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Women and Smoking: An Interdisciplinary Examination of Socioeconomic Influences

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1. INTRODUCTION

The dramatic decrease in smoking prevalence that has occurred over the past half century in the major industrialized countries has not been evenly distributed across all subgroups of smokers. In particular, young adults, disadvantaged individuals, and women have experienced proportionally smaller declines in smoking (e.g., Graham et al., 2007). Indeed, during this period of decline in overall smoking prevalence, disadvantaged women have come to make up an increasing proportion of the shrinking population of current smokers. While following a somewhat different pattern, overrepresentation of women and the socioeconomically disadvantaged is an emerging problem in less developed countries as well (Graham, 2009). The overarching aim of this Supplemental Issue of *Drug and Alcohol Dependence* is to increase scientific understanding of the extent to which socioeconomic disadvantage increases risk for smoking among women, elucidate potential processes involved in that relationship, and explore implications for improving the effectiveness of treatment and prevention interventions and tobacco-control policies.

Cigarette smoking began as an activity of status among more affluent, culturally influential men, and later, women (e.g., Brandt, 2007). However, as the adverse effects of smoking came to be recognized, the more affluent largely quit or refrained from starting smoking; rather than denoting high social status, smoking has now come to represent socioeconomic disadvantage. This pattern is not unique to cigarette smoking or to women. For example, a similar pattern occurred in the most recent U.S. epidemic of cocaine use and dependence (e.g., Meich et al., 2005). There too drug use began among the more affluent social trend-setters, but as cocaine's considerable potential for producing dependence and other adverse effects came to be recognized, use among the more educated and affluent decreased. Similar to the trends observed with smoking, cocaine use in the U.S. is now a public health problem with greater concentration among the disadvantaged as a larger proportion of those with higher socioeconomic status have either quit using or refrain from ever initiating use (Harder and Chilcoat, 2007).

Recognizing that any adequate scientific account of such a complex intertwining of socioeconomic status, gender, and substance use will almost surely have to be interdisciplinary

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in nature, we invited contributions from a range of different disciplines involved in the study of smoking and other substance use disorders (behavioral pharmacologists, epidemiologists, molecular geneticists, psychologists, sociologists, among other experts). By intensively examining smoking among disadvantaged women from an interdisciplinary perspective, we hope to advance scientific understanding of this specific public health problem but, to a more limited extent, socioeconomic disadvantage and risk for other substance use disorders as well. The major contribution of this interdisciplinary effort is the inclusion of more behavioral, biological, and individual-level science to go along with the population-based analyses that have largely defined the study of socioeconomic status and health. Indeed, it is this broader, interdisciplinary approach to the topic of smoking among disadvantaged women that distinguishes this Special Issue from earlier publications on this topic (e.g., *Journal of Epidemiology and Community Health*, 2007).

2. Development of this Special Issue

Contributors to this Supplemental Issue were invited to participate based on their earlier participation in a College on Problems of Drug Dependence mini-conference on this same topic that was held on April 9 and 10, 2008 in Annapolis, Maryland. The only exception is the invited Commentary from Hilary Graham who was unable to participate in the conference due to a scheduling conflict but nevertheless graciously agreed to contribute to the Supplemental Issue. Each of the contributions except this Editorial underwent thorough peer review. Each of the papers was assigned tone of the Guest Editors who suggested reviewers and made recommendations based on the reviewer recommendations. Final processing and oversight of the review process was provided by the Editor-in-Chief, Robert Balster. A planning committee comprised of the two authors of this Introduction and Margaret Ensminger, who are external to the NIH, and Cora Lee Wetherington, Yonette Thomas, and Debbie Grossman from NIDA and Michele Bloch and Anna Levy from NCI established the general plan for the conference and this Supplemental Issue.

3. Specific Aims and Papers

In addition to the overarching aim outlined above, we have five more specific aims for this Supplemental Issue that we have developed around the papers. First, we seek to increase recognition among researchers, clinicians and policy makers of the robust and fundamental association that exists between socioeconomic disadvantage and risk for smoking and other substance use disorders. These interrelationships between socioeconomic status and risk are sufficiently fundamental and important to warrant ongoing and serious consideration by experts involved in all aspects of combating smoking and other substance use disorders. We anticipate that each of the papers will contribute to this aim in unique ways, but that collectively the body of interdisciplinary work will make a compelling case. Second, we aim to broaden the context for understanding the problem of smoking among disadvantaged women. Considering this problem in a broader context should enhance understanding and foster creativity in terms of the range of options available for trying to ameliorate it. Third, we aim to promote discussion and, where appropriate, facilitate research to reconcile and integrate observations across research disciplines (e.g., epidemiological, social, behavioral, and genetic) and levels of analysis (e.g., population, individuals, genes, preclinical and clinical, etc.). There is little question regarding the need for the relevant scientific disciplines and specialty areas to interact in order to make headway in elucidating how socioeconomic disadvantage increases risk for smoking and other substance use disorders. However, even a cursory reading of the relevant literatures readily reveals that the respective disciplines are often operating without interdisciplinary input and as a consequence are at a significant disadvantage. Fourth, we aim to further characterize how socioeconomic status and gender influence the different stages of smoking, including initiation of smoking, progression to regular use and dependence, and the

probability of attempting and succeeding at cessation and avoiding relapse. Such a fine-grained analysis is essential to effective targeting of treatment and prevention efforts and policy development. Lastly, we seek to delineate implications for improving the effectiveness of treatment and prevention interventions and policies to eliminate smoking and its associated problems among disadvantaged women and to fill gaps in the knowledge base relevant to those aims. In the U.S. alone, an estimated 170,000 women die annually from smoking related causes and maternal smoking produces substantial and costly adverse effects on fetal and child health (e.g., U.S. Department of Health and Human Services, 2001). These are public health problems for which there are great unmet needs. We can and must do more to meet those needs. It is our hope that this issue will help to do so by providing new knowledge and insights that can contribute to the development of more effective interventions and policies.

3.1 Commentaries

The Commentaries by Link and Phelan (2009) and by Graham (2009) directly address the aim of placing this topic of gender and socioeconomic inequality in smoking risk into a broader conceptual framework. Link and Phelan articulate how disparities in smoking risk can be considered as an instance of a broader pattern wherein social factors create health disparities and as such can be considered as a fundamental cause of them. They describe how health disparity gradients emerge as a function of growth in knowledge about how to effectively treat or prevent a particular disease. When dealing with diseases where little is known about effective treatment or prevention, socioeconomic gradients are modest or absent (e.g., arrhythmias, pancreatic cancer, brain cancer). By contrast, when dealing with diseases where much is known about effective management (e.g., ischemic heart disease, lung cancer, flu) disparity gradients are pronounced. Link and Phelan then effectively illustrate how gradients in smoking prevalence grew from being relatively flat in the mid 1950s when smoking prevalence was high and knowledge about harmful effects still low to being strikingly disparate currently as smoking prevalence has decreased and knowledge about harmful effects has increased substantially.

Graham's Commentary also broadens the conceptual context by providing an historical and international perspective on the problem of smoking among disadvantaged women. She discusses how changes in economic circumstances have been associated with substantial changes in smoking prevalence over time in Northern Europe and North America and more recently in Southern and Eastern Europe and Asia. She provides a compelling characterization of how socioeconomic disadvantage acts cumulatively to influence smoking risk over the life-course of girls and women. Lastly, she offers a brief and insightful discussion of the importance of strong population-wide tobacco control policies to combat current disparities in smoking risk, but notes how they alone will not be sufficient and that broader, more distal policies focused on reducing inequality in economic opportunity will be necessary to effectively eliminate inequalities in smoking risk. As is noted below, this need for broader policies focused on reducing socioeconomic inequality is one that a number of contributors to this Supplemental Issue have endorsed (e.g., Hemsing and Greaves 2009; Higgins et al., 2009; Kandel et al., 2009).

3.2 Epidemiological Papers

A series of epidemiologic reports offer a detailed characterization of the empirical evidence on socioeconomic disparities in women's smoking. They do so through the use of cross-sectional, prospective, and historical epidemiologic data, mostly from the United States, to quantify the magnitude of the disparities in women's smoking, and to estimate these associations for specific indicators of socioeconomic status and in the context of other environmental and individual-level characteristics. The paper by Chilcoat (2009) reviews findings on the emergence of socioeconomic and gender differences in smoking against the

historical backdrop of growing awareness of the harmful effects of smoking and decreases in prevalence. This report examines age, period and cohort effects to highlight growing disparities that are compounded for each stage of increased smoking involvement. Compared to their higher socioeconomic status counterparts, women with lower status are increasingly more likely to start smoking, and if they smoke are more likely to progress to heavy smoking, less likely to quit, and more likely to develop serious health consequences, including lung cancer.

Kandel et al. (2009) use recent epidemiologic data from several national surveys to emphasize that the differences for women with low versus high education increase in magnitude for stages of increased smoking involvement. The association of education with each stage of smoking remains strong even after other risk factors are taken into account and its magnitude remains large compared to other predictors. Kandel et al. extend these findings further by examining educational differences in persistence of smoking during pregnancy (also see Higgins et al., 2009), demonstrating that women with lower versus higher education are more likely to continue smoking after becoming pregnant and that continuing to smoke during pregnancy increases risk of antisocial behavior, anxiety/depression, and smoking among their children.

A report by Ensminger et al. (2009) points to the cumulative impact of social disadvantage on women's smoking using a sample of African-American women who grew up in the same disadvantaged Chicago neighborhood. Education was the strongest predictor of smoking across the life-course among the indicators of social disadvantage. Wallace et al. (2009) also examines the interaction of race/ethnicity and socioeconomic status with smoking by girls during adolescence using data from the University of Michigan's Monitoring the Future survey. This report points to significant differences in smoking prevalence by race/ethnicity, which persist but have narrowed over time. However, they report that girls' socioeconomic status is associated with smoking risk independent of race and ethnicity.

Given the association of psychiatric disorders with gender and educational attainment, Johnson and Novak (2009) examine whether the presence of these disorders might account for the observed associations of gender and socioeconomic status with smoking. They used longitudinal data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) spanning a three-year follow-up to test whether educational attainment, occupation, and gender predicted onset and persistence of daily smoking independently of pre-existing depression, anxiety, or substance use disorders. Each of these characteristics was independently associated with smoking initiation, but none with smoking persistence.

Considered together, these epidemiological studies establish a clear and growing association of socioeconomic status with smoking outcomes and lay the foundation for the other research reports found in this Supplemental Issue. These studies are consistent with the notion of socioeconomic status as a fundamental cause of smoking and suggest that clinical and policy interventions to reduce smoking will likely need to be broadened to include programming designed to reduce economic inequalities in order to be maximally effective.

3.3 Genetics Papers

Reports by Uhl et al. (2009) and Beirut (2009) underscore the importance of genetic influences on smoking among women, particularly on nicotine dependence and smoking cessation. These reports point out the complexity of genetic influences on smoking and emphasize that, despite identification of specific genes associated with smoking, the influence of any single gene is likely to be small. Beirut reports that genetic influences appear to be strongest for heavy smoking and nicotine dependence, whereas environmental influences likely have a greater role on earlier stages of smoking involvement. Her report focuses on a growing body of evidence linking the family of $\alpha 5\alpha 3\beta 4$ nicotinic receptor genes to development of nicotine dependence among smokers, which has now been replicated in several studies. However, the variant

associated with increased smoking risk is only found in those of European descent and is likely to account for only a modest proportion of the risk of developing nicotine dependence. In their review of family, twin, and genetic association studies on smoking, Uhl et al. highlight the heritable component of smoking. They note that changes in the environment, such as those leading to increased concentration of smoking among socially disadvantaged populations, can have an impact on the expression of genetic vulnerability. They also review data that provide molecular genetic support for shared genetic underpinnings of nicotine and other drug dependence with heritable, complex phenotypes that include cognitive functions, frontal lobe volumes, bipolar disorder and neuroticism. Both of these reports in this issue point to the promise of genetics research for informing interventions to treat or prevent smoking. However, these genetic influences must be understood in the context of the growing role played by social disadvantage. In addition, these reports underscore that not all individuals in disadvantaged environments smoke, and it is important to understand individual differences in smoking in this environmental context. A contribution by Schnoll and Patterson (2009) on pharmacogenetics showing the promise of genetics research for enhancing the efficacy of treatment for smoking cessation is included in the Treatment, Prevention, and Policy Papers section below.

3.4 Preclinical and Clinical Laboratory Papers

Preclinical and clinical laboratory research on risk factors for smoking is likely to be important to a complete understanding of the mechanisms underpinning increased risk of smoking among disadvantaged women due to the high level of experimental control those settings permit. We invited three papers on laboratory behavioral science. Carroll et al. (2009) provide a highly informative review of a body of preclinical research on risk factors from smoking and other substance use. The review reveals an impressive degree of concordance with observations from studies using community and patient samples, addressing the influence of age, sex, impulsivity, and perhaps most germane to the topic of this issue, environmental impoverishment, on risk for smoking and other substance use. As an example of this concordance, Carroll and colleagues report a cumulative increase in risk as a function of the number of risk factors present in their preclinical models concordant with the observations that Graham (2009) and Ensminger et al. (2009) report for community samples of disadvantaged women. The ability of impoverished environments (i.e., absence of alternative non-drug reinforcers; Higgins, 1997) to increase smoking risk has been demonstrated in human laboratory models as well (Bickel et al., 1995; Tidey et al., 1999), although that research is not reviewed in this Supplemental Issue. Additionally, the ability of enriched environments to decrease smoking among disadvantaged pregnant women is part of the conceptual foundation underpinning the efficacious contingency management treatment interventions on which Higgins et al. (2009) comment.

Perkins (2009) reviews a programmatic body of research examining gender differences in response to nicotine and cigarette smoking in laboratory studies, attempting to glean areas with potential implications for understanding the problem of smoking among disadvantaged women. Among a number of interesting observations noted were (a) a greater sensitivity to environmental than pharmacological determinants of smoking among women compared to men and (b) interactions between gender, mood, and genotype where women without the dopamine DRD4-7 allele showed greater positive influence of negative mood on the reinforcing effects of smoking compared to men. Considering that socioeconomic disadvantage is associated with increased risk for depression and smoking, this latter observation may warrant further investigation. Discounting of delayed rewards discriminates between those with versus those without substance use disorders (Bickel & Marsch, 2001) and predicts relapse back to smoking among abstinent postpartum women (Yoon et al., 2007). Looking to build upon those findings, Jones and colleagues (2009) report an original study examining whether delay discounting or a task measuring future time perspective might provide insights into why

disadvantaged women are at increased risk for smoking. Performance on these tasks was not associated with socioeconomic status, perhaps related to a limited range in socioeconomic characteristics of the study sample. The future time perspective, but not the delay-discounting, task discriminated between female smokers and non-smokers, and to a lesser extent male smokers and non-smokers, underscoring the potential importance of a balance between more proximal versus distal time perspectives to risk for smoking.

3.5 Treatment, Prevention, and Policy Papers

The important topic of treatment is introduced through a literature review from Schnoll and Patterson (2009) on the emerging area of pharmacogenetics and smoking cessation, a topic that promises to play an increasingly important role in future treatment efforts. No data are yet available regarding socioeconomic factors in this area of inquiry, but Schnoll and Patterson report on interactions between gender, pharmacological interventions, and genetic variation that make for numerous potential hypotheses to be pursued around the use of nicotine replacement products and bupropion in promoting smoking cessation among women.

Moving on to behavioral interventions, Higgins and colleagues (2009) report an original study examining the role of education as a predictor of smoking status in a cohort of women who participated in trials on the efficacy of voucher-based contingency management for promoting smoking cessation and preventing relapse among pregnant and recently postpartum women (Heil et al., 2008; Higgins et al., 2004). Low educational attainment is shown to have a striking association with the ability to quit smoking prior to entering prenatal care, or during the course of the pregnancy, and the ability to sustain abstinence postpartum. As mentioned above, the study also demonstrates a robust and promising role for the use of abstinence-contingent incentives in promoting abstinence among disadvantaged pregnant smokers. In agreement with numerous contributors to this Supplemental Issue, the authors support a broadening of tobacco control policies to reduce smoking among disadvantaged women arguing for the importance of improving educational attainment among disadvantaged girls and women as a method for reducing smoking-related, but also other, health disparities.

Finally, Heil and colleagues (2009) contribute a literature review focused on gleaning ideas from treatment approaches used to treat dependence on illicit drugs to advance smoking cessation treatments for women. They note the success of contingency management with disadvantaged pregnant smokers as an instance of successful borrowing from the literature on treatments for dependence on illicit drugs. They go on to suggest potential promise in better tailoring smoking-cessation interventions to the severity of the problem being treated, increasing accessibility of treatment, and increasing the use of more intensive, multi-component interventions.

Effective prevention, of course, is an essential component of any comprehensive effort to ameliorate the problem of increased smoking risk among disadvantaged women. Vallone and colleagues (2009) contribute an insightful original study from the Truth Campaign of the Legacy Foundation, a counter-marketing campaign designed to prevent smoking among at-risk youth in the U.S. Using data from the Legacy Media Tracking Survey, a U.S. nationally representative random digit dialing survey of youth, the authors investigated the extent to which penetration and receptivity to their prevention message was being moderated by gender and socioeconomic factors. The evidence suggested that girls are less likely to have been exposed to the intervention than boys independent of socioeconomic status, and that more disadvantaged youth are less likely to have been exposed to the message than more affluent youth independent of gender. In examining different measures of household disadvantage, mean household educational attainment appeared to be of particular importance. The authors offer ideas for how to improve efforts to get the message out to girls and disadvantaged youth.

The Supplemental Issue closes with a contribution on policy from Hemsing and Greaves (2009) that functions to underscore the multiple layers and complexities often involved with public health problems. Hemsing and Greaves review the literature demonstrating important associations between smoking among disadvantaged girls and women and a broad range of psychological, social, and economic variables. The review is sobering in terms of driving home the complexities involved in understanding and ameliorating the problem of increased risk for smoking among disadvantaged girls and women, but also inspirational in illustrating why the status quo is simply unacceptable. The devastating individual and collective costs associated with smoking among disadvantaged girls and women are simply too high for the status quo to continue. Hopefully, this Supplemental Issue will contribute new knowledge, spur discussion, and perhaps foster scientific collaboration and initiatives that can make a meaningful contribution towards eliminating this serious international public health problem.

4. Summary

Increased risk for smoking and smoking-related diseases among disadvantaged girls and women is a serious international public health problem. As was noted above, in the U.S. alone 170,000 deaths per year among women are attributable to smoking-related causes. The proportion of those women who are socioeconomically disadvantaged is growing (e.g., U.S. Department of Health and Human Services, 2004). Disadvantaged women on average are least likely to respond to treatment and prevention interventions. Greater scientific understanding of the important social, behavioral, pharmacological, and biological controlling variables involved in this problem are needed if more effective interventions and policies are to be developed. Researchers from a number of different disciplines are studying the problem, but interdisciplinary efforts are lacking. This Special Issue has the potential to enhance recognition of the scope and urgency of the problem, embed the problem in a broader conceptual context, provide new scientific insights into processes underpinning these relationships, and perhaps foster much needed interdisciplinary research on this important topic.

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