability of the bibliographic analysis, intercoder reliability was assessed for the data extraction process. Data cleaning and standardization procedures were also applied to address inconsistencies in author names, journal titles, and keyword variations.

Results: The total number of publications relating to gender based differences in tobacco cessation over the time period of 30 years was 483. 23 (5%) in 1995– 2005, 188 (39%) in 2005-2015, and 273 (56.5%) in 2015-2025. Maximum publications were seen in time period from 2018-2022.The annual growth of publications in the health-related

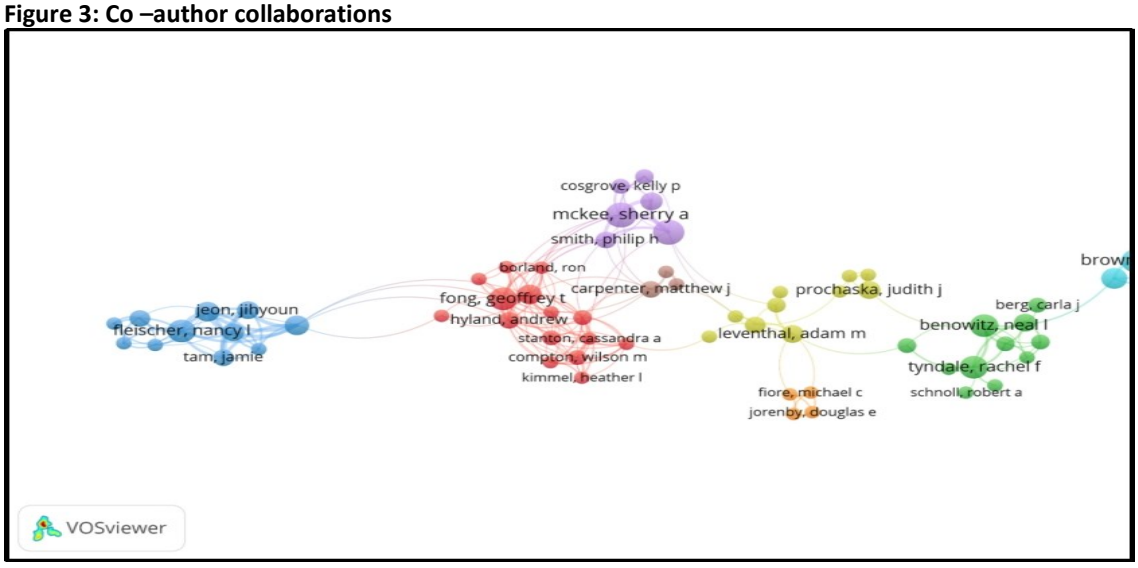
literature were less than ten till 2006 but showed a steep rise from 2012 onwards and maximum publications as high as 35-40 publications were seen in time period from 2018-2022 and then a sharp decline to less than ten was seen in 2023-24 . In 1995–2025, 11.2 % (n = 42) of data-based publications were categorized as clinical trials, 2.6% (n = 10) as meta-analysis and systematic reviews measures, and 6.4% (n = 24) as reviews. Rest were descriptive articles 79.6 % (n= 297). So, worldwide clinical trials provided the best evidence of gender differences in use and cessation of tobacco.

Figure 2: Top 10 Institutional affiliations analysis



The list of top active institutions/organizations for the literature was dominated by USA and Canada with University of Michigan topping the list and University of California ranking second. Most publications were from USA with 19.5% (n=73) publications were from University of Michigan and 12% (n=69) from University of California and 12.06% (n=45) from Yale University in USA. Canada and England featured next with 10.4%(n=39) from University of Toronto and 8.5% (n=32) articles from University college London. Most frequent collaborations were seen between USA and Canada, Mexico and Spain. The second most frequent collaboration was between Canada and Australia. USA also had collaborations with Argentina, Germany, Italy and India.

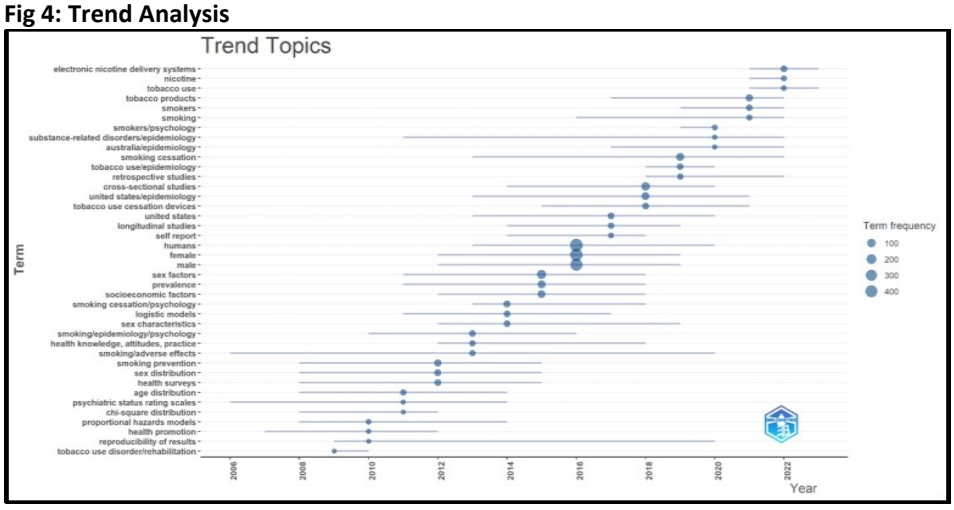
Figure 3: Co –author collaborations



The network is highly modular, indicating distinct research communities. Identifying central and bridging authors helps in mapping scholarly influence and potential collaborators. The strong intra-cluster links suggest well-defined thematic areas; meanwhile, inter-cluster links suggest opportunities for interdisciplinary collaboration. Central Authors: Geoffrey T. Fong and Neal L. Benowitz appear to be central influencers due to their proximity to multiple clusters and node size. Bridging Authors: Adam M. Leventhal and Matthew J. Carpenter serve as connectors between

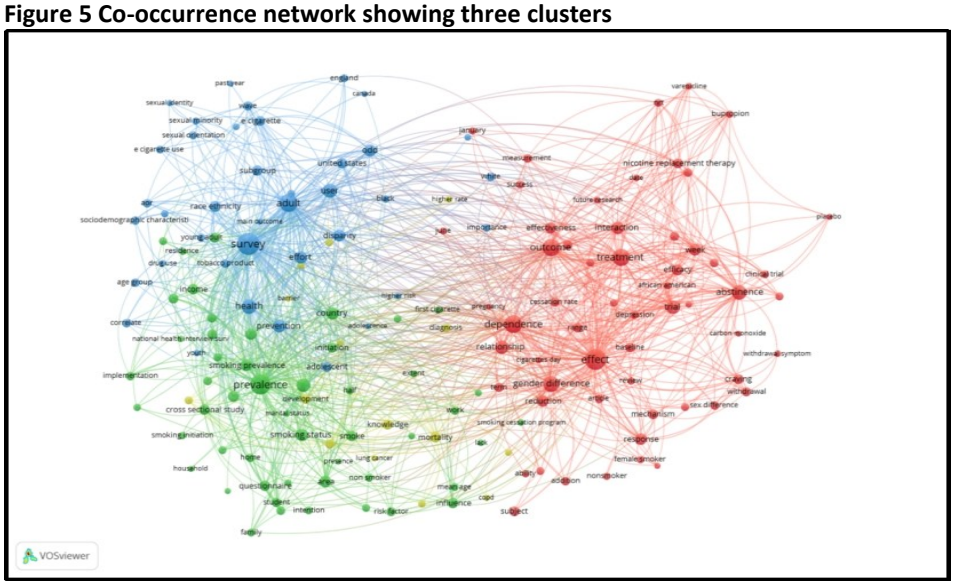
otherwise distinct groups.Isolated Clusters: Purple and Blue clusters show strong internal collaboration but limited external links.

Fig 4: Trend Analysis



This trend analysis visualizes the evolution of key research topics in tobacco-related literature from 2005 to 2022. Early studies focused on foundational terms like "prevalence," "logistic models," and "health surveys," with a shift toward more specific themes such as "smoking cessation," "self-report," and "sex differences" emerging around 2014–2016. Recent years show growing interest in modern concepts like "electronic nicotine delivery systems" and "tobacco use cessation devices." Term frequency, represented by bubble size, highlights the dominance of topics like "smoking cessation" and "longitudinal studies." Overall, the field reflects a dynamic shift from epidemiological basics to intervention and technology-oriented research.

Figure 5 Co-occurrence network showing three clusters



The three clusters are population-level studies (blue), health outcomes (green), and clinical interventions (red). The blue cluster focuses on demographics, especially youth and minority groups; the green highlights smoking prevalence and health impacts; the red covers treatment and pharmacological strategies. Central terms like *"dependence"* and *"treatment"* bridge clusters, reflecting a multidisciplinary research landscape. Terms with ≥10 occurrences are included.

DISCUSSION

This review provides a comprehensive bibliometric assessment of smoking cessation research with a focus on gender dynamics across nearly thirty years. By mapping patterns in publication growth,

thematic evolution, and methodological development, it addresses an important gap in the existing literature. Research outputs related to gender differences increased sharply between 2018 and 2022—from 18 to 45 papers—mirroring trends seen in other global bibliometric evaluations. Despite this expansion, most studies continued to emphasize descriptive analyses, with only a gradual transition toward randomized controlled trials (RCTs). This pattern aligns with Nutbeam's research translation model, which proposes that scientific fields typically progress from exploratory descriptions to more rigorous intervention-driven work capable of shaping public health practice(17,18).

While descriptive research remains essential for understanding gender-specific cessation behaviors, there is an urgent need to elevate the volume of intervention studies to reduce persistent disparities in quitting outcomes. According to Nutbeam's framework, as a field matures, greater emphasis should be placed on trials that test effectiveness, feasibility, and implementation. The Nagahama study (2022) found distinct gender differences in the intergenerational transfer of smoking in Japan, showing that parental smoking, particularly mother-to-daughter, significantly impacts smoking initiation. Women in the study had greater difficulty maintaining long-term smoking cessation, highlighting the importance of gender-specific tobacco control strategies(24). Notably, global investment in gender-specific cessation research remains limited, as highlighted in major tobacco control reports.

Recent years have seen a modest rise in systematic reviews, meta-analyses, and RCTs, accompanied by more diverse geographical representation and stronger cross-country collaborations. These developments enhance the applicability of findings, as noted in emerging global research. Nonetheless, the bulk of intervention studies are still situated within healthcare facilities, which continue to serve as critical delivery points for cessation services. This is particularly relevant given the documented gender variations in tobacco use patterns and cessation trajectories.

Much of the literature reproduces findings from long-standing multicountry surveys, particularly in the United States and Canada, where genetic, socioeconomic, and behavioral determinants of quitting have been extensively examined. This concentration exposes a geographic imbalance, with limited representation from low- and middle-income countries. Additionally, the exclusion of grey literature and the dependence on author-provided keywords may have contributed to the underrepresentation of lifestyle-based or community-driven interventions.

Gender disparities were most notable among adults aged 30–55, where women exhibited lower long-term abstinence rates. Hormonal fluctuations—including those associated with menopause—may partially account for differences in nicotine processing and cessation outcomes. Expanded research into the role of female hormones, particularly in relation to non-pharmacological strategies, is warranted. Future bibliometric work would benefit from incorporating terms linked to menopause and age-related gender variations.

From 1995 to 2024, 1,501 studies examined gender in relation to cessation. Although research from 2018 to 2022 demonstrated progress—particularly in data-driven analyses and gender-specific interventions—the overall volume of intervention research remains inadequate. Strengthening the evidence base for gender-tailored cessation strategies is essential for developing equitable, high-impact public health approaches.

Numerous studies highlight that women often encounter greater psychological and social barriers to quitting. Women commonly report elevated emotional stress, heightened concern for health, and a preference for supportive counseling environments. Men, in contrast, are more likely to be influenced by external triggers and environmental cues. Biological factors—such as faster nicotine metabolism among women—further complicate cessation outcomes. Social and cultural pressures also disproportionately hinder women's quit success.

India provides a distinctive context for examining gendered patterns. This divergence has important implications for cessation strategies, as interventions developed for cigarette smoking may not be directly transferrable to SLT use among Indian women.

Indian women also face multiple overlapping barriers. Social stigma linked to female tobacco use often discourages disclosure and limits help-seeking behavior. Evidence from several Indian states indicates limited awareness of cessation resources among women, reduced access to nicotine replacement therapy, and minimal family support during quit attempts. Cultural acceptance of SLT products as mouth fresheners or traditional remedies further complicates efforts to quit.

Another gap is the insufficient incorporation of cessation support into reproductive and maternal health services. Despite the established risks of tobacco use during pregnancy—such as low birth weight and stillbirth—routine screening and counselling remain inconsistent. A logistic regression model in a Korean study by Lee et al

showed a statistically significant association between the utilization of smoking cessation services and a history of pregnancy and childbirth, depression, current use of heated tobacco products and multiple tobacco products, parental smoking status and receiving advice to quit(25) . Health-focused messaging related to pregnancy or child well-being often motivates Indian women more strongly than legal or policy restrictions (20).

Psychosocial influences also play a strong role. Many women describe using SLT as a coping mechanism for domestic stress, economic challenges, and caregiving burdens. Unlike in Western settings, weight control is not a predominant factor in cessation decisions among Indian women. While men's quit attempts are often driven by external policies or medical advice, women's attempts tend to be motivated by concerns for family health, suggesting that counselling strategies emphasizing child and household well-being may be more effective as reflected in the findings of a study in West Bengal by Dasgupta et al (26).

From a policy standpoint, although India's National Tobacco Control Programme (NTCP) has expanded cessation infrastructure, gender-responsive strategies remain limited. Most clinics are urban-based, and women—particularly in rural areas—remain underrepresented in quit line utilization. Limited digital access further restricts engagement(23) .

To improve outcomes, India requires more experimental research tailored specifically to women. RCTs assessing culturally adapted behavioural counselling, community-based support models, and maternal health–linked cessation interventions could significantly strengthen policy and practice. Trials evaluating pharmacological treatments for SLT cessation among women are also needed, given the limited applicability of evidence from high-income settings. Leveraging community health workers such as ASHAs and ANMs could help expand access and acceptability, especially in rural populations.

Conclusion

Gender plays a pivotal role in shaping cessation behaviours and outcomes. Although both men and women receive advice to quit, women are more frequently counselled by health professionals. However, treatment recommendations rarely differ by gender, indicating a need for more tailored approaches. Evidence suggests that women benefit more from interventions addressing internal, behavioural, and social challenges, whereas men respond better to strategies that target external influences. Implementing gender-responsive cessation strategies is therefore essential for improving equity and effectiveness.

Recommendations

Future research should prioritize gender-responsive randomized controlled trials that address both smoked and smokeless tobacco use, particularly among women in low- and middle-income countries. Integration of tobacco cessation services into reproductive, maternal, and primary healthcare platforms should be strengthened to improve early identification and counselling. Community-based delivery models utilizing ASHAs and ANMs can enhance outreach among rural and socially marginalized women. Policymakers should allocate dedicated funding for gender-specific cessation research, including pharmacotherapy trials tailored to women's nicotine metabolism and psychosocial needs. Additionally, digital quit line services must be redesigned to improve accessibility, awareness, and acceptability among women through culturally sensitive and family-centered approaches.

Limitation of the Study

This review is restricted to English-language publications indexed in PubMed, which may have resulted in selection bias and the exclusion of relevant studies. Additionally, the use of author-supplied keywords may have constrained the breadth of included themes. Due to the limitations of the PubMed database, which does not provide citation metrics, the study could not perform citation analysis to assess the academic impact or influence of individual publications.

Relevance of the Study

This study maps global research trends on gender differences in tobacco cessation and identifies major evidence gaps, particularly the limited focus on intervention trials. The findings support the need for gender-responsive cessation strategies, especially in countries like India with diverse tobacco use patterns. The review guides policymakers and researchers in designing equitable, evidence-based tobacco control programs to improve quit outcomes.

Authors Contribution

All authors have contributed equally.

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None

Conflict of Interest

The authors declare no competing interests.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

No use of generative AI or AI assisted technolies was used in the writing process. The authors have reviewed and edited the content as needed and take full responsibility for the content of the publication.

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