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Sex/gender differences in smoking cessation: A review

Philip H. Smith[a], **Andrew J. Bessette**[b], **Andrea H. Weinberger**[c,d], **Christine E. Sheffer**[a], and **Sherry A. McKee**[b]

[a]Sophie Davis School of Biomedical Education/CUNY School of Medicine

[b]Department of Psychiatry, Yale University School of Medicine

[c]Ferkauf Graduate School of Psychology, Yeshiva University

[d]Department of Epidemiology and Population Health, Albert Einstein College of Medicine

Abstract

Data from treatment studies tends to show women are less likely to quit smoking than men, but these findings have been disputed, typically based on contradictory evidence from epidemiological investigations. The purpose of this review was to shed light on this conflict. We conducted a qualitative review in January, 2016 to examine sources of variation in sex/gender differences for smoking cessation. We identified 214 sex/gender difference tests from 190 studies through Medline and studies were categorized into efficacy trials (k=37), effectiveness trials (k=77), prospective observational studies of cessation (k=40; current smokers transitioning to former smokers), prospective observational studies of relapse (k=6; former smokers transitioning to current smokers), cross-sectional investigations of former smoker prevalence (k=32), and community-based interventions (k=4). We also summarized evidence across time periods, countries, outcome assessments, study sample, and treatment. Evidence from efficacy and effectiveness trials, as well as prospective observational studies of relapse, demonstrated that women have more difficulty maintaining long-term abstinence than men. Findings from prospective observational studies and cross-sectional investigations were mixed and demonstrated that bio-psycho-social variation in samples across place and time may determine whether or not women or men are less likely to quit smoking. Based on these findings, we consider whether sex/gender differences in quitting meet criteria for a disparity and outline directions for further research.

Cigarette smoking continues to be the leading cause of preventable death and disease in the United States (U.S.), killing approximately 556,000 Americans annually.[1] While tobacco control efforts have had remarkable success in the past 50 years reducing the prevalence of

Please direct correspondence to: Philip Smith, Sophie Davis School of Biomedical Education, Harris Hall, Suite 400, 160 Convent Avenue, New York, NY 10031, Phone: 212.650.7738, smith@med.cuny.edu.

Conflict of Interest Statement

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smoking, the risk of mortality from smoking-related disease is increasing, particularly for women.[2] The risk of dying from many smoking-related lung cancer, oral cancer, and cardiovascular disease is greater for women than men even when controlling for level of tobacco exposure.[3–9] Smoking cessation leads to significant immediate and long-term reductions in smoking-related disease,[10] and is key to addressing smoking-related disease. In this qualitative review, we examine differences between women and men in the ability to achieve long-term abstinence from smoking. We refer to differences between women and men as "sex/gender" differences to incorporate the biological and social dimensions of sex and gender that are captured in investigations of smoking cessation.

Observed differences between men and women in the success with which individuals achieve smoking cessation (e.g.,[11,12]) in a variety of contexts have been reported. For example, many studies report that women have a lower likelihood of achieving abstinence in tobacco dependence treatment clinical trials (e.g.,[13,14]); however, the reasons for this are unclear and the existence of actual sex/gender differences in the ability to achieve cessation is disputed. Some speculate that perceived sex/gender differences in cessation result from failing to account for a higher proportion of men replacing cigarette use with other tobacco products,[13,15] or from unique albeit unknown characteristics of treatment-seeking smokers.[13,16–18] Killen and colleagues (2002) suggest that clinical trials rarely pre-emptively design studies to assess sex/gender differences, and post-hoc sex/gender comparisons are likely to be biased because non-stratified randomization fails to balance treatment groups within sex/gender. Furthermore, historical cross-sectional population-level epidemiological evidence from the U.S. has led the Surgeon General to report that previously existing sex/gender differences have narrowed to the point where differences are no longer evident,[19] but this cross-sectional evidence does not sufficiently account for contradictory evidence from other data sources.

The purpose of this qualitative review is to examine evidence that contributes to the debate about sex/gender differences in smoking cessation. We aimed to compile and summarize variation in sex/gender difference findings across different research methodologies, time periods, countries, and study samples. We identified a large number of studies that focused on sex/gender in relation to smoking cessation as well as studies that identified sex or gender as a covariate in the study abstract. We searched Medline abstracts and keywords for the terms ((cigarette OR smok*) AND cessation AND (sex OR gender)) on January 8, 2015. Studies were included in the review which statistically compared and reported results for a sex or gender difference in smoking cessation. We did not limit the range of years or geographic locations of publications included in the review. We included foreign language publications if there was an English language abstract that reported on a sex or gender difference test.

We examined the methodological approach used in studies to understand its relation to sex/gender difference outcomes. We sorted studies into the following categories: (1) cross-sectional observational, (2) prospective observational, (3) community-level intervention, (4) efficacy intervention, and (5) effectiveness intervention. We classified studies as efficacy interventions if their main purpose was to evaluate a treatment in ideal trial settings; effectiveness interventions if the study results were generalizable to smokers quitting in real-

world contexts (including studies examining the “effectiveness” of making unaided quit attempts); community-level interventions if the intervention was administered to communities rather than select individuals; prospective observational if current smokers were examined at baseline and followed over time, or former smokers who had been abstinent for a period of time were examined at baseline likelihood of relapse was estimated over time; and cross-sectional observational if the study examined the prevalence of former smokers among ever smokers (i.e., the quit ratio) at a single point in time or serially among independent samples over time.

For each study we recorded brief details about the study sample, cessation outcome, treatment, if applicable, and results. We tabulated the sex/gender comparison results as follows: women were less likely to quit (or to maintain abstinence in relapse investigations) than men (W<M; $p<0.05$); women were more likely to quit than men (W>M; $p<0.05$); or no difference in the likelihood of quitting for women and men (W=M; $p>0.05$ for W>M or W<M). We then counted the number of studies in each of these categories. We used one sample tests of proportions to examine differences in the proportion of studies finding W>M vs. M>W. This test of proportions is based in the assumption that the distribution of effect sizes for sex/gender differences across all studies is normally distributed, and therefore if there were no real sex/gender difference then the proportion of studies finding W>M would equal the proportion finding W<M. Based on this assumption, an imbalance in one direction or the other would be indicative of a sex/gender difference. We compiled effect sizes in the form of odds ratios (ORs) and variance estimates (e.g., 95% confidence intervals (CI)) when available, and summarized the distributions of effect sizes within study types, regardless of statistical significance. When summarizing effect sizes, we coded studies that found W=M but that did not report an effect size as having an OR of 1.

Search results

The search terms returned 3,140 abstracts, 190 of which reported 214 tests of sex/gender differences in smoking cessation, either as a variable of interest or as a control variable. By subtype, we identified 37 efficacy trials (47 tests), 77 effectiveness trials (79 tests), four community-based trials (4 tests), 40 prospective observational studies (46 tests), and 32 cross-sectional observational studies (38 tests). Results are detailed by study type below.

Efficacy trials

Efficacy trial results are summarized in supplementary materials Table S1 (online only). Thirty-seven studies reported on 47 tests of sex/gender differences in smoking cessation. Twenty-five found W<M, one found W>M, and 21 found W=M (see Table 1). There were significantly more W<M than W>M ($p<0.001$). Of tests finding W=M, we were able to extract effect size details for 15. Of these, 10 tests found non-significant W<M (OR<1.0), 4 found non-significant W>M (OR>1.0), and one found W=M (OR=1.0). Of the 10 finding non-significant W<M, ORs were: 0.18, 0.47, 0.60, 0.63, 0.76, 0.84, 0.84, 0.96, 0.97. Of the four finding non-significant W>M effect sizes were: 1.21, 1.26, 4.34, and 6.96. Further information on effect size (e.g., 95% CI), when available, is presented in Table S1. These findings suggest a number of studies had inadequate power to detect meaningful sex

differences, although more studies had inadequate power to detect effects showing W<M than W>M. The full range of effect sizes are presented in Figure 1A, showing a shift in the distribution towards W<M. Based on the assumption of normally distributed effect sizes for sex/gender comparisons, we conclude that this pattern of findings is highly improbable ($p < .001$) if there were, in fact, no sex/gender difference in smoking cessation for those participating in efficacy trials.

Based on a qualitative review of study characteristics, no clear patterns emerged among studies that did and did not find sex/gender differences. Mean duration of follow-up for tests that found W<M was 6.14 (SD=4.39) months, while the mean duration of follow-up for tests that found W=M was 7.02 (SD=4.39) months ($t_{44}=0.76$, $p = 0.45$). Sub-group comparisons within treatment conditions found no sex/gender differences and differences in placebo and treatment conditions. The characteristics of participants (e.g., age, nicotine dependence levels, etc.) varied widely among studies that did and did not find sex/gender differences and no differences. We also did not discern any change in the pattern of findings over time.

Effectiveness trials

Effectiveness trial results are summarized in supplementary materials Table S2 (online only). Seventy-seven studies reported on 79 tests of sex/gender differences in smoking cessation. Thirty-four tests found W<M, 1 found W>M, and 44 found W=M (Table 1). The proportion of tests finding W<M was significantly greater than the proportion finding W>M ($p<0.001$). Of the 44 tests that found W=M, 16 reported odds ratios. Of these, 10 had OR<1.0 (i.e., non-significant W<M), 1 found W=M (OR = 1.0), and 5 found non-significant W>M (OR>1.0). It is notable that among the five tests that found non-significant W>M (OR>1.0), the maximum OR was 1.38 and the other four were between 1.0 and 1.09. The ten studies finding non-significant W<M had the following ORs: 0.50, 0.52, 0.52, 0.67, 0.69, 0.74, 0.84, 0.91, and 0.91. These findings suggest that a number of studies were underpowered to detect meaningful differences where women were less likely to quit smoking than men, but only 1 study was underpowered to detect a potentially meaningful difference where men were less likely to quit smoking than women. The full distribution of effect sizes is presented in Figure 1B. Taken together, this distribution of findings is highly improbable ($p < 0.001$) if there were no sex/gender difference in smoking cessation among those participating in effectiveness trials.

Based on our qualitative review there was some evidence that studies finding W<M had longer duration of follow-up than studies finding W=M. Among the 44 tests finding W=M, 22 (50%) had followed participants for less than 1 year, and 15 (34%) for less than 6 months. By comparison, of the 34 tests finding W<M, 8 (24%) had durations of follow-up less than 1 year, and 3 (9%) less than 6 months. The mean duration of follow-up for studies finding W=M was 8.75 (SD=6.56) months, compared to 14.83 (SD=13.20) months for W<M ($t_{(75)}=2.62$, $p = 0.01$). Among studies with follow-up durations of at least 1 year, 22 tests found W=M and 27 found W<M; among studies with durations of follow-up less than 1 year, 22 tests found W=M and 8 found W<M. We did not discern any other characteristic patterns among effectiveness studies that might account for sex/gender differences, We also did not discern any change in the pattern of findings over time.

Community-based interventions

Results from community-based interventions are presented in supplementary materials Table S3 (online only). Our review identified too few studies (n=4) to draw conclusions about sex/gender differences among community-based intervention studies. Two of the investigations found W< M, and two found W=M. Of the two that found W=M, one had an OR of 0.60 (non-significant W<M), and therefore may have been underpowered to detect a meaningful difference.

Prospective observational

Results from prospective observational studies are summarized in supplementary materials Table S4 (online only). Forty studies reported on 46 tests of sex/gender differences. Of these, 10 tests found W<M, 5 found W>M, and 31 found W=M (Table 1). There were significantly more tests finding W<M than the proportion finding W>M (p=0.007). Of the 31 tests finding W=M, we were able to extract effect size data from 20. Of these 20, 10 found non-significant W<M (OR<1.0) and 10 found non-significant W>M (OR>1.0). The full range of effect sizes is depicted in Figure 1C. Among the prospective observational studies, women tended to be less likely to quit than men.

Among the prospective observational studies, 6 of the 46 tests were examined relapse rather than smoking cessation (e.g., former smokers at baseline were then identified as current smokers at follow-up). Of these 6 studies, three found W<M and 3 found W=M. Of the 3 that found W=M, 2 reported effect sizes, and both of these found non-significant W<M (OR=0.71 and 0.84). These findings suggest women are more likely to relapse after a period of abstinence than men. Of the 40 studies of smoking cessation (current smokers transitioning to former smokers), 7 found W<M, 5 found W>M and 28 found W=M.

Based on a qualitative review of study characteristics, duration of follow-up varied widely, from weeks to 32 years. Mean duration of follow-up for tests finding W<M = 9.70 (SD=7.63); for tests finding W=M = 5.35 (SD=6.67); and for tests finding W>M = 3.10 (SD=2.36). This pattern suggests that studies finding W<M may have had longer follow-up periods, although the differences did not reach statistical significance (p<0.10). Some differences were found by country. For example, among 26 studies with U.S. participants, 17 found W=M, 4 found W<M, and 5 found W>M. All 4 tests finding W<M were published in 1996 or earlier, and 3 of the 4 were published in 1990 or earlier. By contrast all 3 studies conducted in Spain found W<M, and all 3 studies were published after the year 2000. Social/cultural factors and changes over time in the characteristics of smokers and the environmental context of smoking may play an important role in the development of sex/gender differences in cessation

Cross-sectional observational

Results from cross-sectional observational studies are summarized in supplementary materials Table S5 (online only). Thirty-two studies reported on 38 tests of sex/gender differences in cross-sectional studies. These studies based their definition of smoking cessation on the ‘quit ratio,’ which is the proportion of ‘ever smokers’ in a population who at the time of the survey no longer smoke. Eleven found W<M, nine found W>M, and 18

found W=M (Table 1). There was no difference in the proportion of studies finding W<M from the proportion finding W>M. Of the 18 tests finding W=M, we were able to extract effect size data from 9. One test found a non-significant OR of 0.29 (W<M), while the rest were close to 1.0, ranging from 0.80 to 1.07. The distribution of effect sizes is presented in Figure 1D. Overall, the distribution of findings provides evidence for a slight sex/gender difference whereby women were less likely to be former smokers than men.

Among the cross-sectional observational studies, effect size may have varied with time. Among studies published prior to 1990, five found W<M and one found W=M. Among studies published between 1990 and 1999, 3 found W=M and 2 found W<M. Among studies published 2000 or later, 13 found W=M, 9 found W>M, and 4 found W<M. These findings suggest that the proportional differences were driven by earlier investigations, and that among more recent investigations there was no evidence that women were less likely to be former smokers than men, and possibly a small difference whereby women were more likely to be former smokers than men. We were unable to discern patterns by any other study characteristics.

Discussion

Of 126 tests conducted in efficacy and effectiveness trials, only 2 found women were significantly more likely to quit smoking than men, compared to 59 that found women were significantly less likely to quit smoking than men. Among effectiveness trials, we found evidence that women were particularly less likely to quit smoking than men when followed for longer durations of time. Taken together, these findings suggest that in a given quit attempt women have more difficulty maintaining long-term abstinence than men.

We found mixed evidence of a sex/gender difference among prospective observational studies, although our consideration of both non-significant and significant effect sizes (Figure 1C) suggests women were slightly less likely to achieve abstinence than men. These findings contradict findings from a review of factors predicting smoking cessation among population-based prospective studies of cigarette smokers that concluded there were no sex/gender differences in the likelihood of quitting smoking.[20] We speculate that the findings differ because our review considered a broader range of study samples and sizes than the previous review, and considered distribution of both significant and non-significant effect sizes. Also, when our results were separated into investigations of cessation and investigations of relapse, we found less evidence for differences in cessation than we did for differences in relapse. In the U.S., we did not find any significant differences of W<M published in the past 20 years supporting the 2014 Surgeon General's conclusion that among those who had ever smoked, there was little evidence that women were currently less likely to be former smokers than men.[19]

Studies of relapse tended to find women were more likely than men to transition from being a former smoker to a current smoker, and these findings were consistent regardless of publication year. This finding is consistent with the evidence from efficacy and effectiveness trials suggesting that women have more difficulty maintaining longer periods of abstinence. The lack of time trends for efficacy and effectiveness investigations, as well as the general

consistency across samples and methodology suggest that sex/gender differences in achieving long-term abstinence may not be strongly influenced by differences in social/cultural and environmental factors in the past 50 years.

Overall, we did not find evidence to support a sex/gender difference in smoking cessation among cross-sectional investigations, although effect sizes varied by time and geographic location. This evidence supports conclusions drawn by others.[13,15,19] There may have been a difference in previous time periods,[21] but more recent studies provide evidence there is likely no longer a difference, at least in major developed countries such as the U.S., U.K., and Canada.[15,19]

These cross-sectional studies should be interpreted within the confines of inherent limitations. Cross-sectional quit ratios are a cumulative representation of smoking cessation over time for the given sample, rather than a study of smoking cessation over a defined time period, and therefore group differences may be influenced by factors acting in the past. The ability to control for important variables is limited, such as the former smokers' level of nicotine dependence while they smoked, or the frequency, quantity, or duration of smoking. Conclusions from cross-sectional studies of cessation should be tempered based on these limitations.

A paradox?

There seems to be a paradox, whereby among quit-attempters women consistently have more difficulty maintaining abstinence in treatment settings (and we contend in non-treatment settings as well), while epidemiologic investigations show a greater degree of variability over time and place in sex/gender differences for smoking cessation. As previously noted, explanations for these seemingly contradictory findings have focused on differences between treatment and non-treatment seeking smokers,[15] or the failure of treatment investigations to stratify randomization by sex, potentially biasing findings due to unbalanced sex-specific comparisons.[18] Our review suggests neither explanation fully accounts for the pattern of sex/gender difference findings across investigations.

There are multiple differences between treatment seekers and non-treatment seekers that may impact sex/gender differences in smoking cessation, including nicotine dependence levels[14,22] and interaction with the healthcare system. It is possible these differences explain sex/gender difference findings. However, using data from the International 4-Country Survey, a longitudinal community-based study of smokers in Australia, Canada, the U.K. and the U.S., we found that the sex/gender gap in smoking cessation success (W<M) was most evident among non-treatment seekers.[14] Regarding the potential for bias resulting from non-stratified randomization, a recent large trial in which women and men were block-randomized still found women were less likely to quit than men,[23] suggesting this explanation also falls short. Jarvis and colleagues (2013) acknowledged an alternative explanation, whereby women make more attempts to stop smoking over time.[15] However, the authors also cited evidence of equal quit attempts for men and women,[20] and did not propose other alternative explanations.

We extend this previous work by proposing an explanation for the overall pattern of findings that potentially rectifies contention over whether women or men have more difficulty quitting smoking. The mixed findings from prospective observational studies are likely to be evidence of the complex multi-level factors that influence whether smokers transition to abstinence and which may also contribute to variation in sex/gender differences across time and place (e.g., geographic region or country). For example, at the social level, one largely unacknowledged factor that may *promote* cessation among women to a greater degree than men is pregnancy/parenting. Jarvis (1996) found that among women, having one child was associated with 40% greater odds of cessation compared to similarly aged women with no children, which increased to 120% greater odds for those with three or more children.[24] Among men, those with children had approximately 25–30% greater odds of cessation regardless of the number of children. Further, the prevalence of smoking during the last 3 months of pregnancy decreased significantly and substantially in the U.S. between 2000 and 2010.[25] Other potentially important factors may include menstrual cycle and hormone variation,[26,27] sex/gender differences in smoking cessation medication use and effectiveness,[14,28] sex/gender differences in nicotine dependence,[14,22,29,30] and sex/gender differences in the use of other tobacco products both prior to and subsequent to quitting smoking.[15]

Are there sex/gender disparities in smoking cessation?

In 2002, the National Conference on Tobacco and Health Disparities (NCTHD) set a research agenda to eliminate tobacco-related disparities.[31] The NCTHD defined tobacco-related disparities as “differences in the patterns, prevention, and treatment of tobacco use; the risk, incidence, morbidity, mortality, and burden of tobacco-related illness that exist among specific population groups in the U.S.; and *related differences in capacity and infrastructure, access to resources, and environmental tobacco smoke exposure*.” Clearly, disparities are differences that are linked to environmental factors, social context, factors outside of individuals’ control, and ultimate a sense of injustice and inequity.[32] It is becoming increasingly evident that there are disparate responses among many groups to tobacco control efforts and this may also be the case among women.[19,33–35] The identification and reduction of tobacco-related disparities improves health equity as well as reduces the overall health burden of tobacco use. Women constitute more than half of the population in the U.S. and although fewer women smoke than men, the difference in prevalence rate is shrinking. Between 1965 and 2009 smoking rates decreased 55% among men, and just 47% among women.[36] In the southern U.S., life expectancy may actually be decreasing among women, and a study identified smoking was one of only two factors related to this decline.[37]

Our findings indicate that sex/gender differences in smoking cessation are present in treatment contexts, as well as among smokers making quit attempts in real-world contexts with or without treatment, and among former smokers attempting to maintain abstinence. These differences could be considered disparities if they are linked to avoidable environmental factors, social contexts, factors outside of individuals’ control (but within societies’ control), and ultimately a sense of injustice or inequity. While it is beyond the

scope of this manuscript to identify the full range of factors associated with sex/gender differences in cessation, we propose several frameworks to guide such an examination.

Hebert and colleagues provide conceptual guidance for understanding and determining the extent of a disparity.[22] A sociopharmacological model for tobacco addiction proposed by Leventhal[38] can be helpful for identifying factors that contribute to tobacco-related disparities in particular. Adler et al. provide a very practicable conceptual framework that incorporates components of several health behavior theories.[39]

Leventhal's *Sociopharmacology* theory of tobacco addiction applies a multi-level perspective, focusing on psycho-pharmacological and contextual factors that interact in relation to tobacco addiction. At the psycho-pharmacological level, the theory delineates how stimuli (e.g., tobacco administration) generate acute psycho-pharmacological effects (e.g., intoxication). These stimuli and effects occur in social contexts that shape how the experiences promote tobacco addiction (e.g., class, social mobility, neighborhood deprivation, poor education). Importantly, the theory provides a framework for understanding tobacco disparities created by the interaction between psycho-pharmacological effects and social contexts (and their biological manifestations).

There is clear evidence for sex/gender differences in the psycho-pharmacological effects of tobacco-related stimuli, in the social/environmental contexts in which these effects take place, and in the interaction between psycho-pharmacological effects and social/environmental contexts. It is highly conceivable that some of these differences are either rooted in or affected by differences in capacity an infrastructure, access to resources, environmental tobacco smoke exposure, or simply social injustices. As an example, women in the U.S. are more much more likely than men to experience both sexual victimization and harassment.[40] Both sexual victimization and harassment are related to psychiatric distress and substance use (e.g.,[41–43]). Further, an association between early trauma/maltreatment and the persistence of smoking may be stronger among women compared to men.[44,45] There is also a well-documented sex/genderbased income and poverty gap in the U.S.,[46,47] potentially limiting the ability to afford adequate healthcare. These examples contribute to a rationale that supports the presence of a sex/gender disparity in treatment outcomes. Given these theoretical and conceptual considerations, it is highly plausible that social/environmental injustices may create barriers to cessation among women to a greater degree than men. Further research into the relationship between social/environmental injustice and smoking cessation based in health-disparity theory will help elucidate targets for social justice reform.

Limitations

There are limitations of the search methods we employed for this review. Our search was focused on studies which identified sex/gender as a variable of interest by identifying it in the abstract. Thus, the review was not designed to systematically identify every study that ever examined sex/gender differences in smoking cessation. Such an endeavor was deemed infeasible for the current study, because sex/gender is nearly ubiquitously included as a control variable in models, and therefore such an endeavor would have required an

examination of every study of smoking cessation conducted. Our sample is likely to be representative, although not entirely inclusive, of studies in which 1) smoking cessation was an outcome, and 2) sex/gender was a variable of interest. Therefore rather than being comprehensive our systematic, our qualitative review includes a large number of studies that examined gender differences in smoking cessation, from which we were able to generate conclusions about patterns across different study types.

It is important to also note the possibility of a phenomenon whereby researchers may be more likely to report on gender differences in an abstract, or in a paper, if their test of gender differences was statistically significant. It is also possible that findings of W<M are more likely to be published than findings of W>M. Consequently, non-significant findings and findings of W>M may be under-represented in the sample of studies, and therefore tests of proportions may be biased. Our test of proportions was based on the assumption that the underlying distribution of effect sizes for gender differences was normally distributed. This assumption may be violated if researchers were more likely to report on findings of women being less likely to quit than men, compared to findings of men being less likely to quit than women.

Conclusions and future directions

We contend that women have more difficulty achieving long-term abstinence than men in a given quit attempt, but that the manner in which this difference translates to sex/gender differences in epidemiologic investigations varies by time and location, based on the influence of multi-level bio-psycho-social factors. Based in Leventhal's *Socialpharmacology* theory of tobacco addiction, there are likely many sex/gender differences in psycho-pharmacological and social/environmental contextual factors, as well as interactions between factors, that may influence epidemiological findings. Research addressing the following will likely have a beneficial impact on sex-informed intervention for smoking cessation: 1) sex/gender differences in the psycho-pharmacology of smoking cessation, 2) sex/gender differences in social/environmental contextual factors that may promote or hinder smoking cessation, 3) sex/gender differences in the interactions between psycho-pharmacology and social/environmental contexts in relation to smoking cessation, and 4) social/economical injustices (and their removal) that create barriers to smoking cessation for women.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

1. There are mixed findings of sex/gender differences in the ability to quit smoking
2. In a given quit attempt women have more difficulty quitting smoking than men
3. Time, location, and varying methods contribute to mixed epidemiological findings

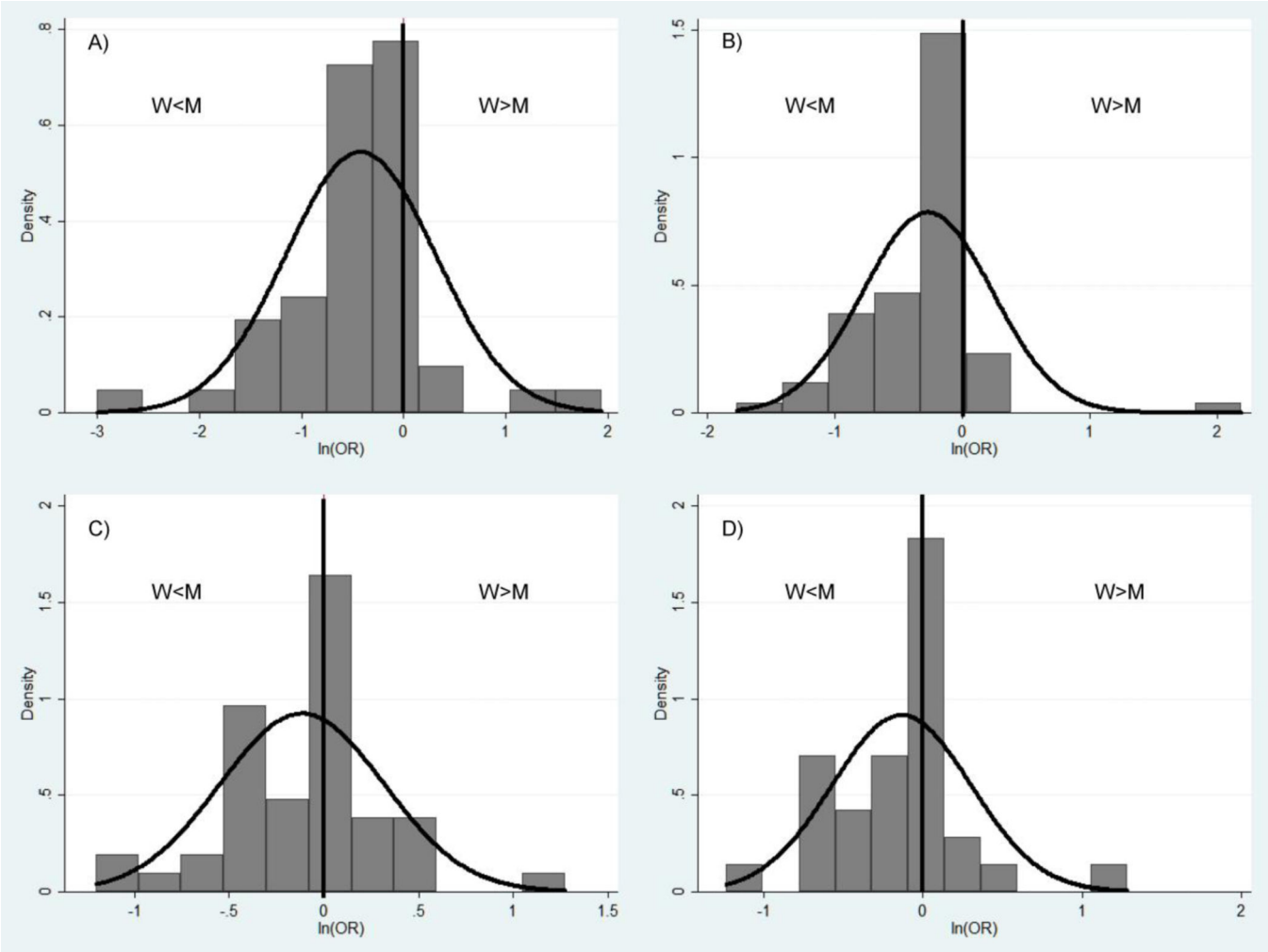

Figure 1.

A–D. Effect size distributions, by study type. A) efficacy trials, B) effectiveness trials, C) prospective observational studies, and D) cross-sectional studies. Investigations that found W=M but that did not report an effect size were given an OR of 1 (ln(OR)=0). The ORs were calculated with men as the reference group. There for studies with ln(OR) < 0 found women were less likely to quit smoking than men, and studies that found ln(OR) > 0 found women were more likely to quit smoking than men.

Table 1

Number of studies finding sex/gender differences in the likelihood of smoking cessation, by study type

	W<M *n*	W>M *n*	p-value[a]	W=M *n*	*k(n)*[b]
Efficacy intervention	25	1	<.001	21	*37(47)*
Effectiveness intervention	34	1	<.001	44	*77(79)*
Community-based intervention	2	0	NA	2	*4(4)*
Prospective observational	10	5	0.007	31	*40(46)*
Cross-sectional observational	11	9	0.369	18	*32(38)*
Total	*82*	*16*		*116*	*190(214)*

Note: W<M: women were significantly less likely to quit smoking than men; W>M: women were significantly more likely to quit smoking than men; W=M: there was not a significant difference in smoking cessation between women and men. N represents the number of publications fitting into each category.

[a]Among tests that found a statistically significant sex difference, we tested the proportion that found W<M vs. W>M. With an assumption of normally distributed effect sizes, this test was a proxy of whether the distribution of effect sizes was shifted towards W<M or W>M.

[b]*k* is the number of studies included; *n* is the total number of tests included. Some studies reported sex/gender differences within sub-groups