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Adolescent Pregnancy: Past, Present and Future Trends and Issues

Edited by
Naomi Farber

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Naomi Farber (Ed.)

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Guest Editor
Naomi Farber
College of Social Work
University of South Carolina
USA

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Table of Contents

List of Contributors

Nancy F. Berglas Philip R. Lee Institute for Health Policy Studies and Bixby Center for Global Reproductive Health, University of California, San Francisco, 3333 California Street, San Francisco, CA 94143-0936, USA.

Claire D. Brindis Philip R. Lee Institute for Health Policy Studies and Bixby Center for Global Reproductive Health, and National Adolescent and Young Adult Health National Resource Center, University of California, San Francisco, 3333 California Street, San Francisco, CA 94143-0503, USA.

Jeanne Brooks-Gunn National Center for Children and Families, Teachers College, Columbia University, 525 W. 120th Street, Box 39, New York, NY 10027, USA.

Jacqueline Corcoran Virginia Commonwealth University, Richmond, VA 23284, USA.

Martha J. Decker Philip R. Lee Institute for Health Policy Studies and Bixby Center for Global Reproductive Health, University of California, San Francisco, 3333 California Street, San Francisco, CA 94143-0936, USA.

Naomi Farber College of Social Work, University of South Carolina, 902 Sumter Street, Columbia, SC 29208, USA.

Frank Furstenberg Department of Sociology, University of Pennsylvania, 3718 Locust Walk, Philadelphia, PA 19104, USA.

Saul D. Hoffman Department of Economics, University of Delaware, Newark, DE 19716, USA.

Quentin Karpilow Reproductive Health & Family Formation, Child Trends, Bethesda, MD 20814, USA.

Jennifer Manlove Reproductive Health & Family Formation, Child Trends, Bethesda, MD 20814, USA.

Anne Martin National Center for Children and Families, Teachers College, Columbia University, 525 W. 120th Street, Box 39, New York, NY 10027, USA.

Huong Nguyen College of Social Work, University of South Carolina, 902 Sumter Street, Columbia, SC 29208, USA.

Susan Philliber Philliber Research and Evaluation, Accord, NY 12404, USA.

Chengshi Shiu School of Social Work, University of Washington, 4101 15th Ave NE, Seattle, WA 98105, USA.

Adam Thomas Reproductive Health & Family Formation, Child Trends, Bethesda, MD 20814, USA ;McCourt School of Public Policy, Georgetown University, Washington, DC 20057, USA.

Elaine M. Walker Department of Education Leadership, Management & Policy, Seton Hall University, 400 South Orange Avenue, South Orange, NJ 07079, USA.

Kate Welti Reproductive Health & Family Formation, Child Trends, Bethesda, MD 20814, USA.

About the Guest Editor

Naomi Farber, Ph.D., M.S.W., is an Associate Professor and M.S.W. Program Coordinator at the University of South Carolina College of Social Work. Her research interests include issues of family formation and well-being in the context of both urban and rural poverty, with a particular focus on prevention of adolescent pregnancy, services to adolescent parents, high-risk sexual behavior, and HIV/STI prevention among low-income adolescents; life trajectories of vulnerable single mothers; and barriers to and supports for upward mobility among low-income youth. She is the author of *Adolescent Pregnancy: Policy and Prevention Services*, a resource integrating cross-disciplinary research and theory to inform practitioners in a range of service professions.

Preface to "Adolescent Pregnancy: Past, Present and Future Trends and Issues"

This Special Issue of *Societies* provides a timely forum for leading scholars to examine theoretical insights and empirical findings associated with the recent decline in adolescent pregnancy and childbearing internationally, with special attention given to the United States. This recent shift in the incidence of adolescent fertility is notable in its consistency and magnitude; at the same time, however, continuing historic disparities require focused attention on the contemporary meaning of early childbearing in the U.S. as well as across the globe.

The papers included here contribute to interdisciplinary literature, focusing on demographic trends in adolescent fertility; successful intervention approaches and major "lessons learned" regarding primary pregnancy prevention; identification of key theoretical issues associated with these trends, with particular focus on the existence and meaning of disparities and their implications for youth development and wellbeing.

Naomi Farber
Guest Editor

Special Issue: Adolescent Pregnancy: Past, Present and Future Trends and Issues

Naomi Farber

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The dramatic overall decrease in rates of pregnancies and births to American teenagers over the last few decades should be counted among contemporary success stories in systematic efforts to reduce bio-psychosocial risks to youth. Since the modern peak in 1991, fertility among all major racial and ethnic groups of teens has, with a few brief reversals, steadily and sharply declined: births by about 64% and pregnancies 55% [1]. Though the rate of births to teens remains among the highest in developed nations, approaching twice that of the next-highest, the U.K., the consistency of the trends suggests that the modern tide of high-risk sexual activity associated with unplanned conception among ever-younger American youth has been at least somewhat curtailed [1].

While we see broad changes in young people's sexual behavior that resulted in reduced risk overall of unplanned pregnancy and childbearing, continuing stark disparities in the incidence of early pregnancy among adolescents reveal the profound impact of social and economic inequality on youth's wellbeing in American society. For example, despite within-group declines, Latinas, African American and Native American girls continue to face disproportionate risk of pregnancy; births to teens in impoverished rural areas have risen sharply; and girls in foster care are twice as likely to give birth as those in the general population [2,3]. The clear association of teen pregnancy and childbearing with the complex dimensions of disadvantage led Sarah Brown, former Director of the National Campaign to Prevent Teen and Unplanned Pregnancy to observe that we may already have achieved the "easy wins" in bringing down rates of pregnancy and childbearing among American adolescents [2].

After several years of significant public investments in reducing fertility among teenagers though research, policy, services, and education, the result is that more teens are delaying sexual initiation; many teens are less sexually active; more of those teens who do have sex use contraception effectively; and many of those teens who become pregnant have abortions. Though there remain both empirically- and ideologically-based debates over the relative value of abstinence-only interventions and comprehensive sex education, research suggests that many teenage pregnancy prevention programs are quite effective, and that some programs are more effective for certain teens than for others. That is, if we employ a comprehensive and

multi-faceted rather than one-size-fits-all strategy to preventing teen pregnancy, we have significant impact on diverse youth's sexual behavior.

The largest proportion of adolescents falls into whom Brown includes as the "easy wins". In other words, the category of youth who were, and remain, at lowest risk of early conception have benefitted most from efforts at teen pregnancy prevention, while others at higher risk will require interventions that target more closely the particular sources of their vulnerability.

Most American teenagers are unlikely to become parents because they do not possess the many environmental and individual risk factors associated with engaging in early and unprotected sex. They face the challenges of negotiating cultural expectations for decision-making in important behavioral arenas such as sexuality typically with normal developmental limitations in cognitive processing and the emotional maturity that are necessary to meet those expectations wisely, and lack of access to contraception and other sexual health services. However, for these low-risk youth the realistic possibility of educational and occupational success generally provides sufficient motivation to avoid young parenthood when they possess the requisite knowledge, skills, and resources.

At greater risk are teens whose family and individual characteristics are associated with a variety of high-risk behaviors such as drug and alcohol abuse in addition to having unprotected sexual intercourse. They face the same developmental challenges to healthy decision-making as low-risk peers in the context of a highly sexualized socio-cultural environment, but often without strong family and community support and resources that support healthy decision-making. Teens are at greater risk of early pregnancy when they: (1) become sexually active young; (2) have low expectations for, weak attachment to and/or poor performance in school; (3) engage in problem behaviors associated with conduct disorders and other forms of mental health challenges and are easily influenced by similar peers; and (4) do not have strong relationships with parents or guardians [2]. Thus, high-risk sexual activity may reflect a different developmental context for these youth than it does for adolescents at lower risk of unplanned pregnancy.

At the farthest and most worrisome end of the continuum of risk of pregnancy and parenthood are those young people who share few of the attributes of the "easy wins". They possess the risk factors of teens at lower levels of risk, but face additional hazards to developmental wellbeing generally associated with poverty and other forms of extreme disadvantage. Whether these vulnerable adolescents grow up in impoverished rural or urban communities, or come from families that are struggling with such serious dysfunction that the child welfare system has intervened, they often conceive for a variety of complicated reasons that are difficult to mitigate through the most common approaches to pregnancy prevention. For these most vulnerable youth, whose lives too often are filled with trauma, turmoil, unfilled emotional and other

developmental needs arising from family and community patterns that may extend back over generations, the meaning of teen pregnancy is distinct from those teens who most need high quality sexual health services in order to prevent unplanned pregnancy [4].

Given the impressive success in influencing teenagers at low levels of risk to avoid unplanned pregnancy, it is a felicitous time to stand back and examine what accounts for the changes, to assess the current situation, and to establish priorities for continuing efforts to enhance the health and wellbeing of our youth. This collection of papers together addresses these large questions from the perspectives of some of the most seasoned and influential observers in the field, representing a variety of disciplines such as developmental psychology, economics, sociology, education, and social work. These scholars are among the leaders whose research and insight helped shape both knowledge and its application in the national movement to reduce teen pregnancies and births and their consequences in the United States. Their work, while acknowledging that there remain unresolved and challenging questions, reflects the increasingly sophisticated and nuanced approaches to understanding the very meaning of teen pregnancy and childbearing today.

What accounts for the steep decline in overall rates of teen pregnancy over the last few decades? There are, logically, limited means for avoiding conception deliberately, aside from sterilization: abstinence from sexual intercourse or use of contraception. While it is difficult to pinpoint precisely how much each of these changes in behavior contributed to the decline in teen pregnancy and, further, what factors influenced each choice to what degree, there is wide agreement that a significant increase in contraceptive use has played a major role [5]. Beyond the obvious overall impact of contraceptive use per se, there are complex questions regarding specific patterns of use of each form of birth control whose answers are critical for informing practice with sexually active youth. Manlove, Karpilow, Welti, and Thomas examine adolescents' contraceptive use over time in, "Linking changes in contraceptive use to declines in teen pregnancy rates". Employing an innovative microsimulation method, they find that about half of the overall decline in rates of teen pregnancy between 2002 and 2010 is the result of changes in contraceptive use, and further specify what individual practices constitute this "contraceptive effect". Their recommendations for further reduction in teen pregnancy include both targeting the highest-risk teens who do not use birth control and increasing teens' use of effective methods.

Despite sexually active teens largely becoming more effective at using contraception, the association between growing up disadvantaged and experiencing early pregnancy and childbearing endures. Why is this so, given the greater options for and availability of birth control? What economic and social consequences of early childbearing can rightly be attributed to teen parenthood; what consequences to the

predisposing conditions of early and unprotected sexual activity and pregnancy? Early research in the area of teen pregnancy tended to reflect the assumption that abridged educational achievement, economic independence and similarly compromised life trajectories of their children resulted primarily from the young age of conception. In the course of cultural and economic changes in the larger society and new scholarly insights, there developed more emphasis on teen pregnancy as a "marker" of disadvantage. These overarching issues shaped much of the scholarly discourse—as well as policies and programs—since the era that teen pregnancy was defined as a public problem in the United States in the 1960s. Have the answers to these fundamental questions changed over time? The next several pieces help untangle these multifaceted questions through diverse methodological and theoretical lenses and place them in historical context.

Each bringing to bear his deeply-informed respective scholarly perspective on these issues Saul Hoffman and Frank Furstenberg investigate how causes and consequences of early childbearing have been explained, how accurate these explanations are, and the implications of these conventions for intervention. In, "Teen childbearing and economics: A short history of a 25-year love affair", Hoffman provides a critical assessment of the strengths and limitations of the major economic theories, such as the widely influential opportunity cost hypothesis, and their associated methods that have informed assumptions about the motivations for and impact of teen births for disadvantaged young women. He examines how the "threads" of rational choice decision-making, empirical evidence undergirding the supposition that teen motherhood caused lifelong and multi-generational disadvantage, and the fact of plummeting rates in teen fertility, all tie together in a concise and coherent account of the intellectual history of scholarship in this area. While his analysis supports the view of teen pregnancy as more marker of than independent contributor to disadvantage, he concludes with the "reasonable" acknowledgement that the weight of scholarship affirms that there is merit to both perspectives and warns of the need for methodological care in reaching firm conclusions.

Taking up a related set of issues in, "Reconsidering teenage pregnancy and parenthood", Furstenberg reviews what the past 50 or so years of research have shown about the impact of early childbearing on the life course of teen mothers and their children, and what insight that provides about the significance of early motherhood among disadvantaged youth. Drawing on his own seminal longitudinal research in light of wide-ranging additional research, he argues that despite the positive changes in general trends in teen pregnancy, it is the "long shadow of disadvantage" rather than age per se that continues to darken the prospects of young parents and their offspring. Consequently, delaying childbearing alone will

not improve the life chances of young mothers and their children unless they also increase their educational and occupational achievement.

There is general agreement among the authors here that the pre-disposing conditions that heighten the likelihood of teen parenthood are also integral factors in the challenges they may face as young adults and thereafter. Nevertheless, despite the strong evidence supporting this shift in perspective over the last several years, the next set of authors remind us that adolescent parents and their offspring face special vulnerabilities not resulting solely from prior life circumstances that must be attended to. In posing the question, "Has adolescent childbearing been eclipsed by nonmarital childbearing?" Anne Martin and Jeanne Brooks-Gunn identify one of the very bases for the problematizing of teen pregnancy—the rise in adolescents bearing children outside of marriage. As the fertility rate among adolescents essentially declined after 1960, so did their rate of non-marital childbearing increase, to over 90% today. However, this significant shift in adolescents' choices occurred as part of dramatic changes in broader norms of family formation, particularly a steep rise in non-marital childbearing among older women. The authors suggest that in the context of wider attention to the negative economic and other outcomes associated with non-marital childbearing, we may be neglecting several specific difficulties faced by adolescent mothers and their children. They recommend that in order to assess the true impact of early childbearing, as distinct from pre-existing disadvantage, it is important to identify the appropriate comparison group, namely unmarried women in their 20s. Bringing to bear their considerable expertise in understanding the characteristic developmental needs of young mothers and their children, Martin and Brooks-Gunn delineate three compelling areas for further research: the experience of co-residence in three-generation households, the place of biological and social fathers of teens' children, and the nature of their childcare choices, all of which constitute noteworthy ongoing problems for teen mothers.

Continuing the volume's theme of the continuing challenge in discerning which risks precede and which may follow early childbearing, Jacqueline Corcoran reviews the literature on, "Teenage pregnancy and mental health". She focuses on two of the most prevalent mental disorders experienced by pregnant and parenting teens, depression and conduct disorders. While it is difficult to separate definitively the pre-existing factors that would elevate the risk for mental disorders among disadvantaged youth as distinct from the stresses of pregnancy and childbearing, the association is clear: Adolescents living in poverty and who experience multiple adverse childhood events also are vulnerable to depression, conduct disorder, and early pregnancy. Concluding that it is crucial to understand the etiology of these mental health problems in their full environmental complexity and intervene accordingly, Corcoran also identifies the best practice models focusing on family treatment.

Widening the geographic lens on what constitutes risk of early pregnancy to a hitherto unexamined Southeast Asian cultural context, Nguyen, Shiu, and Farber report on fertility trends in, "Prevalence and factors associated with teen pregnancy in Vietnam: Results from two national surveys". Providing a comparison between two very disparate cultures with distinct socio-political histories, their findings from a nationally representative sample over time reveal some themes similar to those in the United States. However, they also highlight the need for cultural specificity and consideration of the social and historical factors in analyzing the meaning of early childbearing in a developing nation undergoing rapid transformation.

Next, Decker, Berglas, and Brindis focus closely on two major themes of this collection in emphasizing the importance of providing reproductive health services, with special attention to the most vulnerable youth. In, "A call to action: Developing and strengthening new strategies to promote adolescent sexual health", the authors analyze the specific ways in which the complex lives of both special populations of youth and their general counterparts require new approaches to enhancing their sexual health. Synthesizing findings from their comprehensive review of recent research, they suggest six "promising strategies" that incorporate programmatic innovations and respond to the particular needs of diverse young men and women. Together these strategies incorporate attention to policies, services, education and individual factors, and recognition of the potential power of using technology to enhance adolescents' sexual health. This far-reaching blueprint provides a basis for establishing priorities in designing multi-level sexual health services to adolescents.

The final two articles focus on the central importance of improved research methods over the past several decades of prevention efforts. Susan Philliber recounts how increasing methodological rigor in process and outcome evaluation research has been inextricably connected with governmental and other formal organizational standards and investments in improving knowledge from evaluation science. Reflecting on lessons from her long experience conducting evaluation research, she finds significant progress in scientists' ability to measure the impact of interventions, but reminds us of the remaining challenges of "real world" research especially related to recruiting the most at-risk youth, data collection, randomization, and loss to follow-up.

Finally, as an example of the growing expectations of methodological sophistication in evaluation research in adolescent sexual behavior, Walker reports significant findings from one study suggesting the importance of ethnic identity as a factor in program impact. She notes the complexity in developing a trustworthy knowledge base by drawing attention to the continuing problem that attrition poses to the development of reliable and valid conclusions about behavior change.

The convergence of concerted efforts to reduce teenage pregnancy and childbearing with the shifts in complex social, cultural and health-related norms

have reduced the risk of many young women and men of unplanned conception and parenthood. While we must gratefully acknowledge these major positive changes, the clear lesson proffered here is that further reductions may be even more difficult because they require no less than mitigating the worst threats to child wellbeing and optimal development today in American society. However, the contributions of the senior scholars here provide balanced and deeply-grounded perspective necessary to guide the next chapter in fulfilling our collective responsibility to ensure the wellbeing of our young people.

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Linking Changes in Contraceptive Use to Declines in Teen Pregnancy Rates

Jennifer Manlove, Quentin Karpilow, Kate Welti and Adam Thomas

Abstract: Using a unique microsimulation tool, Teen FamilyScape, the present study explores how changes in the mix of contraceptive methods used by teens contributed to the decline in the U.S. teen pregnancy rate between 2002 and 2010. Results indicate that changes in contraceptive use contributed to approximately half of the decline in the teen pregnancy rate during this time period (48%) and that a little more than half of this "contraceptive effect" was due to an increase in teen condom use (58%). The remaining share of the contraceptive effect can be attributed to an increase in the use of more effective hormonal (pill, patch, ring) and long-acting reversible contraceptive (LARC)/injectable methods (Intrauterine Devices (IUD), implant and injectable). Results from an additional counterfactual analysis suggest that the contraceptive effect was driven by the fact that the percentage of teens using no birth control fell during the study time period, rather than by the fact that some teens switched from less effective methods (condoms) to more effective hormonal and LARC/injectable methods. However, very high typical use failure rates for teen condom users suggest the need for a two-pronged approach for continuing reductions in teen pregnancy for sexually active teens: first, targeting the youth most at risk of not using contraception and helping them choose contraception, and second, increasing the effectiveness of method use among existing contraceptors.

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1. Introduction

The teen pregnancy rate in the U.S. has declined dramatically over the last two decades [1], declining by almost one-third (31%) between 2000 and 2010 (the most recent year for which data are available) from 83.4 pregnancies per 1000 teenaged women to 57.4 pregnancies per 1000 teenaged women. This decline is the result of two underlying trends: reductions in the percentage of teenagers who are sexually active and improvements in contraceptive use among teens who are sexually active. There has been some debate about whether recent declines in teen pregnancies are due primarily to increases in abstinence or to improvements in contraceptive use. A number of studies have attempted to parse out the relative importance of these trends. These studies generally find that both factors have contributed to the reduction in teen pregnancies. The estimated magnitudes of the abstinence and

contraceptive effects, however, differ, based on the specific time period studied, the dataset used, and the way in which sexual activity and contraceptive use are measured. For example, two studies that focused primarily on trends in the 1990s found that declines in sexual activity had the greatest impact on reductions in teen pregnancy. Mohn *et al.*, [2] found that the decline in teens engaging in sex accounted for 67% of the drop. Meanwhile, Santelli *et al.*, [3] calculated that 53% of the decline in teen pregnancy rates among high school students could be attributed to a higher percentage delaying sexual initiation and the rest could be attributed to improved contraceptive use.

However, more recent studies, using data into the 2000s, found that trends in contraceptive use had a greater impact on reductions in teen pregnancies or births. Santelli *et al.*, [4] found that improvements in contraceptive use accounted for 86% of the reduction in teen pregnancy between 1995 and 2002 for teens aged 15–19. The authors also found that improved contraceptive use accounted for 77% of the reduction in pregnancies among teens aged 15–17. Kearney and Levine [5] studied the related drop in teen births between 1991 and 2007 among high school students and found that increased contraceptive use was responsible for 65% of the decline. Additionally, a review by the Guttmacher Institute found there was no decline in the share of teens who were sexually experienced between 2003 and 2010, but found evidence of improvements in contraceptive use (reductions in non-use combined with increases in the use of more effective methods). The report concluded that the decline in the teen pregnancy rate during that time period was due primarily to improvements in contraceptive use [6].

Although estimates differ based on time period and measurement, all of these studies found that a substantial percentage of declines in teen pregnancies or births were due to changes in contraceptive use among teens. However, none of the papers described above examined which changes in contraceptive use contributed most to the overall contraceptive effect. This is an important gap in the literature because some changes in contraceptive use have greater impacts than others. For example, long-acting reversible contraceptive (LARC) methods, such as Intrauterine Devices (IUDs) and subdermal implants are notably more effective than other, more user-dependent methods such as condoms and oral contraception. Because they are less susceptible to user error, these methods' perfect-use failure rates (the annual rates of pregnancy among women who use their methods consistently and correctly at each act of intercourse) and their typical-use failure rates (the average annual pregnancy rates accounting for the fact that many women do not always use their method correctly and consistently) are both less than 1% [7]. On the other hand, among pill users, the perfect-use failure rate is about the same as for long-acting methods, but the typical-use failure rate is higher, at 9% [7]. Among condom users, the perfect-use failure rate is only 2%, while the typical-use failure rate is 18% [7].

Studies have found that teens are less likely than adults to be perfect users of their chosen birth control method and therefore experience even higher failure rates when relying on user-dependent methods [8–10]. Therefore, increasing the percentage of teen women using highly effectively LARCs can further reduce pregnancies *versus* increasing the percentage that use condoms.

While there is considerable variation in different methods' failure rates, even the least effective methods can substantially reduce the risk of pregnancy, relative to the use of no method. Our analyses of the 2011–2013 wave of the National Survey of Family Growth (NSFG) suggest that 12% of teens who were sexually active in the past three months did not use contraception at last sex. The annual rate of pregnancy is estimated to be 85% among sexually active women who do not use contraception [7]. It might be possible, then, to achieve meaningful further reductions in teen pregnancy without large increases in the use of the most effective (but the least prevalent) forms of contraception. For example, previous research has found that dramatic reductions in the pregnancy rate can be achieved by increasing the use of condoms among those who are using no method of contraception [11]. We shed light on this issue by documenting the changes in teens' use of long-acting methods and various other forms of contraception that accompanied the precipitous drop in teen pregnancies over the last decade. We then use a unique microsimulation model, Teen FamilyScape, to estimate the way in which changes in teens' contraceptive behaviors contribute to population-wide changes in pregnancy rates. The results of these analyses allow us to assess which of these changes were the most important to the reduction in the teenage pregnancy rate between 2002 and 2010. We chose this time period in part because of recent changes in contraceptive method use among teens. Additionally, our focus on these years allows us to study the more recent decline in teen pregnancy, thereby expanding on previous work that focused on the 1990s and early 2000s.

2. Methods

Teen FamilyScape was developed by researchers at Child Trends, Georgetown University, and The Brookings Institution[1]. The model is designed to reproduce real-world fertility-related behaviors and outcomes among teenagers in the United States. We use data from a range of sources[2] to ensure that we realistically simulate

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[1] Teen FamilyScape is an extension of FamilyScape 3.0, a model of pregnancy and childbearing that was developed by the same group of researchers. While FamilyScape 3.0 focuses on all women aged 15–44, Teen FamilyScape focuses only on the teenage population and is therefore better equipped to simulate teen-specific fertility dynamics. For more information on FamilyScape 3.0, see Thomas and Karpilow (2015).

[2] As described, authors' analyses of the NSFG were used to develop many of the model's parameters. More information on the NSFG and the relevant sexual activity and contraceptive measures can

the rate at which teenage women have sex; the frequency with which sexually active teens use contraception; the types of male-controlled and female-controlled contraception that they use; the number of teens who switch onto and off of various contraceptive methods; the frequency with which teens using various types of contraception (or none at all) become pregnant; the share of teen pregnancies that result in live births, abortions, and fetal losses; and the gestation and postpartum infertility periods for each of these pregnancy outcomes.

Figure 1 diagrams Teen FamilyScape's three simulation stages. The model has a daily periodicity, which is to say that each increment in analysis time corresponds to a single day. In the first stage of the simulation, we use the female respondent file of the 2006–2010 National Survey of Family Growth (NSFG)[3]—a nationally representative survey that contains extensive information on sexual activity, contraceptive use, and fertility outcomes—to populate the model with a group of teenage women whose demographic characteristics are nationally representative with respect to marital status, age, race, educational attainment, and socioeconomic status [12]. Most simulated behaviors and outcomes vary according to these demographic attributes.

In the second simulation stage, we use data from the NSFG to model sexual and contraceptive behavior. Teen FamilyScape realistically models distributions of the number of months in which teen women are sexually active and the number of days in which they have intercourse during sexually active months. The model also produces realistic distributions of teenage contraceptive use. We simulate the use of three different categories of female-controlled contraception: LARC/injectable methods, including IUDs, implants, and injectables; female sterilization[4]; and other female-controlled methods, such as the pill, contraceptive patch, or vaginal ring (PPR)[5]. With respect to male-controlled methods, we simulate the use of condoms, withdrawal and male sterilization[6]. We would have preferred to place

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be found in the Appendix A. The remaining parameters are based on published data. Sources are outlined, and cited, in the Methods section.

3 The most recently available NSFG data are from the cycle that began in 2011. We did not use data from this more recent cycle to develop Teen FamilyScape because published teen pregnancy rate estimates for this period are not yet available. Thus, we currently lack the external benchmarks that would be needed to validate a model parameterized using data from the 2011–2013 NSFG cycle.

4 We consider teen women to be sterilized if they are naturally sterile or are surgically sterilized.

5 The PPR category also contains the small proportion of teens who use a variety of other female-controlled methods, including emergency contraception, diaphragms, female condoms, foams, jellies/creams, suppositories/inserts, the contraceptive sponge, and natural family planning. Approximately 2% of teens in the PPR category in the 2011–2013 NSFG were using one of these other methods.

6 Condoms and withdrawal have similar levels of estimated effectiveness (Trussell, 2011). For purposes of simplicity, we therefore collapse condom users and users of withdrawal into a single "condom" category. As is the case for female sterilization, we consider teen women to rely on male sterilization if their partners are surgically sterilized or are naturally sterile.

injectables in their own category, as they have higher failure rates than IUDs and implants. However, sample size restrictions prevented us from doing so. We do, however, account for differential changes over time in the use of injectables *versus* IUDs and implants (explained in the next section). The model allows teens to switch contraceptive methods over the course of the simulation. Thus, as analysis time passes, some non-contracepting teens will begin to use contraception, and some contracepting teens will discontinue contraceptive use or switch to a different method.

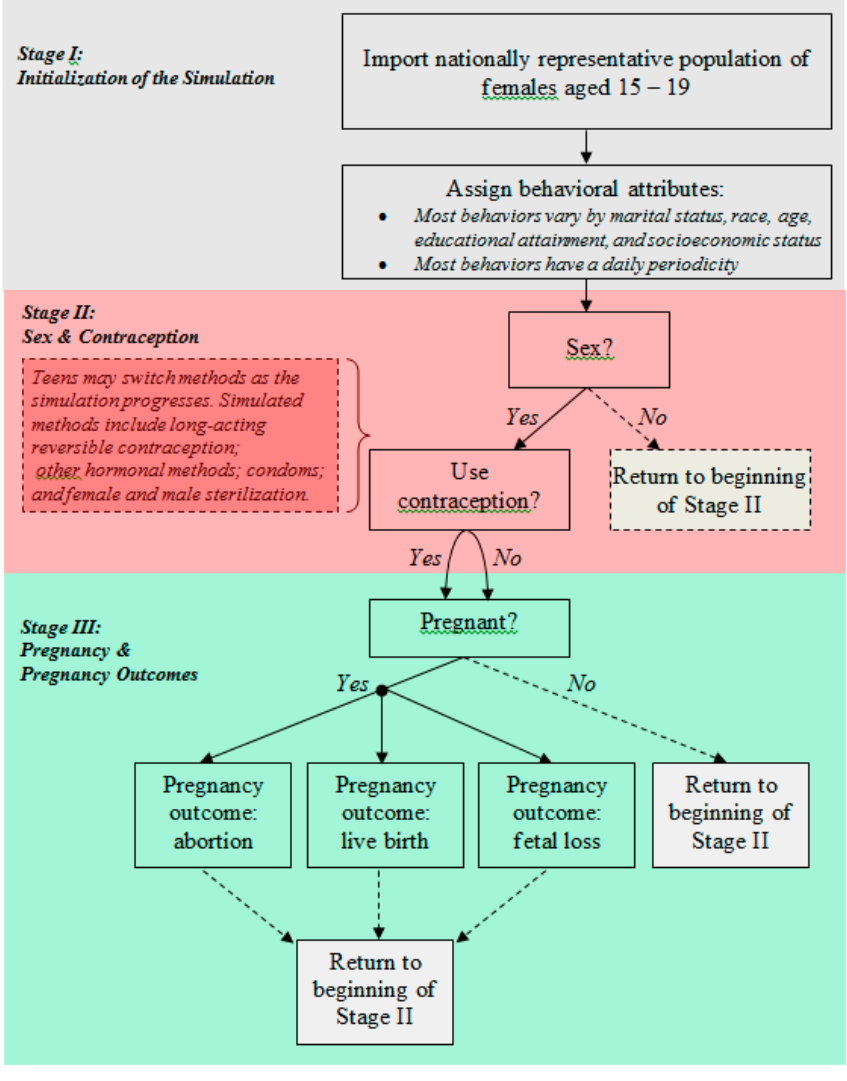

Figure 1. Summary diagram of the Teen FamilyScape Microsimulation Model.

Teen FamilyScape's third and final stage models the occurrence of pregnancy. A teen's risk of pregnancy when she has sex is dependent on her underlying fecundity (*i.e.*, her probability of experiencing a pregnancy from a single act of unprotected intercourse) and the efficacy of any contraception that she is using. Fecundity varies according to a girl's age and the day in her menstrual cycle. Thus, on each new day within the simulation, we update each girl's menstrual calendar and modify her age-adjusted pregnancy probability accordingly. The model's fecundity parameters were developed by synthesizing the results of several fertility studies (see Thomas and Karpilow (2015) for more information on these fertility studies) [11].

We developed Teen FamilyScape's contraceptive efficacy parameters by combining information on the age-dependent fecundities, coital frequencies, and typical-use pregnancy rates of girls in each contraceptive category. We estimated fecundities and coital frequencies using NSFG data, and we produced method-specific pregnancy rates by combining a number of different published estimates. More specifically, for each contraceptive method incorporated into our simulations, we: (a) used data reported in Trussell *et al.*, (1997) to compute a ratio of the pregnancy rate among teen users of the method in question to the pregnancy rate among all users of that method; and (b) multiplied this ratio by Trussell's (2011) more recently estimated method-specific pregnancy rate for all women [7,13]. This allowed us to take advantage of Trussell *et al.*'s teen-specific estimates (which are the most recent of which we are aware) and to update those estimates under the simplifying assumption that there has been no change over time in the proportional difference between the method-specific pregnancy rates experienced by teen contraceptors and all contraceptors. We then calculated weighted averages of these teen-specific, method-specific pregnancy rates for each of the model's contraceptive categories, where the weights reflected the share of teens in a given category who use each of the methods falling into that category. Thus, for example, our final failure rate for the LARC/injectable method category is a weighted average of the pregnancy rates experienced by teenage women who use IUDs, implants, and injectables. Our weights were constructed using age-specific estimates of the distribution of methods used at last sex as reported by Jones *et al.*, [14]. The only exceptions to this rule are male and female sterilization, both of which we always assume to be 100% effective.

We would also note that, because of sample-size limitations, we do not model separate contraceptive efficacy rates for dual-method and single-method users. Our efficacy parameters instead reflect the average risk of pregnancy across dual-method and single-method users. As such, we assign to each member of the simulation population an efficacy rate that corresponds to the most effective method (if any) that she is using. Thus, for example, we use PPR efficacy rates to model the risk of pregnancy among pill users (whether or not they are also using condoms), and we use condom efficacy rates to model the risk of pregnancy among teen women

who rely on condoms and are not using a female-controlled method. We followed the approach outlined in Thomas and Karpilow (2015) to model pregnancy risk among non-contraceptors [11].

Every simulated pregnancy eventually results in a birth, an abortion, or a fetal loss (*i.e.*, a miscarriage). We used data reported in Ventura *et al.*, (2012) to develop the model's pregnancy-outcome parameters [15]. For each pregnancy, we also simulate a gestation period and an interval of post-pregnancy infertility, both of which vary according to the pregnancy's outcome (see Thomas and Karpilow (2015) for more information) [11]. Although an individual may continue to have sex while she is pregnant, she is not at risk of pregnancy until after her interval of post-pregnancy infertility has ended.

Teen FamilyScape can be validated by comparing its outputs to their equivalent real-world benchmarks. Table 1 compares simulated and real-world rates of teenage pregnancy, childbearing, and abortion. For all three outcomes, the model closely approximates the relevant real-world benchmark[7].

Table 1. Pregnancy and pregnancy outcome rates, 2008.

	Teen FS	**Ventura *et al.***
Pregnancies per 1000 teens	70.0	69.8
Births per 1000 teens	40.8	40.2
Abortions per 1000 teens	17.2	17.8

2.1. Description of Simulation Specifications and Results

We used Teen FamilyScape to model the effects of historical changes in teen women's contraceptive use on the teen pregnancy rate. The first and fourth columns of Table 2 report the distribution of contraceptive use among teenage female respondents in the 2002 and 2011–2013 NSFG samples. As was done in previous research [4], we focused in particular on the method used at last sex among respondents who were sexually active in the three months prior to the survey. Based on these distributions, the share of sexually active teens who failed to use contracgeption at last sex fell by 4.9 percentage points over the past decade (from 17.1% to 12.2%). This reduction in non-contraception was accompanied by an increase in condom, PPR, and LARC/injectable method use. The condom category experienced the largest percentage-point increase, followed by the PPR category and the LARC/injectable category. Additional analyses of the NSFG (not shown here) found that, between 2002 and 2011–2013, this 4.9 percentage-point increase in

[7] Benchmarks were taken from Ventura *et al.*, (2012).

contraceptive use was accompanied by a similar reduction of 4.7 percentage points in the number of sexually active teens (those having sex in the past three months), suggesting that both factors were associated with declines in teen pregnancy over this time period.

Table 2. Decomposition of changes in teenage contraceptive use between 2002 and 2011–2013 and simulated effects on the teen pregnancy rate.

Most Effective Method Used at Last Sex	(1) 2002 Distribution	(2) 2002 Distribution + Increased Condom Use	(3) 2002 Distribution + Increased Condom and PPR Use	(4) 2011–2013 Distribution: 2002 Distribution + Increased Condom, PPR and LARC/Injectable Method Use	Total
Sterilization	0.7%	0.2%	0.0%	0.0%	-
LARC/injectable	9.8%	9.8%	9.8%	10.1%	-
IUD/Implant	*0.6%*	*0.6%*	*0.6%*	*3.3%*	-
Injectable	*9.2%*	*9.2%*	*9.2%*	*6.8%*	-
Pill, patch, ring (PPR)	36.0%	36.0%	37.2%	37.2%	-
Condom	36.4%	40.5%	40.5%	40.5%	-
No method	17.1%	13.5%	12.5%	12.2%	-
Simulated reduction in the number of pregnancies per 1000 teen women	-	−4.7	−1.7	−1.8	−8.1
% of the Total Contraceptive Effect	-	57.6%	20.6%	21.8%	100%

Note: The italic numbers represent a breakdown of the LARC/injectable category.

Our objective was to develop separate estimates of the effects of the increases in teenage women's use of condoms, PPR methods, and LARC/injectable methods between 2002 and 2011–2013 on declines in teen pregnancy rates. We therefore began by re-parameterizing Teen FamilyScape to replicate the 2002 distribution of method use at last sex as reported in column (1) of Table 2. We then implemented a series of intermediate simulation specifications in which we successively aligned the proportion of teens who use each of these three method types with the corresponding benchmark from the 2011–2013 distribution. For all three simulations, we moved a subset of teens out of the "sterilized" and "no method" categories, which are the two categories that shrank in size during our period of interest. We specified these reductions in sterilization and non-contraception so as to ensure that we were ultimately able to replicate the 2011–2013 distribution of teenage contraceptive use. Table 2 shows that, between 2002 and 2011–2013, the share of teens who were sterilized fell by 0.7 percentage points, while the share of teens who were noncontraceptors fell by 4.9 percentage points. Thus, we ultimately simulated

changes in contraceptive use for 5.6% (0.7% + 4.9%) of teens[8]. After implementing these three specifications, we arrived at the 2011–2013 distribution of teen method use. The change in the teen pregnancy rate from one specification to the next reflects the estimated effect of the corresponding change in contraceptive use between 2002 and 2011–2013.

For the first of our three simulations, we started with the 2002 distribution of contraceptive use and then moved a subset of sterilized and non-contracepting teens in the Teen FamilyScape model into the condom use category, which yielded the distribution shown in column (2). In this distribution, the share of teens who were condom users was the same as in the 2011–2013 distribution; the share of teens who were sterilized or non-contraceptors was smaller than in the original 2002 distribution; and the shares of teens who were PPR and LARC/injectable method users were held constant at their 2002 levels. The difference between the simulated teen pregnancy rates produced by the distributions shown in columns (1) and (2) was our estimate of the effect of the increase in condom use between 2002 and 2011–2013, a decrease of almost five pregnancies per 1000 teen women.

For the second simulation, we began with the distribution in column (2) and then moved a subset of the remaining sterilized and non-contracepting teens into the PPR category. This specification yielded the distribution shown in column (3), in which the shares of teens who were condom and PPR users were the same as in the 2011–2013 distribution, while the share of teens who were LARC/injectable method users was again unchanged relative to the 2002 distribution. The difference between the simulated teen pregnancy rates produced by the distributions shown in columns (2) and (3) was therefore our estimate of the effect of the increase in PPR use between 2002 and 2011–2013, a decrease of approximately two pregnancies per 1000 teen women.

Finally, for the third simulation, we began with the distribution in column (3) and then moved a subset of the remaining sterilized and non-contracepting teens into the LARC/injectable method category, which yielded the 2011–2013 distribution of contraceptive use shown in column (4). The difference between the simulated teen pregnancy rates produced by the distributions in columns (3) and (4) was our estimate of the effect of increased LARC/injectable method use, a decrease of approximately two pregnancies per 1000 teen women.

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[8] Among the members of this group, 12.5% originally fell into the "sterilized" category, and 87.5% originally fell into the "no method" category. When we simulated flows out of these two categories, we therefore always made certain that 12.5% of the affected teens were originally in the "sterilization" category and that 87.5% of the affected teens were originally in the "no method" category. In so doing, we ensured that our simulations ultimately reproduced the 2011–2013 distribution of method used at last sex.

Note that Teen FamilyScape combines LARCs and injectables into a single category encompassing IUDs, implants, and injectables. The efficacy rates for IUDs and implants are higher—and their discontinuation rates are lower—than for injectables. Among teens who used one of these three methods, the share who relied specifically on IUDs or implants rose from less than 10% in 2002 to nearly one third in 2011–2013. For the simulation described above, we adjusted the LARC/injectable category's efficacy and discontinuation rates in order to account for changes over time in mix of LARC/injectable methods used by teens[9]. We did not make similar adjustments when we simulated increased PPR use because the estimated efficacy and discontinuation rates for the pill, patch, and ring are very similar [7]. We would also note that, aside from adjusting efficacy and discontinuation rates within the LARC/injectable category, we did not model any other changes over time in the probability of contraceptive discontinuation or in the consistency of correctness of method use. Nor did we simulate the effects of changes in coital frequency or in teenagers' demographic characteristics. This is because our specific purpose was to isolate the effects of changes in contraceptive use during a typical act of intercourse, holding all else constant.

Overall, we found that changes in contraceptive use produced a reduction of 8.1 pregnancies per 1000 teens in the teen pregnancy rate, which corresponds to a little less than half of the decline in teen pregnancies during our period of interest (17 pregnancies per 1000 teenage women between 2002 and 2010) [1][10]. Our results imply that more than half (about 58%) of this contraceptive effect was driven by increased condom use and that the remainder was attributable in roughly equal measure to increased PPR and LARC/injectable method use[11]. Other simulation results (not shown here) indicated that about 30% of the "LARC/injectable method effect" was attributable to the growth in the number of teens who used an IUD, an implant, or an injectable. The remaining 70% of the effect was attributable to the fact

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[9] Because the contraceptive efficacy and switching parameters for Teen FamilyScape's base specification were developed using NSFG data from 2006–2010, and since injectable use was more common among teenaged LARC/injectable users in 2002 than in 2006–2010, we made comparable adjustments to the model's LARC/injectable efficacy and switching rates when we parameterized the model to reproduce the 2002 distribution of contraceptive use.

[10] The most recent pregnancy estimates are from 2010. Based on historical trends in the teen pregnancy rate and the continued decline in the teen birth rate between 2010 and 2012, we anticipate that the teen pregnancy rate might have been even lower by 2012 in which case the magnitude of the contraceptive effect would be reduced as we study contraceptive changes from 2002 to 2011–2013.

[11] Because these three simulations are additive in nature, their order has no effect on our results. Our estimates of the effects of increased condom, PPR, and LARC/injectable method use would have been the same if (for example) we had simulated an increase in LARC/injectable method use, then in condom use, and then in PPR use.

that, among teens who used these three methods, there has been an increase in the share who rely more specifically on IUDs and implants rather than injectables.

2.2. How Important Was the Decline in Non-Contraception?

During our period of study, increases in the use of effective methods were accompanied by a substantial reduction in the number of non-contracepting teens. To understand the relative importance of the decline in non-contraception as compared to the increase in the use of effective methods, we performed a final counterfactual simulation in which we modeled a change in contraceptive behavior for the same number of teens as in our main specifications (approximately 5% of sexually active teens), but we assumed that the number of non-contraceptors remained constant. We instead achieved the desired change in contraceptive use by moving a subset of condom users onto more effective methods.

The top panel of Table 3 shows our simulated counterfactual distribution of method use. We also restate the 2002 distribution that is reported in Table 2. As was the case in our earlier simulations, we once again move 0.7% of teens out of the sterilization category. However, whereas our main specifications assumed a 4.9 percentage-point reduction in the share of teens who were non-contraceptors, we assumed instead for this simulation that there was a 4.9 percentage-point reduction in the share of teens who used condoms, as well as a 0.7 percentage point decline in sterilization. All of these "former condom users" were moved into the PPR and LARC/injectable method categories. We assumed that the ratio of new LARC/injectable method to PPR users was identical to the equivalent ratio as measured in our real-world 2011–2013 distribution (see Table 2, column 4). Under this assumption, the sizes of the LARC/injectable method and PPR categories increased by 1.2 and 4.4 percentage points, respectively. As was the case for our earlier simulations, we also modeled increases in contraceptive efficacy and reductions in discontinuation rates among LARC/injectable method users in order to account for changes over time in the mix of LARC/injectable methods that are used by teens.

We found that, when we moved from the 2002 distribution of method use to the counterfactual distribution shown above, the teen pregnancy rate was reduced by 3.0 pregnancies per 1000 teenage women. This effect was only about 37% as large as the effect that was produced when we modeled the change from the 2002 distribution to the actual 2011–2013 distribution (an overall decline of 8.1 pregnancies per 1000 women). In other words, moving non-contracepting teens onto condoms had a larger impact on the teen pregnancy rate than moving teen condom users onto PPR and LARC/injectable methods. Thus, our analyses indicate that the decline in teen pregnancy rates between 2002 and 2011–2013 was driven primarily by reductions in non-contraception, rather than by reductions in the use of less effective methods.

Table 3. Counterfactual simulation of changes in teenage contraceptive use.

Most Effective Method Used at Last Sex	(1) 2002 Distribution	(2) Counterfactual Distribution
Sterilization	0.7%	0.0%
LARC/injectable method	9.8%	11.0%
Pill, patch, ring (PPR)	36.0%	40.4%
Condom	36.4%	31.5%
No method	17.1%	17.1%
Simulated Reduction in the Number of Pregnancies per 1000 Teenaged Women		**−3.0**

Note: Contraceptive distributions are based on the authors' analysis of data from the 2002 and 2011–2013 National Surveys of Family Growth. Estimated contraceptive effect is based on the results produced by the Teen FamilyScape Microsimulation model.

3. Discussion

There have been dramatic declines in teen pregnancy rates in the past decade, and previous research suggests that improvements in teen contraceptive use have played a major role in these declines [3–6]. A better understanding of the implications of changes in contraceptive behavior for historical declines can inform policymakers and practitioners as to the most effective strategies for sustaining the reduction in the rate of teen pregnancy, which remains high compared to other industrialized countries [16]. Our analyses indicate that approximately half of the decline in teen pregnancies since 2002 was due to changes in contraceptive method use[12]. This estimate fits within the range of other studies, which found that changes in contraceptive use accounted for between 47% and 86% of declines in teen pregnancy and childbearing [4,5]. Differences between our findings and those of other studies may be due, in part, to the more recent time period of our study (previous work highlighted trends in sexual activity and contraceptive use since the early 1990s and did not extend past the early 2000s). Our estimate of the contraceptive effect may, in fact, be a lower bound because we focus only on the effect of changes in methods used at a typical act of intercourse and do not model changes in other dimensions of contraceptive behavior. If changes in the mix of contraceptive methods were accompanied by, for instance, reductions in discontinuation rates, improvements in

[12] We did not explicitly model changes in sexual behavior or attempt to explain the remaining portion of the historic decline in teen pregnancy. However, we did find an almost five percent point reduction in the number of sexually active tens (those having sex in the past three months), suggesting that both increased contraceptive use and decreased sexual activity were associated with declines in teen pregnancy over this time period.

the consistency or correctness of use, or changes in dual method use[13], we might have found that changes in contraceptive behavior had an even more substantial impact on trends in teen pregnancy. For instance, Santelli *et al.* 2007 modeled a reduction in nonuse as well as increased use of more effective methods and of multiple methods simultaneously and found a larger contraceptive effect. Moreover, recent research has documented an increase in dual method use among teens in recent years [6].

Our work extends previous research by examining how changes in the mix of contraceptive methods are linked to declines in teen pregnancy. Previous research has found that the percentage of sexually active teens not using contraception declined from 1998 to 2006–2010 [17], and we found that these declines have continued into 2011–2013. Declines in nonuse have been accompanied by increases in condom use and pill, patch or ring (PPR) use, and slight increases in LARC/injectable methods—all of which contributed to declines in teen pregnancy rates in the past decade.

Condoms were the most frequently used contraceptive method among sexually active teens, with more than 40% reporting condoms as their most effective method in 2011–2013. The increase in condom use since 2002 accounts for more than half of the contraceptive effect on declines in teen pregnancy rates in our models. Increases in the use of PPR methods and LARC/injectable methods account for the remaining contraceptive effect in equal measure. Our analyses highlight slight increases in teen use of PPR contraceptive methods during the time period of study, with 37% of teen women relying on these methods in 2011–2013. Our analyses also indicate an overall slight increase in the LARC/injectable methods (injectables, IUDs and implants). However, this overall slight increase in the combination of injectables and LARCs masks a decline in the use of injectable methods that was accompanied by a larger increase in LARCs (IUDs and implants). In fact, while LARC use is still very low among teens (about 3% used an IUD or implant in 2011–2013), it has increased by a factor of more than five since 2002 (see Table 2).

Additional simulation analyses highlighted that the contraceptive effect was driven primarily by the drop in the percentage of teens using no method, rather than by the increase in the use of more effective methods. When we modeled only changes in the method mix among contraceptors, leaving the percentage of teens using no method at 2002 levels, we found that the magnitude of the contraceptive effect dropped by two-thirds from a decline of 8.1 pregnancies per 1000 teen women to a decline of three pregnancies per 1000 teen women. Women who do not use contraception have a very high rate of pregnancy: an average of 85% of sexually

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[13] Teen FamilyScape accounts for dual method use in that the failure rates for the PPR and LARC/injectable method groups are weighted averages of the failure rates experienced by dual-method and single-method users. The model, however, does not account for *changes* in dual method use over time. Thus, we implicitly assume that dual method use patterns remained constant.

active women experience pregnancy over the course of a year. Thus, we find that take-up of even less effective methods among teens can result in a dramatic reduction in the teen pregnancy rate [7].

Our findings suggest the need for a two-pronged approach to continue declines in teen pregnancy among sexually active teens into the future. First, policies and programs should continue to target sexually active youth who do not use contraception. Second, teen pregnancy rates could decline further if policymakers can increase the effectiveness of method use among existing contraceptors—for example, by providing evidence-based contraceptive counseling, affordable services and same-day prescriptions/insertions [18–20].

Despite recent declines, more than one in ten sexually active teens in 2011–2013 (12%) did not use any method of contraception at last sex, highlighting the need for targeted efforts to improve contraceptive use among this population. Reasons for non-use among teens include concern about side effects (for hormonal and LARC methods), misunderstanding of the risk of pregnancy associated with unprotected intercourse, being "in the moment" and not wanting to break the mood, and partner resistance to the use of contraception [21–23]. Many currently non-contracepting teens have used contraceptive methods in the past, as is evidenced by the high rates of sexually active teens who have ever used condoms (97%) and the pill (54%) [24]. While method switching can lead to gaps in contraceptive coverage and increase the risk of unplanned pregnancy [25], research suggests that providers can help to prevent gaps in contraceptive coverage by providing teens with multiple contraceptive options and helping them switch to another effective method if they are unhappy with their current method [25]. Additionally, teens who do not use contraception often engage in other risky behaviors such as alcohol and drug use and are more likely to disconnected from school and family, highlighting the need for multiple and combined intervention efforts [26].

A review of effective teen pregnancy prevention studies has documented several programs that have increased condom use among teens who were not using contraception, including very short STD prevention programs and longer, more intensive youth development programs [27]. However, typical use failure rates for condoms are relatively high (at 18%), and may be even higher for teens [28,29], and many researchers have found that condom use declines as relationships become longer or more serious [30,31], suggesting that transitioning teens to more effective hormonal or long acting-methods of contraception can help teens avoid pregnancy.

Among more effective contraceptive methods, PPR methods remain popular among teens. These methods provide high levels of protection when used perfectly (0.3% failure rate), although typical use pregnancy rates are higher (9%) [7–9], and many women ultimately switch off of these methods [32–34], highlighting the importance of consistent and sustained method use. In the LARC/injectable

method category, our study found a decline in injectable method use since the early 2000s. Qualitative research and interviews with providers indicate that clinics are more likely to prescribe and deliver injectables on-site *versus* other longer-acting methods. However, side effects and difficulty with attending regular appointments have led to high discontinuation rates among injectable users [23]. Although not currently as popular, LARCs (implants and IUDs) are recommended as a first-line method for teens, as they combine effectiveness and consistency and have very low typical use failure rates (less than 1%) [35]. Additionally, despite higher upfront costs, these methods are cost-effective for women who do not intend to get pregnant for several years as their use does not require regular health care visits or prescription refills [36]. Evidence suggests that the low level of LARC use in the United States is attributable in part to a lack of information regarding their benefits, misinformation about their likely side effects, and their high upfront costs [11,12]. However, evaluations of recent LARC-based interventions have found that young women are more likely to choose LARC methods when they are well-informed as to their benefits and potential side effects, same-day insertions are available, and cost barriers are removed [19,20].

4. Limitations

Our work has some limitations, mainly related to the Teen FamilyScape model. The model is an accurate and powerful tool for answering our research question—how changes in the use of specific contraceptive methods were associated with the historical decline in teen pregnancy. As noted in the Discussion, however, our estimate of the overall contraceptive effect does not incorporate changes over time in contraceptive behaviors such as dual method use and consistency and correctness of method use. The model also combines LARCs and injectable methods, which is not ideal given the differences in failure and discontinuation rates for these method types. However, we account for this by adjusting failure and discontinuation rates accordingly and are able to capture the relative increase in IUD users over time. Despite these limitations, our model allows us to extend previous research by examining how trends in contraceptive method use have contributed to recent declines in teen pregnancy in the U.S.

5. Conclusions

Our work contributes uniquely to the literature on the declining U.S. teen pregnancy rate by parsing out the effect of changes in contraceptive use. The study's findings highlight the importance of targeting pregnancy prevention efforts towards teens who do not use contraception as well as efforts to improve the effectiveness of teens' chosen birth control methods.

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Author Contributions: Quentin Karpilow and Adam Thomas conceived of the modeling process, Quentin Karpilow completed the modeling, constructed the tables, and wrote the the first draft of methods and results. Jennifer Manlove helped conceptualize the analyses, wrote the introduction, literature review and discussion and aided in the construction of the remainder of the paper, as well as the revisions. Adam Thomas and Kate Welti added to the introduction, literature review and discussion sections, edited all sections, and aided in the completion of the manuscript and the interpretation of the findings. All authors have read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A.

The National Survey of Family Growth (NSFG) 2006-10 is a survey of women and men aged 15–44 conducted between 2006–2010. The NSFG contains a sample of women and men from all states in the United States. Resulting statistics are nationally representative when sampling weights are applied. The 2006–2010 NSFG includes 2284 teenaged women ages 15–19. We used information from the NSFG to estimate Teen FamilyScape's parameters related to the probability that a teen woman would have sex in a given month and her monthly coital frequency. We also used the NSFG to assign each woman to an initial contraceptive method and to develop our estimates of contraceptive efficacy. We then used the 2002 and 2011–2013 versions of the survey to calculate the distribution of women using each type of contraceptive method during these two time periods. The table below summarizes the relevant measures:

Contraceptive choice and sexual activity over the course of a year
For each month in the three years leading up to the interview date, women filled out a contraceptive
calendar in which they indicated whether they had sex, and they then selected the methods of birth
control that they used (if any) from the following list:

- No method
- Birth control pills
- Condom
- Partner's vasectomy
- Female sterilizing operation, such as tubal sterilization and hysterectomy
- Withdrawal, pulling out
- Depo-Provera, injectables
- Hormonal implant (Norplant or Implanon)
- Rhythm or safe period by calendar
- Safe period by temperature or cervical mucus test, natural family planning
- Diaphragm
- Female condom, vaginal pouch
- Foam2

- Jelly or cream
- Suppository, insert
- Today sponge
- IUD, coil, or loop
- Emergency contraception
- Other method—specify
- Respondent was sterile
- Respondent's partner was sterile
- Lunelle injectable (monthly shot)
- Contraceptive patch
- Vaginal contraceptive ring

The number of sexually active months in a year is calculated using this calendar and the woman's
selected method of birth control is drawn from the first month of the past year in which the woman
was sexually active and not pregnant.

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Teen Childbearing and Economics: A Short History of a 25-Year Research Love Affair

Saul D. Hoffman

Abstract: Despite its apparent distance from the core topics of economics, economists have been attracted to, and deeply engaged in, research about teen fertility for more than a quarter century. Research has focused on two broad, interrelated issues: the socio-economic consequences of a teen birth and the socio-economic causes of a teen birth. In researching these issues, economists have drawn on and extended basic concepts in economic theory and in applied statistical research. I review those literatures for a non-economist audience and conclude that the research love affair has substantially benefited both parties, although definitive answers to causes and consequences are still elusive.

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1. Introduction

It is relatively easy, at least for an economist, to see why economists would be attracted to issues like teen pregnancy and teen childbearing, despite their apparent distance from the core topics of economics. First, economics—especially microeconomics—is fundamentally the study of choices that individuals make, traditionally and most often in formal markets with monetary prices, but now more and more frequently outside that sphere. Viewed from that perspective, choices involving sexual and fertility behavior among teens are an incredibly challenging, but inviting, target. Is it possible to identify the role of economic incentives, including government policy, on these behaviors? Is it sensible to apply traditional models of rational choice decision-making to teens?

Second, the traditional concern about teen fertility was predicated on the notion that it was an economically catastrophic act. In a famous and oft-quoted 1968 article, Arthur Campbell wrote that "The girl who has an illegitimate child at the age of 16 suddenly has 90 percent of her life's script written for her" [1] (p. 238), including reduced opportunities for schooling, the labor market, and marriage. But it doesn't take too much reflection to appreciate that more may be going on in leading to these poor outcomes than just a teen birth. Disentangling the causal effect of teen childbearing on subsequent socio-economic outcomes from its correlational effect is another deliciously inviting and challenging target, this time well-suited for the applied economist or econometrician.

Just to make all this yet more inviting, the two research strands are closely related. Suppose it could be demonstrated that for some teens the socio-economic impact of a teen birth was negligible. For example, maybe future prospects for some teens were equally poor with or without a birth or perhaps government programs provided substantial benefits, so that the net impact on socio-economic well-being was consequently small or even positive. Then, it might well be "rational" in an economic sense to have a teen birth in the first place, thereby linking the research on the causal impact of a teen birth with the research on the choice determinants of a teen birth. So what came to be known as the teen birth "causes" literature and the teen birth "consequences" literature were clearly interrelated.

And then, to add yet another layer of challenge, the teen fertility rate in the U.S. has fallen at a rate that is totally unprecedented (see Figure 1). Teen fertility was once widespread, with most of it occurring within early and sometimes not entirely voluntary marriage. In 1960, the teen fertility rate was approximately 90 births per 1000, which implied that more than 40% of women ever had a teen birth. When I published my first article on teen births 25 years ago [2], the teen fertility rate was 60 births per 1000, down one-third from 1960, but it had increased six years in a row in what turned out to be a deviation from the downward trend. Since then the rate has declined every single year, except for a short but puzzling uptick between 2005 and 2007. In 2014, the teen fertility rate was 24.2 births per 1000, the lowest teen fertility rate every recorded in the U.S., though still shockingly high by European standards [3].[1] Thus, the rate fell by more than 50% during my professional association with the topic and by 70% since 1960. Of course, at the same time teen marital births largely disappeared, falling from 85% of teen births to 12%.

This adds yet another focus for economic research. Why did the rate fall? Did it have anything to do with changes in the costs of teen childbearing or changes in policy? Is it a good thing or not?

In this article I try to make sense out of these various research strands by providing a personal narrative through the economics literature on teen childbearing, with a special emphasis on the three issues discussed above. My goal is to make the literature, including some reasonably technical content, accessible and valuable to a non-economist.

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[1] In order to focus on broad methodological issues, I do not attempt to explain the higher teen fertility rate in the U.S. Suffice it to say that the U.S. is an outlier and that simple explanations involving public support and transfers cannot be an explanation since most European countries with lower teen fertility have more generous support systems.

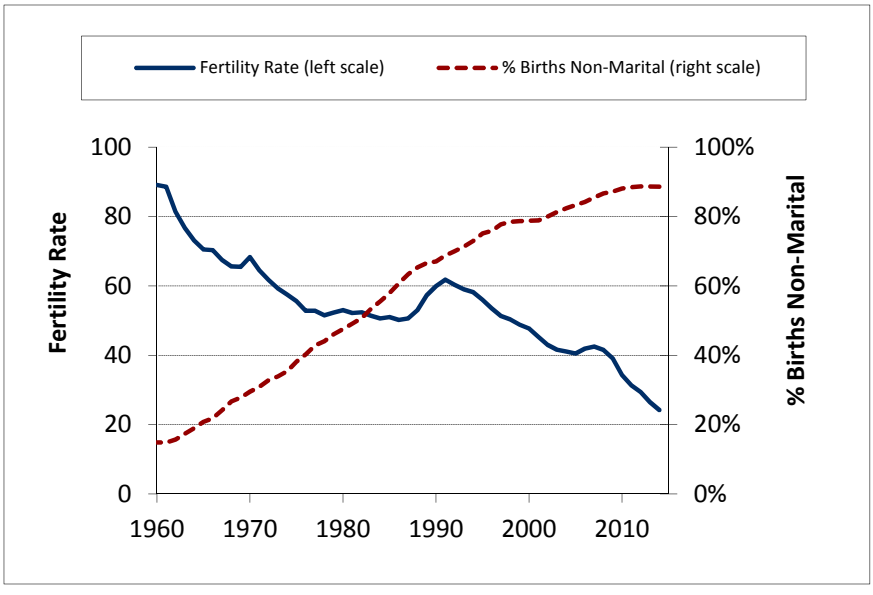

Figure 1. U.S. Teen Fertility, 1960–2014.

2. The Socio-Economic Consequences of a Teen Birth: Methods and Findings

Problems. A very lengthy literature in economics and sociology has attempted to measure the socio-economic consequences of a teen birth; for a well-known early survey see Hayes [4] and for well-known more recent ones see Maynard [5] and Hoffman and Maynard [6]. Measuring the socio-economic consequences of a teen birth is orders of magnitude more complicated than it might seem. The first important point to make is that there is no such thing as *the* socio-economic consequences of a teen birth in the sense of an effect that is independent of time period or geographic location. Policies and countries and cultural context surely matter and these vary over time and space. Just as an illustration, the safety net in the U.S. in the mid-2010s is far different than it was in the 1980s or 1990s and so too is the labor market for less-educated men and women. As a result, the socio-economic consequences of a teen birth are likely to differ across these time periods. At best, we can hope to measure an average teen birth effect for a particular population living in a particular time and place. The effect on a particular teen mother will naturally vary, some greater, some smaller.

To make matters yet worse, we can only know what the effects of a teen birth *have* been, not what they likely *will* be for current teen mothers. If we want to measure the impact over a time span long enough to reflect long term or life-cycle impacts, then inevitably the births in question must have occurred just as long ago in the past, when circumstances and policies were potentially different—exactly as argued

above. Are the results of studies like that predictive for contemporary teen births or are they primarily of historical value? The answer is not always obvious and it is almost never acknowledged.

The second equally important point is that even if there were such a thing as the teen birth effect, we could never measure it fully accurately with confidence. Understanding this latter point requires a minor, but relatively painless, detour into statistical analysis. The standard way to quantify the relationship between a potentially causal variable like a teen birth and some outcome like subsequent family income is with regression analysis. In the very simplest form, this can be written as $Y = \beta_0 + \beta_1 TB + \eta$, where Y is the outcome of interest (e.g., education, earnings, or poverty status), TB is a measure of whether a young woman had a teen birth (=1 if yes, =0 if no), and η is a random error term representing all the other factors that may affect outcome Y but are unobserved. Technically, β_0 is the average value of Y for women without a birth, while $\beta_0 + \beta_1$ is the corresponding average Y for women with a teen birth, so that β_1 is the difference in the average Y between the two groups of women. This is the simplest possible formulation imaginable because it includes only a single explanatory variable (TB). In effect, this simple model attributes all the difference in outcome Y between the two groups to the single difference between them in having had (or not) a teen birth.

An immediate and natural criticism is that this model is far too simple, because it fails to account for other factors that affect outcome Y. This criticism is both potentially true and false, that is to say, it depends on the particulars of the analytical situation, which, in turn, illuminates why we can never measure the causal effect perfectly. Let's agree that some other variable (call it Z) also affects outcome Y. Z could be mother's education or neighborhood quality or the income of the young woman's family when she was growing up; all of these are firmly established in the research literature in economics and sociology as causal factors affecting adult outcomes. It is clear enough that if Z is omitted, then Y will be less fully explained than if it were included; this would be reflected in an R^2 value that is lower than it might be. But it is not immediately clear how the estimate of β_1 will be affected. It is, in fact, quite possible, for Y to be poorly explained, but at the same time for the causal effect of a teen birth to be estimated accurately.

Fortunately, the statistical theory of omitted variable bias tells us exactly how this works out. Without going through the formulas and equations, the key results, which are critical for the entire research literature on teen birth consequences, are as follows. (1) If a variable that affects Y is omitted from a regression equation, it biases the estimates of all variables with which it is correlated. The extent of the bias increases with the size of the correlation between the omitted variable and X and

also with the impact of the omitted variable on the outcome Y.[2] (2) Omitted variables that are uncorrelated with the causal variable of interest do not create bias, even if they are important determinants of Y.

These two results are actually remarkably intuitive, as well as incredibly useful in a wide range of applications well beyond teen childbearing. If a relevant explanatory factor is omitted, then its effect on Y is "captured" by the included variable to the extent that the two variables are correlated. As such, the estimated effect reflects, at least in part, a correlation, rather than a causal effect. In that case, a policy that managed to reduce the incidence of teen childbearing would have an actual effect different from the estimated effect, unless it also changed the correlated variables. (More on this below.) But if, instead, the omitted variable is uncorrelated with the included variable, then its omission is harmless in so far as determining the causal effect of X on Y is concerned.

Based on this, it is possible to see exactly why the critique of the overly simple one-variable model of teen birth effects can be either true or false—and what would have to be done to estimate a causal estimate of a teen birth. Suppose, for example, that it were possible to run a randomized control trial (RCT) in which the treatment was having a teen birth and young women were randomly assigned to have or not have a birth (Of course, such a trial cannot be conducted, for obvious reasons). In that case, while other factors might well influence the outcome of interest, their omission from the analysis would not affect the estimate of the treatment effect, here, the effect of a teen birth on subsequent socio-economic outcomes. The reason is exactly what makes RCTs the gold standard of research: by construction, the experimental design makes omitted variables uncorrelated with the treatment.

In the absence of an RCT, however, researchers have only data generated by actual human behaviors and choices about fertility, education, marriage and so on. In that case, omitted variables will very likely be correlated with both having a teen birth and the outcome in question.

In the world of social science research about the effects of a teen birth on socio-economic outcomes, no one would dream of estimating the simple one-variable model that I introduced above, precisely because it is obvious that teen births do not occur randomly. Thus, explanatory variables are added: race, ethnicity, family structure, family income, urban residence, parents' education, neighborhood characteristics, and so on, depending on the data source. This was the standard practice in the research literature on teen birth effects through the early 1990s and it

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[2] The bias is the product of these two terms. Because the bias term is multiplicative, it is often possible to predict the sign of the bias. The correlation term is actually the estimated coefficient on the included variable of interest in a regression of the excluded variable on all the included variables.

was considered good enough. But that was before economists discovered selection bias [7], which compelled social scientists—especially economists—to confront the role of unmeasured and perhaps unmeasurable variables more directly. Truthfully, the potential observable variables available in even the best nationally-representative U.S. samples such as the Panel Study of Income Dynamics (PSID), National Longitudinal Survey of Youth (NLSY) or The National Longitudinal Study of Adolescent to Adult Health Adolescent Health (ADD-Health) are quite limited relative to the ways in which young women differ from one another and that might affect both their likelihood of having a teen birth and their subsequent socio-economic outcomes. No matter how long the list of available explanation variables, it is always possible to argue that some critical variable is yet omitted. And the charge is impossible to rebut fully: on what rigorous basis can a researcher argue that he or she has included all relevant correlated variables? The unhappy result is that these studies are inevitably imperfect, with, even worse, the extent of imperfection (technically, bias) impossible to pin down.

This, in a nutshell, is the basis for my pessimistic statement above that, even if there were a teen birth effect, we could never measure it perfectly. We cannot conduct an RCT and cannot persuasively measure all relevant variables that are correlated with a teen birth and the outcome of interest. Researchers are left estimating an effect that cannot be definitive.

Indeed, it is plausible that any estimate of a teen birth effect on outcomes from standard data sets using standard regression analysis is an over-estimate of the true effect. Adding observable explanatory variables (e.g., the teen mother's education or her own mother's education) to a teen birth regression typically reduces (in absolute value) the estimated teen birth effect, confirming the basic message of omitted variable analysis. By extension, if we could add measures of the unobserved variables, they, too, might operate in the same way to reduce the estimated effect; perhaps teen mothers and non-teen mothers differ in unobservable ways as well that also contribute to the difference in outcomes. Since we cannot add these unobservable factors, this implies that the resulting regression estimate is still too large.[3] It does not follow, of course, that the true effect must be zero.

A Very Very Important Caveat. Suppose that we were attempting to evaluate on a cost/benefit basis a proposed intervention that would potentially reduce the teen birth rate. Conceptually, the benefits of such a program are the negative socio-economic impacts that would be averted. Would the causal impact of a teen

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[3] This line of argument has the annoying feature that a researcher is often confidently reporting the results of a regression that he/she has not and cannot perform and thus whose results are not really known.

birth (if we could measure it) be the appropriate benefit measure to use to evaluate the program?

The answer depends on what the intervention actually does. The causal effect is the impact of a teen birth, with no other changes in a young woman's life prior to the time at which a teen birth or perhaps pregnancy occurs; the young woman is the same, except for her first birth timing and whatever follows directly from the delay in the first birth, such as changes in education, work, and marriage. In terms of policy, this thought experiment might best correspond to an intervention involving the timely distribution of long-acting reversible contraceptives (LARCs) that prevent a pregnancy with substantial certainty but do not otherwise change the particulars of a young woman's life prior to the administration of the LARC; see Peipert *et al*. [8] and Secura *et al*. [9] for an evaluation of such an intervention in a slightly different context. But many, if not most, interventions attempt to change something about an adolescent female—her self-image, her school or neighborhood quality, her confidence, her negotiation skills, her after-school activities, and so on—that will affect her early fertility and that may also affect subsequent socio-economic outcomes, independently of the delay of a first birth. In that case, the causal estimate is absolutely the wrong estimate and will typically underestimate the benefits of the intervention.

To make this idea clearer, let's return to the simple one-variable model of the effect of a teen birth introduced at the beginning of this section. It does not provide an estimate of the causal effect of a teen birth on subsequent outcomes. Rather, it is a measure of the potential benefits of a successful intervention that eliminated all pre-existing differences between the average woman who is a teen mother and the average woman who is not. Most interventions would likely eliminate much less than this and thus have fewer benefits. But as long as they eliminate some relevant differences between the two groups of women, they will have benefits greater than the pure causal effect of a teen birth.

Solutions. The major research strands in the teen birth literature make sense when viewed from the perspective of omitted variable problems and in light of the impossibility of conducting a teen birth RCT. They are all attempts to identify circumstances in which omitted and unobserved variables are less likely to be problematic.

Four broad approaches have been used to measure the socio-economic impact of a teen birth (in a specific place and time and for a specific population). Again, I provide an intuitive overview without going through the technical details and formulas. One is adding additional observable independent variables, but that is simply not likely to resolve lingering statistical issues of causality, given what is actually available for inclusion in nationally-representative samples. A second

involves comparing outcomes across sisters who differ in their fertility timing.[4] Quite plausibly, sisters are more alike than two unrelated women; they share some family background and neighborhood features that are otherwise difficult to measure. As a result, there are fewer unmeasured variables whose correlation with a teen birth and the outcome variable are the root of the problem. Unmeasured individual differences may yet exist and if they are correlated with a teen birth, this would create a potential problem, but probably of a second order of magnitude.

A third approach is to emulate an RCT by identifying a situation in which a teen birth is (more or less) randomly assigned. Such a situation is usually referred to as a "natural experiment." The difference between a natural experiment and an RCT is that a natural experiment occurs without the intervention and design of the researcher. Identifying natural experiments is as much art as science. Examples in the social sciences, especially in economics, abound: differential WWII mobilization rates of men across U.S. states meant that some young women faced more enhanced labor market opportunities than others [12]; anti-obscenity laws dating from the early part of the 20th century were later interpreted in such a way that young women had earlier access to oral contraceptives in some U.S. states than in others [13]; the increase in the minimum wage in New Jersey in 1992 meant that employers of less-skilled workers there had to pay a higher wage than in Pennsylvania, its neighboring state that did not have an increase [14]. In the teen birth case, a miscarriage provides a potential natural experiment [15]. Most miscarriages are random and they result in an arbitrary delay in the onset of early fertility. Thus whether a young woman has a teen birth or has a delay in the timing of her first birth is plausibly uncorrelated with other unmeasured factors that affect the outcomes of interest. More on this below.

The final approach—instrumental variables (IV) or two-stage least squares—is the most technical and least used. The underlying idea is to find some variable, called an instrument, which affects the probability of a teen birth, but does not directly affect the outcome of interest. Policy measures, like access to health clinics, or individual characteristics, like age at menarche that might be a determinant of early sexual activity, are examples of instruments that have been used in this literature.[5] The statistical approach involves using the instrument to predict the probability of a teen birth that varies across young women in a way similar to a natural experiment. The predicted probability then replaces the actual observation of a teen birth in a regression equation to estimate a causal effect.

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[4] Technically, the use of sisters to estimate teen birth effects is an example of a family fixed effects model, an approach widely used in other research contexts as well [10,11].

[5] Technically, the miscarriage approach is also an IV model, but it is easier to understand it by treating it as a natural experiment.

An exhaustive survey is beyond the scope of this contribution. I focus here on income and education; for surveys of effects on other socio-economic outcomes, see the individual papers in [5] and [6]. Below I discuss each strand briefly, but I begin with what I think are the general lessons and results. First, the general insight about omitted variable bias likely overstating the impact of a teen birth has been validated across all of the newer research approaches. It is fair to say that most economists working in this research area now accept the idea that the negative causal impact of a teen birth for the women who actually have a birth is modest in magnitude. Teen mothers may be doing poorly, but the teen birth is far from the sole cause. Of course, because the births in question occurred several decades ago, this literature tells us that the impacts *were* modest, not that they *are* currently modest. Second, the impacts may have become more negative, a result that is consistent with a trend toward a less generous safety net and a less hospitable labor market for less-skilled and less-educated workers. Third, the results are more fragile than is widely understood. This is, in my opinion, especially true for the miscarriage natural experiment literature, which is the source of the occasional positive effects, but also for the sister studies. The cost of reducing omitted variable bias can be reliance on a sample that is relatively small or specialized and potentially less representative. A quick survey follows.

Sisters. Geronimus and Korenman [16,17] were the first to use this approach in this context. They estimated teen birth effects for pairs of sisters in three nationally-representative data sets and Hoffman, Foster, and Furstenberg [18,19] independently re-examined one of the data sets. The analyses are based on teen births in the 1960s (one data set) and 1970s and early 1980s (the other two).[6] For the teen sisters from the 1960s, Geronimus and Korenman found not only that the effects were smaller than in a standard analysis, but that the sister who had a teen birth did no worse, on average, on most economic measures than her sister who had a later birth. She completed about as much education, had a standard of living that was no lower, and was no more likely to be poor. Geronimus went on to argue on the basis of these findings and other health-related findings that early childbearing might be desirable in some disadvantaged subpopulations [20].

The other analyses from both sets of researchers found teen birth effects that were quite consistently negative, although less than in previous research, precisely as an omitted variable analysis would suggest. The average difference in economic well-being between a teen mother and her (non-teen mother) sister was about

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[6] The data sets are the National Longitudinal Survey of Young Women (NLSYW), the Panel Study of Income Dynamics (PSID), and the National Longitudinal Survey of Youth (NLSY79). The NLSYW includes teen births from the 1960s, while the other two include births from the 1970s and early 1980s.

one-third, whereas in earlier studies, the impact was typically between 40 and 50%. There were also reasonably big differences between the sisters in the probability of being poor, receiving welfare, and educational attainment, all to the detriment of the sister who had the teen birth. The likely explanation for the difference between the results from the various data sets is that the births in the earlier study were far more likely to be marital and that the early period sample suffered from technical sampling problems that made it potentially unrepresentative of sister pairs.[7]

The cost of focusing exclusively on sisters is sample size and representativeness. The results for the earliest dataset are based on samples of about 40–50 sister-pairs with differing teen fertility and even the later stronger results have samples of not more than about 100–150. Larger families are over-represented relative to smaller ones. The research, especially the original paper by Geronimus and Korenman [16], is most important for vigorously making the argument that the problems of teen mothers could lie elsewhere than in their early fertility and for offering an attractive, if limited, methodological approach.

Miscarriage. Because a miscarriage is usually a random event reflecting fetal stress, Hotz, McElroy, and Sanders [15] argued that it could be used as a natural experiment to quantify the effects of a teen birth on the mother. Remarkably, the National Longitudinal Survey of Youth 1979 included a retrospective pregnancy outcome history for teens that included abortion, miscarriage, and even stillbirth as potential classifications. This study is distinctive in several ways. First, it examined the impact of births to teens whose pregnancies occurred at age 17 or younger rather than through age 19, as in the usual definition of a teen birth, and second, it followed the sample through their early 30s. This allowed the researchers to distinguish between short-run and longer-run impacts, which is an important difference not fully considered in previous research. The researchers found that the initial negative effects of a teen birth were short-lived. The teen mothers rebounded and by their late-20s did better over a wide range of outcomes than their counterparts who had a miscarriage. The teen mothers were less likely to have graduated from high school, but they were more likely to have received a GED by an essentially offsetting amount. Teen mothers worked more and earned more than their counterparts, and their spouses had higher incomes. Differences in income from welfare between the two groups were very small. The teen mothers were worse off only on two outcomes: they had more births by age 30 and they spent more time as a single mother than did the teens with miscarriages. The authors concluded, that "the failure to account for

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[7] In the earlier survey (NLSYW), sisters could be identified only if they were still in their parents' home. Because the sample included women age 14–24 and in light of the early median age at marriage for women in the 1960s, it is likely that many older sisters with marital births were missed. This age sampling issue did not arise in the other data sets.

selection bias vastly *overstates* (emphasis in original) the negative consequences of teenage childbearing and [the findings] certainly provide no support for the view that there are large negative consequences of teenage childbearing *per se* for the socioeconomic attainment of teen mothers" [15] (p. 81). So this study suggested that other factors were the primary cause of the poorer outcomes for teen mothers.

Even though this study is careful and thoughtful, it has some weaknesses. First, it is very difficult to obtain reliable information on teen miscarriages from survey data and it is clear that miscarriages were substantially underreported. The entire sample of miscarriages is 68 cases, of which an astonishing 12% are actually stillbirths.[8] If misreporting was highest among young women who viewed their early pregnancy as an unfortunate error and who went on to do relatively well, then the sample of women who *reported* a teen miscarriage would be more disadvantaged than the population of women who had a teen miscarriage. This would bias the analysis toward finding no effect of a teen birth. Second, the miscarriage may not have been sufficient to delay a teen birth: almost a third of the women with a teen miscarriage actually had a subsequent pregnancy by age 17 that resulted in a birth. Third, a reanalysis and extension of the original paper in Hoffman and Maynard [6] found that the same approach applied to more recent teen mothers yielded much more negative impacts of a teen birth across a range of outcomes including educational attainment, own earnings, and the earnings of a spouse. This is another example of the point made earlier: research can only reveal what the effects have been, not what they are or will be, and the longer the time frame of the analysis, the greater the possible difference.

Multiple Methods. Finally, a very interesting recent study by Kane *et al*. [22] used a range of research methods with a single high-quality data set (ADD-HEALTH), thereby eliminating data set and time period as sources of differing estimates. They focused exclusively on educational attainment. The methods employed include standard regression with reasonably extensive explanatory variables, a related technique called propensity scoring, and several instrumental variables methods including one that is quite sophisticated and involves allowing for the existence of unobserved types of women with different underlying preferences for a teen birth.[9] Three of the methods yield estimates of a teen birth effect that ranges from 0.7–1.0 fewer years of education, while one method yields an estimate about twice

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[8] In national data from the National Center for Health Statistics [21] miscarriages outnumber stillbirths by a factor of 35:1. In the NLSY79 data, the ratio is 7:1. If the birth figure is correct, the number of miscarriages ought to be at least twice as high as the number reported.

[9] This involves estimating unobserved heterogeneity of "types" of women using maximum likelihood methods developed by Heckman and Singer [23]. One method not used is sisters, which they report yielded unreliable results.

as large. Their preferred estimate is -0.7, which is a reasonably sizeable impact, but lower than standard regression estimates (about one year in their model) and lower than the overall difference between teen mothers and all other women (about two years). As such, it is consistent with a meaningful negative impact of a teen birth, but also with the general effect of omitted variable bias. They conclude that the wide range of estimates in the literature reflects primarily the different research methods applied.

3. The Socio-Economic Causes of a Teen Birth: The Opportunity Cost Hypothesis

Economists love to talk about *opportunity cost* almost as much as applied economists love to talk about omitted variable bias. Opportunity cost is among the first concepts that students learn in a principles of economics class. It is the cost of an action in terms of what is given up in taking that action, so, for example, it is not the monetary cost of a purchase, but the value of the next most preferred item the same amount of money could have been used to acquire. It applies quite directly and comfortably to teen births. The opportunity cost of having a teen birth is the value of what is given up in alternative options and outcomes over the rest of an individual's lifetime. That value is best thought of as a measure of net lifetime happiness, involving fertility, marriage, work and all the other components of adult life. So the net cost of a teen birth is the difference between the happiness value of the life likely to be had with a teen birth and the happiness value of the likely best alternative life that could have been had if the birth had been delayed.[10]

Economists typically assume that people choose their most preferred feasible alternative, an assumption often denoted as "rational choice" or, in this context, "utility maximization." The hypothesis that follows naturally then is that perhaps teens are rational actors and that some choose not to have a birth and others choose to have a birth because it is their own best personal alternative. This, in a nutshell, is the opportunity cost hypothesis: teen births will be more common when and where and for whom the opportunity cost is low. There are, to be sure, many fragile steps in such an argument, involving knowledge, foresight, planning, and so on, all of which are potentially deficient in matters related to teens in general and teen sexual activity in particular. But it is, at least, an operational and testable hypothesis and, as such, it has been the backbone of research in economics and of policy prescriptions involving the welfare system and safety net.[11]

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[10] Economists use "utility" to represent what I have called happiness value.

[11] It is not economists alone who have imputed rationality to prospective teen mothers. The well-known sociologist Elijah Anderson wrote that "The ghetto teenager sees no future to derail, no hope of a future

In practice, economists and policy-makers trying to operationalize the opportunity costs of a teen birth have emphasized likely incomes, especially those from work, marriage, and/or the welfare system. Family well-being is, on average, positively related to income, so this is a reasonable approach. The U.S. welfare system provides income support to low-income single parents and, indeed, many teen mothers do end up receiving welfare. Importantly, these women are likely to be ineligible for welfare if they marry the father of their child, according to the rules governing the welfare system. Welfare benefit levels vary quite widely across states and over time; thus, the opportunity costs will be lower in some times and places than others, thereby providing incentives that differ across time and space. This argument, which is usually associated with more conservative politicians and economists, was prominently made by Charles Murray in his book, *Losing Ground* [25], and, despite its age, it remains a popular refrain.

William Wilson [26] and many others have emphasized the other side of the issue, namely the very poor marriage prospects of many minority, inner-city women that reflects the declining labor market opportunities and rising incarceration rates [27] of their likely marriage partners—minority, inner-city men. The worse are a woman's future marriage prospects and/or her own future labor market opportunities without a birth, the smaller are her opportunity costs and, thus, the more likely she might be to have a birth. Under some circumstances, the costs might be negative, *i.e.*, it might be beneficial to have a birth if marriage prospects are poor and welfare benefits are sufficiently high.

It is relatively easy to identify circumstances where the net cost of a teen birth is likely to be low and others where it is likely to be high. The low cost configuration would be poor work and marriage alternatives and residence in a time or place with more generous welfare benefits. The high cost configuration would be just the opposite: strong marriage and/or work opportunities and less generous welfare benefits.

The empirical work in this area derives mostly from Murray's contention that the generosity of the welfare system was a primary cause and the research reflects an attempt to do a better job at testing the model than he did. Murray sidestepped the actual hard analytical work by constructing special illustrative cases of welfare use, marriage and work in which the income gains to a teen non-marital birth were substantial. But he never provided any evidence whatsoever either that the special cases were representative or that the prospective teen mothers acted on the incentives as he identified them.

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better than today, hence little to lose by having an out-of-wedlock child" and "middle-class youths take a strong interest in their future and now what a pregnancy can do to derail that future" [24] (p. 6).

Despite all the attention given to the possible role of the welfare system as a responsible factor, the evidence consistently suggests it has a weak effect. In 2013, the teen fertility rate ranged from less than 15 births per 1000 teen girls in five U.S. states to more than 40 births per 1000 in six states, while monthly cash welfare benefits available for a family of two persons through the primary U.S. cash assistance program Temporary Assistance for Needy Families (TANF) ranged from under $200 in five states to over $550 in another five (plus Alaska). But the states with low teen fertility rates are not those with low TANF benefits; in fact, it is quite the opposite. Figure 2 shows the bivariate relationship in 2012 between a state's teen fertility rate and its maximum TANF benefits for a two-person family. As is evident, the relationship is actually negative; on average, the teen fertility rate falls by three births per 1000 for every $100 increase in TANF benefits. 2012 is not unusual in any way; a parallel analysis for 2002 or 1992 would yield a very similar relationship.

Just as in the discussion of the consequences of a teen birth, this simple analysis also likely suffers from omitted variable bias. It is certainly not a valid test of the opportunity cost hypothesis, because it only measures the benefits on one side of the comparison, namely, the welfare benefits that would be potentially available. But the opportunity cost hypothesis involves a comparison of benefits along the two teen fertility paths; perhaps young women in states with low welfare benefits have correspondingly poor non-welfare opportunities. To test the opportunity cost hypothesis more fully requires constructing reasonable estimates of the income flows along the two teen fertility paths.

It doesn't take much thought to realize that a researcher is in a ticklish situation, because only the outcome that is actually chosen by a particular woman is observable in any data set. For women who are teen mothers, a researcher has no information on the life they could have had if they had not had a teen birth. And the same applies to the women who do not have a teen birth: the "counterfactual" of life with a teen birth is not observed. Not observing the counterfactual state isn't necessarily fatal to this line of research inquiry, if it is possible to estimate what it might have been. And that is a less daunting task than might be assumed. The first research to do this is Duncan and Hoffman [2] and Lundberg and Plotnick [28] took a related approach. The underlying idea is to use actual outcomes for women with no teen birth to impute likely counter-factual outcomes to observationally-similar women who had a birth.[12] Here, observationally similar means that the two groups of women have

[12] Technically, this involves estimating a regression equation of the form $Y = X\beta + \mu$ for women who did not have a teen birth, where Y is some outcome of interest and X represents determinants of Y that are observed both for women who did not have a teen birth and women who had one. The estimated values of β are the effect of X on Y. The predicted outcome for a woman with a teen birth is the product of her own value of X and the estimated value of β.

similar family backgrounds. Since teen mothers and others may well differ in terms of unobservable factors, too—this was, after all, the core message of the analysis of the consequences of a teen birth—the analyses adjust for selection bias, which was the state-of-the-art statistical procedure for this kind of problem in that time period. It is far from a perfect procedure, but serviceable.

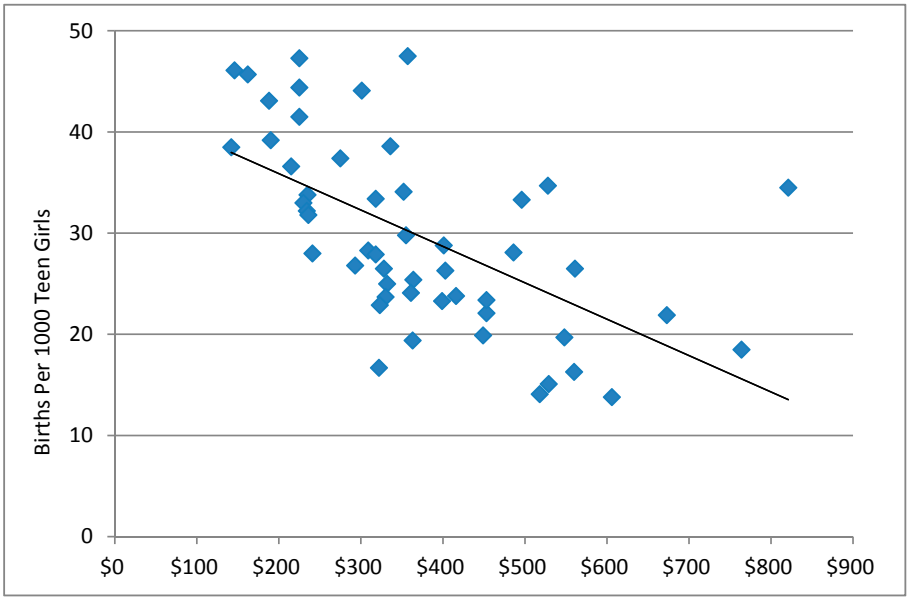

Figure 2. Teen Fertility Rate by U.S. State and Maximum TANF Benefits, Family of Two, 2012.

Duncan and Hoffman applied this procedure to a sample of black teens who had births in the late 1970s and early 1980s. For teen mothers, opportunity costs were measured as the predicted income they might plausibly have about a decade later, when they were in their mid-20s, based on actual observed incomes of similar women who did not have a teen birth. For women who did not have a birth, the counterfactual income was the welfare income they would be eligible for in their state of residence. Lundberg and Plotnick looked at teen births that occurred mostly in the early 1980s. They focused less directly on the counterfactual income for teens, but did examine welfare benefits and other policies (abortion funding and legal environment) in a multivariate context that also included multiple measures of a young woman's socio-economic background. Note that both of these studies reflect teen birth behavior at a time when the teen fertility rate was more than twice as high as it is in the mid-2010s.

Both studies find no evidence that the level of welfare benefits was a determinant of a teen birth for black women; Lundberg and Plotnick find that welfare benefits did increase the probability of a teen birth for whites. Duncan and Hoffman found that teens with better non-birth opportunities were more likely to delay their first birth beyond their teen years. But the impact was relatively modest: a 25% increase in opportunity cost decreased the proportion with a teen birth by about 9%.

With the kind of data that is available, these studies, old as they are, are about as good as can be executed. Economists can interpret these results as suggesting that benefits and costs have some influence on teen fertility behavior, but it is hard to argue that the effects of these measures of benefits and costs are large from a policy perspective. But in a related literature, two very interesting recent papers tell us how and why opportunity costs might sometimes matter less than they could and how and why they might matter more. I think these papers provide clues to the final issue on my agenda, namely the recent sharp decline in teen fertility and its likely future trend.

New Directions. Research by economists Melissa Kearney and Philip Levine [29] suggests that income inequality may play an important role in teen fertility. Rising income inequality is one of the most significant labor market developments of the past few decades; an accessible summary is in Autor [30]. Their argument is a variant of the opportunity cost model. They hypothesize that more extreme inequality creates greater feelings of economic hopelessness, leading young women to view opportunity costs as very low. When the distance to the middle class is greater and more difficult to traverse, they argue, perhaps young women conclude that they won't make it there, no matter what they do, so they have little to lose by having a teen birth.[13]

Kearney and Levine examined the relationship between teen births and "lower tail inequality," across U.S. states; lower tail inequality is defined as the ratio of household income at the median to income at the 10th percentile of the distribution and thus roughly measures distance from near the bottom to the middle class. The critical comparison in their analysis is between the teen fertility of young women from poorer households (measured by low parental education) in high inequality states with the behavior of similar young women in lower inequality states. When they divide states into three broad categories by the extent of inequality, they find a clear pattern. In the low inequality states, about 15% of teens from households where the mother was not a high school graduate had a birth. In states with medium inequality, the percentage with a birth was about three percentage points higher and

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[13] In this approach, income inequality and income immobility are being used somewhat interchangeably. Inequality is a greater issue if income positions are relatively immobile.

in states with high income inequality, it was another five points higher. The overall difference between the low and high inequality states is about seven percentage points, which is almost a 50% difference. The differences in teen birth rates are much smaller across the three groups of states for young women whose mother was a high school graduate and the differences disappear entirely for women whose mother attended college. This suggests that the differences are not due to something about the states themselves.

Kearney and Levine confirm this relationship in more elaborate regression analysis of teen fertility that controls for other individual and state characteristics. They find that a one percentage point increase in lower tail inequality, which is approximately the difference between low and high inequality states, increases the proportion with a teen birth by 5.3 percentage points for teens whose mother was not a high school graduate and by 2.1 percentage points for teens whose mother was a high school graduate. They show that other measures of income and income inequality, including upper-tail inequality and average income at the 10th and 50th percentiles, all have much weaker effects on teen births. The impact of lower tail inequality is not much affected by controlling for other state characteristics, such as religiosity, the political leaning of the state, or its minority population. So this paper is an important clue about how opportunity costs may be perceived.

In another study, Kearney and Levine [31] examined the influence of the media on teen fertility.[14] It is easy enough to believe that television and movies might influence broad cultural attitudes about teen motherhood, but it is hard to actually measure the impact, whether positive or negative. Kearney and Levine managed to do that, focusing on the impact of MTV's *16 and Pregnant* series, which aired beginning in 2009. The show was a popular hour-long documentary series that followed a teen mother through much of her pregnancy, portraying much of it in a gritty and very unglamorous light. Kearney and Levine write that "realities of the lives of teen mothers are presented in ways that may have been unknown or difficult to imagine for other teens viewing the show" (p. 8). In economists' jargon, the show plausibly increased a teen's perception of the opportunity costs of a teen birth, especially its short-term impact on daily life.

To measure the causal impact of *16 and Pregnant*, Kearney and Levine took advantage of a natural experiment, this time involving geographic variation in MTV viewership across TV markets in the months prior to the airing of *16 and Pregnant*. They used viewership in an earlier time period rather than actual viewership of the program because actual viewership might well be higher in areas where teen births were more common, thereby creating a spurious positive relationship between

[14] Other research papers looking at the impact of the media on fertility include [32] and [33].

viewership and teen fertility. The impact of the programs on teen social media behavior is evident. Google searches and Twitter messages about *16 and Pregnant* jumped sharply immediately following each episode, by approximately 30%–40%. More importantly, Google searches and tweets containing the terms "birth control" and "abortion" also both increased following the airing of each episode and they increased more in geographic areas where searches and tweets about *16 and Pregnant* increased more.

Most importantly, Kearney and Levine find that the program appeared to affect teen fertility rates. Teen birth rates fell more in areas that had higher MTV viewership and, thus, where more teens were (exogenously) exposed to the show. They estimate that *16 and Pregnant* and the *Teen Mom* shows that followed it led to a 6% reduction in the number of teen births that were conceived after the show began through the end of 2010. This is about one-third of the total decline in teen fertility during this time period.

Together, the two papers suggest a subtle reinterpretation of the opportunity cost hypothesis. Perhaps opportunity costs don't matter as much as economists would like them to because teens have a highly erroneous faulty conception of them, in particular, a conception that is consistently and systematically too small.

4. What We've Learned: Economics and Teen Fertility

There was a time, not so very long ago, when researchers confidently believed, first, that a teen birth was an economic catastrophe and then somewhat later, that it might be primarily or even exclusively a marker for disadvantage, rather than an important independent causal factor. As I have argued, the latter is, in its weaker form, a thoroughly plausible hypothesis and likely correct. The evidence for the strong version rests largely on the results of one approach (miscarriages), which, while methodologically appealing, suffers from substantial data challenges and may well reflect the opportunities available in an economic environment more hospitable to less educated persons than the current and future ones are likely to be. I think in the end we have come to a reasonable place, one that appropriately appreciates both the selective features of the young women who become teen mothers and the causal effect of a teen birth. This result tells us something very important: to really make a difference in the lives of prospective teen mothers, we need to help them delay a birth *and* address at least some of the other deficits in their lives. It is also very important to appreciate that the correct estimate of a teen birth effect to use in the evaluation of a teen birth intervention depends very much on what that intervention actually does. It can be far greater than the causal estimate, which may hold constant things that are changed by the policy intervention.

There was also a time, also not so very long ago, when the U.S. teen fertility rate was sky-high and when some argued that this was an optimal behavioral response

to low opportunity costs. But since then, teen fertility has declined so steadily and sharply that either the opportunity costs must have increased dramatically or the original hypothesis of optimal behavior must have been incorrect. Like most complicated social phenomena, the answer is not likely to be one or the other exclusively. It is likely that opportunity costs of a teen birth have increased. Reform of the welfare system that imposed lifetime receipt limits and instituted serious work requirements probably played some role, as did the general deterioration of labor markets for less-educated workers. Both contributed to making life following a teen birth a less attractive option. But the findings of Kearney and Levine about the effect of MTV suggest that, however difficult it is to believe, teens knew relatively little about the immediate reality of pregnancy. Their findings about the role of inequality suggest that where inequality is greater, teens at risk of a teen birth tended to understate its long-run costs by underestimating their own prospects. For a broad discussion of factors affecting the recent decline in U.S. teen fertility, see [34].

Like any good lasting relationship, the research love affair between economics and teen fertility has been valuable for both partners. An economic perspective has contributed meaningfully to the understanding of both the causes and consequences of a teen birth, even if it has not managed to definitely resolve either analysis. The analytical problems are very hard ones, beset with a wide range of research challenges, many of which I have touched on here. Perhaps most importantly, the economics research showed that the strongest statements about the negative socio-economic consequences of a teen birth and about the causal effect of the welfare system on a teen birth were both exaggerated. Where economists have erred, it has been primarily by failing to appreciate the fragility of their analyses and drawing conclusions that were stronger than the results warranted. Symmetrically, the relationship has also been beneficial to economics, forcing it to confront the limitations of rational choice modeling and the difficulties of applied research. The new work of Kearney and Levine absolutely reflects that, as does, for example, the work of Yakusheva and Fletcher [35] on the impact of a peer's pregnancy on the likelihood of a teen birth.

I predict with substantial confidence that this research relationship will continue and thrive, especially as economists expand their tool kit. With a bit less confidence, I predict that the downward trend in teen fertility will continue, perhaps not at its current rate of decline, but still on a downward trajectory. And that tells us something important about how young women, even women from disadvantaged families and neighborhoods, view their futures. We need to use the new advances in contraceptive technology, especially LARCs, to enable young women to make the decisions that are in their long-run interest. And we need to do more than that, as well, to make the alternatives economically more attractive. And in doing that, our focus may need to

be wider, including, for example, efforts to improve the economic position of young less-educated men and women.

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Reconsidering Teenage Pregnancy and Parenthood

Frank Furstenberg

Abstract: This paper looks back at the findings reported in *Destinies of the Disadvantaged: The Politics of Teenage Parenthood*, a decade after its publication in light of recent research. Increasingly, the most methodologically sophisticated research has minimized the "causal impact" of early childbearing on later life events consistent with the findings of the Baltimore Study. I argue in the paper that we must see early childbearing primarily as a marker rather than a cause of economic disadvantage. As such, reducing early childbearing will have a minimal impact on the lives of highly disadvantaged teens unless those teens use the delay in childbearing to improve their education and labor market prospects.

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1. Introduction

A decade has passed since I published *Destinies of the Disadvantaged: The Politics of Teenage Childrearing*, the final volume in a trilogy of books on the findings of a 30-year longitudinal study of teen mothers and their offspring in Baltimore [1]. The Baltimore Study was begun in the mid-1960s when America, like many other Western nations, was on the cusp of a huge revolution in the family. Marriage was just beginning its half-century retreat, at least for all but the well-educated, and non-marital childbearing was starting to attract some attention in public health and family planning circles. The final wave of interviews, completed in the mid-1990s, took place after rates of teenage childbearing had already begun to drop in the United States, a trend that has continued nearly uninterrupted to the present day.

The decline in teenage childrearing over the past half century has been nothing short of spectacular: falling from 90 per 1000 in 1960 to 26.5 per 1000 in 2013. Initially, teenagers began to curtail childbearing in part because it became increasingly untenable for them to marry in the event of a pregnancy as they had done throughout the post-war period. This initial decline, beginning in the 1960s, slowed and then reversed in the 1980s, when liberalized abortion policies were reversed and sex education became more controversial during the Reagan presidency (see Figure 1) [2]. This was the period when cultural conservatives mounted a strong campaign to reduce early childbearing by discouraging sexual initiation through "abstinence only" programs, a policy approach that proved to be almost totally ineffective and

perhaps even counterproductive in delaying premarital sex and preventing unwanted conceptions [3,4].

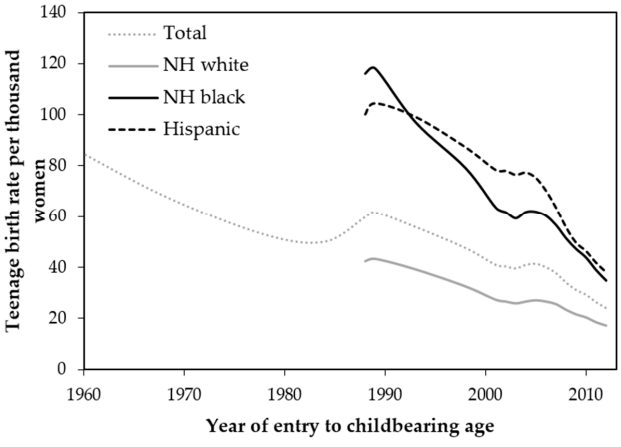

Figure 1. Birth rate for women 15 to 19 years old by year of entering into childbearing age and racial and ethnic group. Source: [5].

After stalling in the 1980s and even reversing for several years from 1988 to 1991, the rate of teen childbearing resumed its downward direction and has continued to decline to the present. The current rate is less than half of what was at its recent high point in 1991 [6]. Hardly any experts in the field would have predicted the sharp decline since the early 1990s when President Clinton, in a bit of hyperbole, called early childbearing the most urgent problem facing this country [7].

This brief commentary begins by reiterating the most important lessons learned from research about the causes and consequences of early childbearing. Then I will turn to some observations about events during the past decade that have helped to bring about the reduction in early childbearing. I conclude with a discussion of future policy initiatives, assuming, as I do, that further delays in the timing of first parenthood will not inevitably bring about an improvement in the economic and social circumstances of disadvantaged young adults.

2. What We Now Know about the Impact of Early Childbearing

By the time that I completed my 30-year study following the life course of 323 teen mothers and their children (out of an original sample of 404), there was growing evidence from a number of studies, consistent with the findings of the Baltimore Study, that politicians, policy makers, and researchers had largely misdiagnosed the problem of teenage childbearing (see, for example, [8]). I, among other researchers, concluded that teenage childbearing was not a root "cause" of

social disadvantage, as many social scientists had initially believed, but largely a marker of under-privilege or a concomitant of growing up poor and, in many cases, a member of a disadvantaged minority (see, for example, [9,10]).

It is certainly true that most teenage parents and their children are likely to be mired in poverty throughout much of their lives, but many of their counterparts who delayed early childbearing in the Baltimore sample and in national studies are not notably better off once we take full account of social and personal circumstances leading up to the occurrence of a pregnancy and birth in their teens. Being poor, in a disadvantaged minority group, attending inner-city schools, exclusively associating with peers who are similarly situated, and a host of other liabilities associated with under-privilege *both* generated high rates of early childbearing and continuing economic and social disadvantage. Having a child early in life certainly does not make things better and it may well create added complications for the teen, her partner, and the child, but much and probably most of the damage to the young mother's prospects has already been done by the time the pregnancy occurs.

Early parenthood occurs as a result of a process of social selection, or what I described in the first volume of the Baltimore Study as "selective recruitment" to early parenthood [11]. This selection process, more than the actual event of early parenthood itself, creates the long shadow of social disadvantage. This means that unless we address the conditions that lead up to parenthood, we cannot hope to change the destinies of the disadvantaged whether they have a birth in early life or not.

This stark conclusion must be tempered to some extent by noting that the lives of teen mothers and their offspring unfolded differently among the families that I studied. Not all the young mothers, their partners, and their families reacted to early parenthood identically. How they responded to the birth of their first child also shaped their life course and how their children fared in later life. These heterogeneous reactions to entering parenthood are one of the reasons that teen mothers do not look very different from their counterparts who delayed children. Put differently, many young mothers were able to get back on track despite the challenging circumstances created by having a birth in the teen years. Others did poorly, but many of those had already exited school and faced enormous obstacles to becoming economically independent.

In the Baltimore Study, I identified several responses or adaptations to early childbearing that affected the lives of the parents and children for better and for worse:

1. Returning to school after their children were born and increasing their educational attainment in significant ways is the first of these adaptations. Of course, the more able students were more likely to return; going back to school also required the assistance of parents or, occasionally, partners. Those who made significant

educational advancements were far more likely to enter the middle class than those whose schooling ended with the birth of their first child. Their children were also more likely to succeed in school and stay out of trouble. Over the course of the study, the great majority of the young mothers returned to school, sometimes a decade or two after their first child was born. So motivation for getting ahead through education matters greatly in the long run. Surprisingly, a tenth of the teen mothers eventually graduated from college, and an additional quarter had entered college but never graduated, at least by their mid-forties. Few, including me, would have expected the delayed route to educational attainment to be so significant in shaping the fate of the women and their children in the study.

2. Curtailing their fertility after the first birth is the second adaptation by young mothers that contributes to their subsequent success. Contrary to expectation, most teen mothers do not go on to have large families, as was often portrayed in the early literature on the topic. "The myth of the brood sow" was what a pair of researchers many years ago referred to the popular stereotype of poor women having babies to remain on public assistance [12]. In the Baltimore Study, only a small minority of mothers went on to have more than three children. Over half (62%) either never had another child or had only one additional birth during the course of the study. Fertility control was associated with returning to school and a higher level of participation in the labor force. Many of the young mothers, even those with lower fertility, opted for sterilization in their 20s and early 30s because they continued to have difficulty using available contraceptive methods, especially birth control pills.

3. The third adaptation, related to the success of the young mothers, was *avoiding* an early marriage. Women who married before or soon after their first child was born were less likely to return to school and were more likely to have subsequent births. Resisting early marriage, after becoming pregnant, in the mid-1960s was still relatively uncommon, even for African-Americans who comprised four- fifths of the original sample. Over half of the teens married the father of their first child, but only one in five of these marriages was still intact 30 years later. Women who married before or soon after their first birth "to give their child a name", as some explained their decision, were no less likely eventually to become single mothers than those who delayed matrimony, usually marrying a partner who was not the father of her first child. Moreover, many of the women who married swiftly left school to do so, thereby compromising their chances of economic independence when their marriages eventually dissolved. Women who married soon after their first child was born were also more likely to have additional children, complicating their prospects of attaining financial independence from their family.

4. Significantly, the receipt of public assistance, "welfare" as it was known then, was *not* a factor in the long-term success of young mothers. Those who persisted on welfare for long spells, not surprisingly, did worse as adults, but short-term use

of welfare, because it was often associated with further schooling and job training, contributed to success in later life as measured by economic independence and the successful development of the first-born child at the time of the 30-year follow up.

5. Similarly, co-residence with the natal family had a contingent association with long-term success. Short-term reliance on the family was associated with greater educational attainment, but long-term reliance had the opposite effect of signaling the inability to gain financial autonomy either through schooling and entrance into the labor force or controlling subsequent fertility.

6. Finally, paternal involvement in the children's lives also produced mixed results. When fathers actively participated by providing material and emotional support, the children were generally better off, but sporadic participation could be worse than no involvement at all. The majority of the offspring were faring reasonably well at the 30-year follow up. However, the educational and labor market success of the first-born daughters was notably higher than the first-born sons whose extensive experience in the criminal justice system had scarred their entrance to adulthood.

There is scant evidence showing that interventions specifically tailored to help mothers persist in school, control their fertility, and gain financial independence helped much to mitigate the postnatal adjustment of teen mothers or their partners. As much as policy makers and service providers have tried to develop effective program models targeted at teens who have already had a child, there is relatively little to show in the way of direct impacts on the life course of young mothers from the vast number that have been developed to assist teen mothers, their families, and their offspring. This is not to say that well-designed programs could not achieve results in moderating the impact of an early first birth, but the programs that have been evaluated have generally not been notably effective.

By far, the most powerful and effective measure for reducing teen parenthood and its potential adverse impacts has been the development of effective reproductive health services that prevent unwanted first births (and subsequent ones) from occurring. This finding takes on special relevance today when reproductive health programs for women have once again become politically controversial.

3. Recent Advances in Reproductive Health and the Prevention of Teen Pregnancy

As mentioned earlier, only about half as many teens become pregnant and have children today as they did just 25 years ago. What explains this steep decline in fertility among teens (and women in their early twenties)? The Youth Risk Behavior Survey (YRBS), conducted by the Center for Disease Control (CDC), has reported on sexual behavior and contraceptive use for students for a national sample of 10th graders since 1991 to 2015, the most recent year of data collection. It is instructive to examine the trends over the past nearly quarter of a century, the period in which

early childbearing has plunged. The data show a significant decline in the incidence of students reporting that they had ever had sexual intercourse from 54.1% in 1991 to 41.2% in 2015, a drop of about 25%. Those currently sexually active in the past three months declined during the same period from 37.5% to 30.1%, strongly suggesting that a reduction of sexual activity is part of the explanation for the decline in teen pregnancy [13,14].

Another large part of the decline has been an increase in contraceptive practice, especially in the use of new, hormonal methods that are more reliable and easier to use than birth control pills, the preferred method of contraception for females 25 years ago. Overall, the YBRS shows that teens have both become more willing to use condoms when they have sex. and they also are much more likely to be using newer and more reliable forms of contraception such as the patch, depropravara, implants, and newer forms of the intrauterine devices (IUD's). Most recently, morning-after pills have now become available over the counter, increasing the repertoire of methods of preventing conception. As a result of the introduction of these more reliable and user-friendly methods, it appears that sexually active teens have become much more adept at preventing pregnancies through effective use of contraception [15].

There are a number of reasons why sexually active teens have become better contracepters. First, they are much more aware than their counterparts were 25 years ago that marriage is no longer available as a comfortable safety net should a pregnancy occur. Young people now realize, more than they did in the past, that their sexual partners are often not able to assume the responsibilities of supporting a family because they are too young and often lack the skills to enter the labor market [16]. Accordingly, early marriage among teenagers has virtually disappeared in the past 25 years [17]. Finally, as the age of women at the birth of their first child has risen, early childbearing has become a more discrepant practice because teenagers are increasingly aware of the difficulty of managing parenthood before they can complete their schooling and find a job. Most who became pregnant in the past, just as today, were not seeking to become parents. While unintended pregnancies are still common today, many more teens now, I suspect, are aware of the potential challenges of parenthood before they are ready to support a family. This applies both to young women and young men, who now realize that they are likely to be responsible for paying child support if and when they find employment. Moreover, it has become more important for fathers to be a "good dad" who is involved with their children; accordingly, women have become more reluctant to share parental responsibilities with partner who fails to assist financially and emotionally. This higher standard of parenting may have helped to discourage men from entering fatherhood casually.

It is possible, though undemonstrated, that the more restrictive climate surrounding the availability of abortion could be motivating teens to take measures to prevent a pregnancy from occurring. It is also possible that more teens are resorting to newly available methods of contraception such as the post-coital, "morning-after" pill to prevent conception from occurring. It is certainly the case that the array of newer contraceptive methods has made using reliable means of birth control far more available than was the case 25 years ago. Of course, local restrictions in both sex education and contraceptive availability in many areas of the United States still provide barriers to the practice of contraception, not to mention the increased barriers to abortion that have been erected since Rowe v. Wade in 1973.

Sexually active youth in the United States are beginning to resemble their counterparts in other countries with advanced economies who have long treated early sexual activity as a public health rather than a moral issue. Still, we continue to maintain relatively high rates of early childbearing compared to Europe and the other Anglo-speaking countries because of, in large part, political opposition to free reproductive health for young people. The state-to-state variation in rates of teenage pregnancy and childbearing in the United States is enormous. Several states, for example Maine and Connecticut, have lower rates of early childbearing than Canada and a number of Western European nations, but in others the incidence of early childbearing remains high. Moreover, the variation within states and cities is at least as great as the variation between them [18].

The availability of more effective and user-friendly methods of contraception has increased contraceptive practice and had considerable success in bringing down the rate of early childbearing despite the lagging efforts in parts of this country.

The success, imperfect as it has been, in reducing early childbearing raises a critical question that has not yet been answered: has this policy success led young women and the men who were their partners to experience greater educational attainment and a better position in the labor market? Has the reduction of early childbearing actually eased the burden on families by creating less fragile partnerships? Has it increased the success of children born to partnerships that are formed later in life?

These are not easy questions to answer empirically because other conditions have eroded the economic fortunes of young adults over the past quarter of a century, especially among those who grow up in disadvantaged families. The lingering impact of the Great Recession and the rising costs of higher education may well have offset whatever gains would have occurred had conditions that prevailed in the 1990s continued today.

Apart from the long tail of the Great Recession, it takes young people longer today to gain financial independence than it did three decades ago [19]. So, the theoretical gains achieved by delaying parenthood, if there were any to be had, may

not have produced brighter futures for disadvantaged youth simply because their prospects are not as good as they were in the 1990s. In any case, more favorable outcomes for disadvantaged youth could not be anticipated *unless* the later timing of first births was due to additional schooling and labor market experience in the interim.

A cursory glance at the descriptive data reveals that young adults who come from economically disadvantaged families and grow up in poor neighborhoods are not making notable advances either in schooling or in the work place (See Figures 2 and 3). Moreover, there are *more*, not *fewer*, children living in poverty than was the case a decade ago. Declining economic fortunes of low-income families is surely part of the explanation (maybe all of it), but nonetheless, it is difficult to make a strong case that advancing the age of first birth has paid off in the reduction of economic disadvantage. If the economy begins to provide more and better-paying jobs to those with low and moderate education, then young adults could be better positioned to gain economic autonomy and could perhaps be in a better position to form stable partnerships capable of providing support for children. At present, we seem far from that prospect.

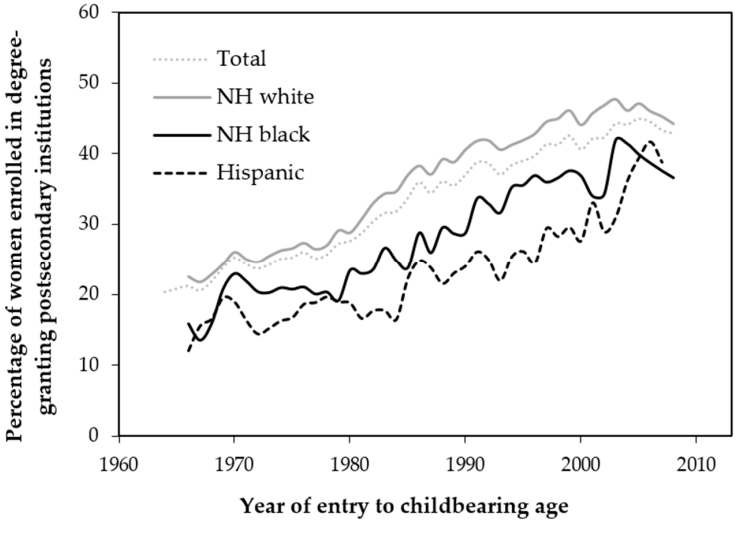

Figure 2. Women's enrollment in degree-granting post-secondary institutions by year of entering into childbearing age and racial and ethnic groups. Source: [20].

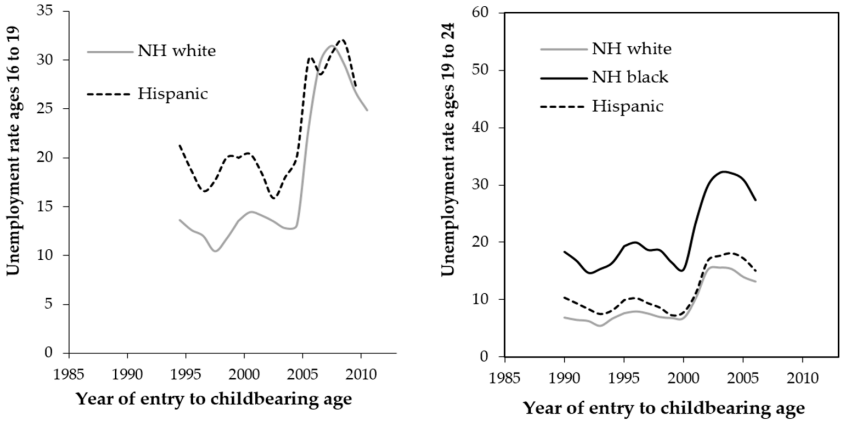

Figure 3. Unemployment rate for men and women ages (**a**) 16 to 19 and (**b**) 20 to 24 by year of entering into childbearing age and racial and ethnic groups. Source: [20].

4. Conclusions

Over the last 25 years, we have seen a positive trend in the rate of births that occur to women under 20, and even below 25, who are unmarried. Part of this drop can be attributed to a rise in the age of onset of sexual activity. Contraceptive practice among sexually active teens also has continued to improve, largely because of the availability of more effective and more user-friendly methods of birth control. These events are welcomed, but it remains unclear whether they are leading to a decline in social disadvantage among younger Americans. Delaying childbearing, unless it is accompanied by improved educational attainment, is unlikely to improve the prospects of social mobility among the less privileged. The intersectionality of class, race, and age continues to produce a powerful mix of barriers to opportunity.

At least one positive thing has occurred as a result of the decline in early childbearing. It now is harder to blame the victims of an economic and political system that ill provides for the least fortunate members of our society. Teenage childbearing, ever since the publication of the Moynihan Report in 1965 [21], has been a popular explanation for the perpetuation of social disadvantage since the mid-1960s. That explanation has become both less prominent and less convincing. However, the sad fact is that unless disadvantaged teens who might otherwise have become young parents improve their circumstances with more schooling and labor force participation before they become partners and parents, and their children are provided with better schools and learning opportunities, the rising age of first parenthood will do little for the poor.

Conflicts of Interest: The author declares no conflict of interest.

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Has Adolescent Childbearing Been Eclipsed by Nonmarital Childbearing?

Anne Martin and Jeanne Brooks-Gunn

Abstract: Adolescent childbearing has received decreasing attention from academics and policymakers in recent years, which may in part reflect the decline in its incidence. Another reason may be its uncoupling from nonmarital childbearing. Adolescent childbearing became problematized only when it began occurring predominantly outside marriage. In recent decades, there have been historic rises in the rate of nonmarital childbearing, and importantly, the rise has been steeper among older mothers than among adolescent mothers. Today, two out of five births are to unmarried women, and the majority of these are to adults, not adolescents. Nonmarital childbearing is in and of itself associated with lower income and poorer maternal and child outcomes. However, unmarried adolescent mothers might face more difficulties than unmarried adult mothers due to their developmental status, education, living arrangements, and long-term prospects for work. If this is true, then the focus on adolescent mothers ought to continue. We suggest several facets of adolescent motherhood deserving of further study, and recommend that future research use unmarried mothers in their early 20s as a realistic comparison group.

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It is our impression that the amount of attention paid by academics, policymakers, and the public to adolescent childbearing as a social problem in the U.S. has markedly declined since the 1980s. The issue became a national policy priority in 1984, when a panel of experts on teenage pregnancy and childbearing was convened by the National Research Council, and funded by a host of private foundations. Three years later, the panel issued its landmark report, *Risking the Future: Adolescent Sexuality, Pregnancy, and Childbearing* [1], which addressed the causes and consequences of these phenomena. This report became an authoritative source for at least a decade. A quick search in Google Scholar reveals that it has been cited over 91,000 times. Teenage pregnancy and childbearing remained a central policy focus in the 1990s, as their rates peaked in 1990 and 1991, respectively [2]. In 1996, the National Campaign to Prevent Teen Pregnancy was founded, declaring its mission to reduce the adolescent pregnancy rate in the U.S. by one-third over the next decade (thenationalcampaign.org/about/history).

Over the 2000s, according to our admittedly impressionistic observations, scholarly and public interest in adolescent childbearing diminished. One very good

reason for this may be that the birth rate among adolescents has been on the decline since 1991 [3]. For example, there were 62 births for every 1000 female 15–19-year-olds in 1980. This rate fell to 48 births per 1000 by the year 2000, and as of 2013 it was 27 births per 1000 [3]. Adolescent pregnancy rates have also fallen since 1991 [4]. Most of this decline appears to be attributable to improved contraceptive use [5]. Perhaps tellingly, the National Campaign to Prevent Teen Pregnancy, having reached its goal, broadened its mission to include unplanned pregnancies for women of all ages.

We propose here that in addition to their drop in rates, another factor that may have contributed to adolescent pregnancy and childbearing's retreat from public view was a related demographic trend unfolding over the same period: the increase in nonmarital childbearing. One of the primary concerns raised about adolescent childbearers in the 1970s and 1980s was their overwhelming likelihood of being unmarried. Part of this concern among the public and some advocates was, no doubt, driven by misgivings about the morality of nonmarital childbearing. However, the concerns of scholars and public health practitioners rested on the troubling observation that the children of unmarried mothers fared worse than those of married mothers.

This issue gained new recognition as a social problem with the publication in 1994 of *Growing Up with a Single Parent* [6], in which McLanahan and Sandefeur reported that adolescents who had grown up in single-parent families had poorer academic performance, lower college enrollment, and higher birth rates than those in two-parent families. Additional evidence accrued in the 1990s showing that poorer academic and behavioral outcomes were found among the younger children of single mothers as well (for a review, see Sigle-Rushton and McLanahan [7]). Our current knowledge base indicates that children born outside marriage have lower academic scores and higher behavior problem scores than children born within marriage, although associations are moderated by biological father involvement and the presence of other father figures over the course of childhood (for a review, see Waldfogel, Craigie, and Brooks-Gunn [8]). In addition, it is clear that women who give birth outside marriage have lower educational attainment and income than women whose births occur within marriage (for a review, see McLanahan and Percheski [9]).

It should be acknowledged that the link between marriage and better maternal and child outcomes is not thought to be fully or even predominantly causal. One study found that the children of married and unmarried parents scored similarly on achievement once controls were in place for self-selection into marriage among women and men with more education, men without criminal backgrounds, and women with higher achievement [10]. However, the children of married parents had better behavior scores even adjusting for parental self-selection into marriage. Nevertheless, it is clear that compared to married mothers, unmarried mothers

receive less financial and instrumental support from their children's biological fathers, have lower-quality co-parenting relationships with those fathers, and are more likely to be stressed and depressed [8].

To be sure, the disadvantage of single motherhood is not the sole reason adolescent childbearing has been viewed as problematic by scholars and practitioners. A greater proportion of teenagers' births than older women's births are unintended [11]. Teenage mothers are less likely than older mothers to obtain prenatal care [12]. The cost of the medical and social services associated with adolescent childbearing and parenting is often borne by taxpayers because adolescent mothers are typically unable to pay [13]. Teenage mothers' youth and immaturity may inhibit optimal parenting behaviors. Some research indicates that compared to older mothers, adolescent mothers are more punitive, less sensitive and less stimulating with their young children [14–16].

Still, the problematization of adolescent childbearing has always highlighted its occurrence outside marriage. In the 1950s and 1960s, the birth rates for adolescents were far higher than they are today, but they were not viewed as problematic because the vast majority of those births occurred within marriage [3]. Although the birth rate for adolescents declined between the 1950s and the 1970s, the proportion of those births that were nonmarital grew [3]. Thus, by 1980, approximately half of adolescent births occurred outside marriage, and by 1990, 67% did so [3].

At the time *Risking the Future* was released, adolescent and nonmarital childbearing overlapped significantly. That is, not only were most adolescent births nonmarital, but additionally, a disproportionate number of nonmarital births were to adolescents. However, between 1980 and the present, a remarkable demographic and social transition unfolded. The incidence of nonmarital childbearing skyrocketed. The nonmarital birth rate (number of births per 1000 unmarried women aged 15–44) in 1980 was 29.4; by 2011, it was 46.0 [17]. Only 18% of births in 1980 were to unmarried women, but by 2000, that figure was 33%, and by 2010, it was 41% [17]. The current average masks much higher rates among particular subgroups of women. Among Hispanics in 2010, 53% of all births were nonmarital, and among blacks, fully 72% of all births were nonmarital [17].

Notably, the rise in nonmarital births has been steeper for mothers in their 20s and older than it has been for adolescents, as illustrated in Figure 1. Between 1970 and 2011, the increase in the birth rate among unmarried women aged 15–19 was 27%, compared to 74% for 20–24 year olds, 83% for 25–29 year olds, 107% for 30–34 year olds, 120% for 35–39 year olds, and 134% for 40–44 year olds ([17] Table 16). While it is true that adolescents remain more likely than older women to give birth outside marriage, it is no longer the case that nonmarital births characteristically occur to adolescents. In 1970, half of all births to unmarried women were to adolescents, but

as of 2007, only one-quarter were [18]. By comparison, 42% of unmarried births in 1970 were to women in their 20s, compared to 60% (the majority) in 2007 [18].

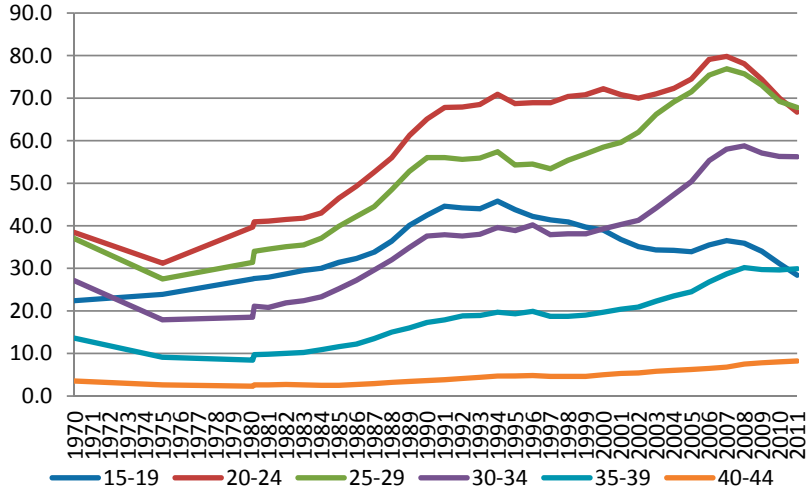

Figure 1. U.S. Birth Rates for Unmarried Women by Age of Mother (Source: Table 16 in [17]).

These trends have radically transformed the relationship between adolescent and nonmarital childbearing. Indeed, over time, as teenage childbearing has receded from public and academic attention, nonmarital childbearing has assumed growing visibility. In 1996, the welfare reform legislation (the Personal Responsibility and Work Opportunity Reconciliation Act, or PRWORA) included, as one of its aims, the promotion of marriage among low-income couples. The initiation of the Fragile Families and Child Wellbeing Study in 1998–2000, sponsored by the National Institutes of Health and several private donors, signaled a new era in the study of nonmarital childbearing. This study recruited nearly 5000 newborns in 20 large U.S. cities and over-represented nonmarital births by design [19]. The study is now following subjects as they reach their 15th birthday, and has been the source for hundreds of publications addressing the parenting, family formation, and fertility behaviors of unmarried parents, as well as the cognitive and socioemotional development of their offspring.

Thanks in large part to this study, it is now abundantly clear that nonmarital childbearing occurs disproportionately among the most socioeconomically disadvantaged women, but that pre-existing disadvantage does not fully account for deficits in family income and maternal mental health later in life [20,21]. Nevertheless, it does not appear wise from a policy perspective to encourage marriage among low-income women in our current economy because the bulk of men in their marriage

pool are unappealing due to their low earnings. Moreover, unmarried men with histories of substance use, criminality, and infidelity may end up being drains on the household [20,22,23]. With respect to adolescents in particular, there is no evidence to suggest that promoting marriage would be advantageous. Although few scholars have looked at marriage among adolescent mothers, likely because of its infrequency, Mollborn [24] found that married teenage mothers had lower educational attainment than other teenage mothers, perhaps because they were burdened by caregiving duties.

The seismic shift in nonmarital childbearing among non-adolescent women of reproductive age has important implications for scholars struggling to understand and quantify the unique disadvantage conferred by adolescent childbearing to both mothers and offspring. We propose that serious thought be given to the question of who should constitute the appropriate comparison group for teenage mothers. In the 1950s and 1960s, when adolescent childbearing within marriage was normative, the primary counterfactual condition for adolescents who became mothers—who were by and large not married—was having a baby during adolescence within the context of marriage. In the 1970s and 1980s, once childbearing during adolescence was no longer normative, the primary counterfactual condition for adolescents who became mothers—who were still by and large not married—was delayed childbirth until their 20s, when their chances of marriage would improve. Currently, the primary counterfactual condition for adolescents who become mothers—who remain by and large not married—is delayed childbirth until their early 20s, when they are likely to remain unmarried. We specify the early 20s rather than the late 20s as a comparison group because it is not realistic to expect public health and welfare programs to convince adolescent women who are apt to become mothers to defer childbearing for more than approximately five years.

There is, therefore, a need for research that delineates the costs and consequences of nonmarital childbearing during adolescence compared to the costs and consequences of nonmarital childbearing during the early 20s. Further, this research should account for the advantages of childbearing within each life stage, such as better grandmaternal health and thus greater odds of receiving help with childrearing among African Americans during adolescence [25]. The reward of conducting research with a clearly and thoughtfully selected comparison group is that it should help us estimate more realistic projections of the gains to be yielded by programs and policies designed to prevent adolescent childbearing, because the comparison group should look like what the group targeted by the program would look like if the program were to succeed. Another advantage of a comparison between adolescent mothers and mothers in their early 20s is that it may allow us to identify features of motherhood in the latter group that point to previously undetected maturational processes occurring in emerging adulthood.

We see at least three areas relevant to the lives of adolescent mothers today that have a pressing need for more research. First, adolescent mothers are likely to live with their mothers for at least the first part of their child's life [26], but past studies suggest that three-generation households can be problematic for families, particularly white families, among whom extended family living is considered non-normative [27]. It appears that coresident grandmothers provide child care and financial assistance to teenage mothers [26], resulting in mothers' increased involvement in school and work, and by their late 20s, greater educational attainment [24]. But coresidence with the grandmother is also associated with mothers' decreased involvement in parenting [28] and poorer parenting skills [29–32].

The coresidence of an adolescent mother's own mother may reinforce her more in the role of daughter than mother [33]. Coresidence may also provoke greater mother-grandmother conflict [28], which in turn detracts from the mother's parenting [34]. Individuation from parents is a normal developmental task of adolescence, but this process is thwarted when adolescent mothers rely on their mothers for key material and emotional assistance with raising their young child. It is a challenge for scholars and practitioners alike to envision strategies for helping adolescent mothers forge an independent identity from their mother while sharing caregiving duties for a young child. Yet the goal is a worthy one. Two small studies of urban adolescent mothers found that those with greater individuation from their mother had higher-quality parenting skills [35,36]. Efforts are needed to understand what kind of programs might support adolescent mothers who coreside with their own mothers that would maximize the young mother's feelings of autonomy, while acknowledging her dependence on and indebtedness to her mother.

Second, we need to understand more about the biological fathers and social fathers of children mothered by adolescents. We already know that relationships between adolescent mothers and their baby's biological father tend to be conflictual [37] and short-lived [38–40]. Past research shows that adolescent mothers are distressed by the uninvolvement of the biological father [41,42], but less is known about how they are affected by the involvement of new romantic partners as their child ages, particularly if a nonmarital union results in a new baby. The presence of new romantic partners is likely to be swift following an adolescent's birth. One study of adolescent mothers in Baltimore found that half were in a new romantic relationship within two years of childbirth [43].

From a child development perspective, romantic partners who move in with an adolescent mother and her child are particularly worrisome because they are not likely to stay, and instability in family composition undermines optimal child development. However, the experience of multiple coresident father figures is becoming increasingly common. The 1990s and 2000s saw a spike in serial cohabitation, and this phenomenon is now particularly prevalent among women who

give birth as adolescents [44]. This development does not bode well for the children of adolescent mothers. Multiple coresidential partner transitions are associated with lower academic test scores and more behavior problems in children as early as age five [8,45]. Thus, there is a pressing need for research on factors that promote stability in adolescent mothers' relationships, and factors that buffer mothers and children from the effects of instability.

Third, further study is needed to investigate the child care arrangements secured by teenage mothers. Plentiful research documents the cognitive advantages conferred by high-quality center-based care and education during the first five years of life [46–48], but adolescent mothers tend to be low-income and may be unable to afford or find access to such care arrangements. Additionally, their home environments may be less stimulating and nurturing than older mothers' owing to a lack of maturity and education. A recent national study found that adolescent mothers who were full-time caregivers for their child had poorer outcomes when the child was age four, than adolescent mothers who used child care [49]. Additionally, compared to adolescent mothers who were full-time caregivers, those using center-based child care were less likely to have a rapid repeat birth, and those either using center care or paying for home-based care had higher household incomes. Interestingly, the children of teenage mothers benefited more cognitively and behaviorally than the children of older mothers from the use of non-parental care. However, teenage mothers who were the exclusive caregivers came from more disadvantaged families than those who used non-parental care, suggesting that affordability may have been a primary consideration behind their care arrangement. There is thus a need for research exploring how adolescent mothers select their child care arrangements and whether they have access to the types of arrangements they prefer.

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Teenage Pregnancy and Mental Health

Jacqueline Corcoran

Abstract: This article reviews the intersection between adolescent pregnancy and mental health. The research involving mental health risks for adolescent pregnancy and for parents who are teenagers are discussed. Depression and conduct disorder have emerged with the most attention. Research-based treatment of these disorders in adolescents is presented.

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1. Introduction

According to the Centers for Disease Control, in 2014, the birth rate for adolescent females (ages 15–19) reached a historic low at a rate of 24.2 per 1000 [1]. However, this still accounts for almost 250,000 babies born to this age group. An Urban Institute report summarizing the evidence has found that teen childbearing is associated with long-term poverty, low educational attainment for both mother and children, and risks for children are increased health problems, incarceration, bearing a child as a teenager, and facing unemployment as a young adult [2]. These risks are present even when controlling for poverty, neighborhood effects, and other sociodemographic risks that contribute to teenage pregnancy.

Mental health disorders are fairly common in adolescence with one in four or five teenagers suffering from a disorder, according to the National Comorbidity [3]. Low social economic status is associated with the development of mental disorders in children and adolescents [3]. Those living in poverty are more exposed to stressful circumstances such as crime, violence, availability of drugs, and lack of safe child care, convenient transportation, quality health care, and adequate housing. A review of the literature on neighborhood effects found evidence that living in a disadvantaged neighborhood had negative consequences for children's mental health functioning [4]. Moreover, a large-scale study of 2805 children found that those living in poor neighborhoods were more likely to have mental health problems [5]. Over time, as children mature, the effects become more deleterious. For adolescents, impaired mental health, criminal behavior, early sexual activity, and teenage pregnancy are associated with living in poor neighborhoods [4]. Other adverse childhood events, such as violence, abuse, neglect, parental substance use disorders, mental illness, or criminal behavior, are also associated with both mental health disorders and adolescent pregnancy, as well as other problematic outcomes [6].

The focus of this article is on mental health risks for adolescent pregnancy and mental health issues that may emerge during pregnancy and parenting for teenage mothers. Search terms were the following: PubMed ("pregnancy in adolescence" [MeSH terms] AND "mental health" [MeSH terms]); Academic Search Complete (SU pregnancy in adolescence OR SU teen* pregnancy OR SU teen* motherhood OR SU adolescent motherhood AND SU mental disorder OR SU mental health OR SU mental illness); and PsychInfo ("mental health" OR "mental disorder" OR "mental illness" AND pregnancy in adolescence OR teen* pregnancy OR teenage motherhood or adolescent motherhood).

Before launching into the topic of study, however, a few caveats are in order. First, the emphasis is on mothers since that is where the research has been located. Second, the occurrence of pregnancy in adolescence and the development of mental health disorders are best described in terms of biopsychosocial phenomenon. To attribute a psychological disorder as the reason for an adolescent pregnancy is simplistic and reductionistic. Third, many of the same social risk factors that contribute to adolescent pregnancy may also contribute to the development of a mental disorder [7]. Fourth, this review concentrates on both the risk of mental disorder for adolescent pregnancy, as well as mental health during adolescent parenting. In the latter, it is recognized that the stress of adjusting to the demands of raising a baby, in addition to navigating the normal developmental tasks of adolescence, may exacerbate or contribute to psychological distress. Therefore, it is difficult to tell whether the stress involved with pregnancy and early childbearing results in poor mental health outcomes or whether these stem from "the adverse life circumstances that often precede and predict teen pregnancy. In other words, the direction of causality in the relationship between teen parenthood and mental health problems is complex and not elucidated by existing research" [6]. Finally, this review will concentrate on specific mental disorders that have been associated in the research with adolescent pregnancy and parenting, which have involved depression and conduct problems.

2. Depression

The depressive disorders that pertain to adolescents are catalogued and described in the Diagnostic and Statistical Manual of Mental Disorders (DSM), published by the American Psychiatric Association (APA). Major depressive disorder is represented by at least a two-week period during which a person experiences a depressed mood or loss of interest in nearly all life activities, with five or more symptom categories being represented. Persistent depressive disorder represents a general personality style featuring ongoing symptoms that are similar to, but less intense than, those of major depression.

While the rate of depression for children is fairly low, the stage of adolescence brings with it a spike in the rate of depression. For adolescents in the general population, lifetime and 12-month prevalence are 11% and 7.5%, respectively [8]. Further, females, beginning at age 13, begin to have a greater risk than males for depression at a 2:1 ratio that then continues throughout the lifespan [9]. While rates vary by study, reviews have indicated that Latino ethnicity is also associated with a greater risk of depression compared to other U.S. ethnic groups [10,11]. Further, rates of suicide attempts among adolescent Latinas are significantly higher than their Caucasian and African-American counterparts [12].

Compared to nonpregnant teens, pregnant teens may have an even greater risk for depression. Figures vary across samples, but rates of 25 [7], 30% [13], band 42% [14] have been reported. Depression may present many serious risks for adolescent pregnancy, birth outcomes, repeat childbearing, and parenting. As mentioned earlier, the occurrence of adolescent pregnancy is multi-factorial, and depression may present one influence that might contribute to early pregnancy in the presence of other risk [15,16] compared pregnant teenagers to pregnant adults. In multivariate analysis, the following factors had a significant independent association with younger age of motherhood in order of magnitude: a history of parental separation/divorce, exposure to family violence in early childhood, illicit drug use, idealization of pregnancy, low family income, a positive score of depression or anxiety on a standardized scale, and a low level of education. In this study, depression was one individual risk factor among several environmental factors.

Pregnancy in late adolescence was studied as an outcome in a prospective study of 992 U.S. young women ages 18 to 20 who wanted to avoid pregnancy [17]. Rates of pregnancy were higher among women with baseline depression (14% versus 9%) and stress (15% versus 9%) compared to women without symptoms. In multivariable models, the risk of pregnancy was 1.6 times higher among women with stress symptoms compared to those without stress. Women with co-occurring stress and depression symptoms had over twice the risk of pregnancy compared to those without symptoms. Depression and stress, which often co-occur, appear to put young women at risk for an unintended pregnancy.

Longitudinal data (the National Longitudinal Survey of Adolescent Health (N = 14,271) were used to examine the relationship between depressive symptoms among females and males in adolescence and unintended first birth in emerging adulthood [18]. Respondents who reported higher levels of depressive symptoms in adolescence were more likely to report an unintended birth compared with respondents who did not have children. Although these births did not occur in adolescence per se, the results still point to the role of depression in early and unplanned pregnancy.

After a pregnancy has occurred, birth outcomes may also be affected by depression. A medical record study of 294 African-American and Latina adolescents found that serious depression in the way of suicidal ideation specifically was associated with lower birth weight, compared to teens reporting no symptoms of depression and those reporting depression without suicidal ideation [7].

Additionally, depression may be related to a risk for use of alcohol and illicit drugs in teenage mothers [14], as well as marijuana and tobacco in another study [19]. Cigarette smoke exposure in itself is associated with a higher risk of school-aged children developing behavioral problems, such as hyperactivity, attention deficit disorder, or peer relationship problems [20]. Controlling for other social influences, children who were exposed to tobacco smoke only prenatally have a 1.9 times higher risk of developing abnormal behavioral symptoms in comparison to children without any exposure, and the risk for such children first exposed to tobacco smoke after birth is 1.3 times higher.

Depression is also identified as a risk for rapid repeat childbearing, defined as experiencing two pregnancies within less than 24 months of each other [21]. These authors also found that trauma increased risk. There is evidence that teenage parents have a high risk for experiencing a traumatic event [7]. One common outcome of experiencing trauma is depression [22]. Indeed, depression is more commonly experienced than post-traumatic stress disorder.

Fortunately, it does not appear that depression is inevitable as adolescent mothers proceed into adulthood. Using data from the National Longitudinal Survey of Youth, women ages 27–29, who had been adolescent childbearers, were assessed for depression [23]. If women were unmarried, they were more depressed than women who first give birth as married adults. However, the psychological health of married teenage mothers in later life was as good as that of married adult mothers, whereas unmarried adult mothers and unmarried teenage mothers had similarly poor outcomes. The findings of this study suggest that marital status, rather than age at first birth, may be more relevant for later-life psychological health. Marriage, therefore, seems to be a protective factor for adolescents who experienced early childbearing for outcomes in later adulthood.

Similar results were found in that long-term mental health outcomes were based on other factors that contributed to adolescent pregnancy to begin with [24]. A similar study following women to midlife, involving both British and U.S. participants, found that mental health problems in adolescent parents persisted over the lifespan. The pattern was different by country, though: for American subjects, the effect went away when controlling for educational level [25]. It appears from this study that other environmental factors, ones that often predict adolescent pregnancy initially, are some of the same factors, at least in the United States, that may result in the

persistence of mental health problems. This pattern may not be the same in other developed countries.

However, the presence of depression in mothers presents many risks for children. A mother who is depressed may have needs for nurturing and care that can interfere with her ability to meet her children's emotional and social needs [26]. Mothers who are depressed may be emotionally unavailable and feel a sense of helplessness in the midst of parenting challenges. Parents may model depressive affect, thinking patterns, and behaviors for their children and then reinforce their children's depressive behaviors. Depressed parents also tend to see their children's behavior in a negative light, using low rates of reward and high rates of punishment, or responding indiscriminately to the child's behavior [27]. As a result of these reasons, children of mothers with depression are at elevated risk of depression themselves [27]. For this reason, it is important to study variables that may impact depression.

In the research on depression in teenagers who are pregnant and parenting, the variables of social support and maltreatment have been studied for their connection to depression. Social support [28], specifically that involving the adolescent's mother and partner [14,29], has been linked to depression. This connection has stood up in both cross-sectional [29] and longitudinal research [14,28] and during periods of pregnancy [14,29] postpartum [14], and up to one year after birth [28].

Maltreatment and its association with depression in teenage pregnancy has also been a focus. In a Canadian study of 252 pregnant adolescents, a history of sexual abuse was associated with depression [30]. Both physical and sexual abuse were also associated with depression in another sample of 116 pregnant adolescents [31]. One of the reasons hypothesized for the higher rate of depression, beginning in adolescence for females compared to males, is the fact that the rate of sexual abuse is higher in females than in males [32] and experiencing abuse may lead to risk for depression. A meta-analysis by [33] estimated the associations between depression and different types of childhood maltreatment, finding that psychological abuse and neglect were most strongly associated with the outcome of depression, and sexual abuse was also related to a lesser extent.

In sum, depression is associated with adolescent pregnancy across the continuum of outcomes—risk for adolescent pregnancy, birth outcomes, substance use, risk for depression in children, and, depending on the country, possibly depression in later life.

3. Conduct Problems

Oppositional defiant disorder is characterized by a pattern of negativistic, hostile, and defiant behaviors toward authority figures [34]. Conduct disorder also involves an entrenched pattern of behavior, but in this diagnosis the basic

rights of others or major age-appropriate societal norms or rules are violated [34]. In the research on conduct problems, it is often referred to as aggressive or antisocial behavior, and, at times, juvenile delinquency is considered a proxy measure for the presence of conduct disorder.

While rates of ODD are fairly comparable for males and females, CD is more common in males. For CD in the United States, the lifetime prevalence overall is 9.5%, with males at 12% and females at 7.1% [35].

The risks for developing conduct problems in children are similar to the ones that may contribute to adolescent pregnancy. Such risks include poverty, unemployment, community disorganization, availability of drugs, the presence of adults involved in crime, overcrowding, community violence, and racial prejudice [36–38]. These risks understandably affect parenting abilities, which in turn are linked to the development of conduct problems in youth [39].

Risk-taking is part of the pattern of conduct problems in youth [40]. Although a history of conduct problems predicts earlier sexual involvement for both boys and girls, the consequences of sexual behavior are more serious for girls because they may become pregnant [41]. Using a large sample archival data from state agencies involving 70,200 females [14], found that girls who had been referred to a state juvenile justice department were three and a half times more likely to have a child as a teenager than girls who had not been arrested.

In another study, the relationship between conduct problems at age eight and teenage pregnancy by the age of 18 years was analyzed in 491 girls [42]. A statistically significant association was found between early conduct problems and later risk of teenage pregnancy, with more severe problems bearing greater risk than milder conduct problems. The authors explain this elevated risk of teenage pregnancy as being influenced by social and family factors that are correlated with early conduct problems, such as the ones discussed above. An additional process is increased risk-taking, which included early sexual behavior and risk for adolescent pregnancy.

Conduct problems are also associated with repeat childbearing. Primarily African-American adolescents (N = 354) completed individual interviews during pregnancy and at 24 months postpartum [43]. Rapid repeat pregnancy was common (42%). Baseline reports of later age at menarche and a greater likelihood of aggression were significantly associated with having a rapid repeat pregnancy within 24 months.

Since people with conduct problems tend to have low educational achievement, under-employment, and low income, this puts any children of such parents at risk for similar problems, as well as early childbearing [44]. There is also the problem of assortative matching; adolescent girls with conduct problems may associate with males with similar issues. If they have children with these partners, both genetic and environmental risks are increased for any children born in such relationships [41].

4. Discussion and Implications

Even though depression and conduct disorder, in particular, are associated with adolescent pregnancy across the continuum of outcomes, the direction of causality is unclear and likely complex. Given this caveat, the main implication emerging from this review involves the fact that there are common risk factors for both depression and conduct disorder, as well as adolescent pregnancy. At a primary level, therefore, these are risks that need to be ameliorated: poverty; living in high crime, crowded neighborhoods; lack of education and unemployment; maltreatment in childhood and other adverse childhood experiences; and inadequate housing. These same risk factors are also responsible for the fact that teenagers from such neighborhoods fail to receive adequate mental health services [36,37].

People from ethnic minorities are particularly underserved when it comes to treatment (e.g., [3,45]). Adolescents from ethnic minorities are also disproportionately represented in those that bear children early. Together, African-American and Latina adolescents comprised 57% of U.S. teen births in 2013 [1]. Timely treatment of mental health disorders when they arise is key to preventing continued problems and adverse consequences, such as premature pregnancy, associated with those problems, and to prevent problems from becoming entrenched [46].

Interventions for both conduct problems and depression have received research support. Since family factors are often involved with the transmission of antisocial and aggressive behavior and environmental control may be the most amenable system to target for change, parent- and family-involved treatments have received the best evidence. Parent training is based on operant behavioral theory, in which reinforcement plays a key role in determining future behavior. In this model, parents are taught various skills, including: specifying goals for behavioral change; tracking target behaviors; positively reinforcing prosocial conduct through the use of attention, praise, and point systems; and employing alternative discipline methods, such as withdrawal of attention, time out from reinforcement, and removal of privileges. Recently, a meta-analysis was undertaken of all treatment studies that addressed disruptive behavior in children and adolescents [47]. Parent-only interventions (typically parent training) performed as well as multi-component interventions (ones that had parent, child, and possibly school or other systems interventions), and better than child-only interventions.

Most of the family models that have developed with adolescents have been in response to their contact with other systems, namely the juvenile justice system, and are multi-component interventions. Drawing on family systems theory and Bronfenbrenner's (1979) ecological model as the theoretical basis, multisystemic therapy (MST) views the juvenile offender as embedded in a context of multiple and interrelated systems [48]. The child's own intrapersonal system (i.e., cognitive ability, social skills), the parent–child system, the family system, the school system, peers,

and the neighborhood system are targeted for intervention. However, a systematic analysis of the data indicates that among the various outcome measures across studies, none showed significant differences from "treatment as usual" [49]. Because training and supervision in the MST model are costly, agency personnel need to be aware of these findings.

Functional family therapy (FFT), which has also been applied with juvenile offenders, integrates systems, cognitive, and behavioral theories [50]. From this perspective, juvenile offending and other clinical problems are conceptualized from the standpoint of the functions they serve for the family system and its members. The goal of FFT is to alter maladaptive interaction and communication patterns so that more direct means of fulfilling these functions can develop. Functional family therapy combines knowledge about parent–child interactions and social learning, along with knowledge about the individual cognitive styles that influence juvenile offending. The model has also been referred to as behavioral systems family therapy [51]. Although a literature review supported FFT as an efficacious treatment [52], a systematic review being conducted should tell us more about the benefits of this treatment [53].

In an overall examination of family interventions for adolescents with conduct problems [54], found eight trials. Although parent- and family-focused treatment reduced time spent by youth in residential treatment and other institutional settings, incarceration and arrest rates were not affected. Further, no significant differences between parent/family interventions and other types of treatment emerged on psychosocial outcomes, such as family functioning and youth behavior. Therefore, the impact of family-involved treatment seems to offer certain benefits and cost savings, since residential treatment is an expensive alternative.

More recently, an examination of family systems therapies found that family therapy compared to no treatment or other treatments reduced delinquency outcomes. Although the effect was small [55], this can still translate into cost savings and important benefits to youth and their families.

For depression in adolescence, cognitive behavioral therapy and interpersonal therapy have received research support [56]. Interventions based on cognitive behavioral models include: (1) Behavioral models focus on the development of coping skills, especially in the domain of social skills and choosing pleasant daily activities, so that the youth receive more reinforcement from their environments; and (2) cognitive models include assessing and changing the distorted thinking that people with depression exhibit, in which they cast everyday experiences in a negative light (e.g., [57]).

Interpersonal therapy (IPT) is a brief (12-session), psychodynamic intervention focusing on how current interpersonal relationships have contributed to depression and helping teens repair these conflicts [58]. The general goals of IPT are to decrease depressive symptoms and to improve interpersonal functioning in the areas of role transitions, grief processes, interpersonal disputes, and interpersonal deficits. As indicated in the studies reviewed in this article, relationships with mothers and partners for the pregnant adolescent are fraught with potential conflict due to the early pregnancy itself, but these are important relationships to center on, as they can affect depression in pregnant and parenting teens, which may have important effects on birth outcomes, later substance use, repeat childbearing, and parenting abilities that may affect their offspring long-term.

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Prevalence and Factors Associated with Teen Pregnancy in Vietnam: Results from Two National Surveys

Huong Nguyen, Chengshi Shiu and Naomi Farber

Abstract: This study asked two broad questions: (1) what is the prevalence of teen pregnancy in contemporary Vietnam; and (2) what selected social, family, and individual factors are associated with teen pregnancy in Vietnam? The study utilized Vietnam Survey Assessment of Vietnamese Youth surveys conducted in 2003 and 2008 to answer the two research questions within the context of fast political, economic, and social change in Vietnam in the last two decades. Results of this study show that the prevalence of pregnancy among Vietnamese teenagers in the surveys was stable at 4%, or 40 pregnancies per 1000 adolescent girls aged 14 to 19. Age, experience of domestic violence, and early sexual debut were positively correlated with higher odds of teenage pregnancy for both survey cohorts; however, being an ethnic minority, educational attainment, sexual education at school, Internet use, and depressive symptoms were significantly related to teenage pregnancy only in the 2008 cohort.

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1. Introduction

Approximately 16 million adolescents aged 15 to 19 become pregnant each year, constituting 11% of all births worldwide [1]. Despite rates of adolescent fertility declining globally in recent decades [1–4], teen pregnancies, births, and their associated negative outcomes remain serious problems in many countries. Complications during pregnancy and childbirth are consistently the second cause of death for girls aged 15 to 19 years old [1]. Babies of teen mothers are 50% more likely to be stillborn, die early, or develop acute and long-term health problems. Young girls who become pregnant are at high risk of abridged education [5], and thus limited economic prospects [1,2]. These and other negative outcomes of early childbearing in the well-being of young mothers and their children have resulted in heightened international efforts to identify sources of risk and protective factors, and to reduce adolescent pregnancy [1,2]

Teen pregnancy, regarded as a significant problem in many Western nations for several decades, has emerged only recently as a social problem in Vietnam because of

the centuries-old tradition of arranged early marriage. Folk poems (Ca Dao) portray young girls who are married at age 12 or 13, and become unprepared mothers of five children by the time they are 18 [6]. Today, however, as Vietnam experiences rapid cultural shifts in the context of increasing globalization, this once half-mocking, half-endearing image of 18-year-old mothers of multiple children has taken on an entirely different meaning: one of shame, failure, and anxiety, not only for the young girls, but also for their families and larger society.

The rates of teen pregnancy and births in Vietnam compare favorably to neighboring and other low- and middle-income countries. According to the World Bank, birth rates per 1000 teenagers aged 15–19 in Vietnam fluctuated between 1980 and 2013, rising steadily from 20 per 1000 to 34 between 1980 and 1992, then declining to 28 in 2002. Rates rose again to 32 in 2007 before declining slightly to 30 in 2011, and 29 in 2013 [7]. These rates were lower than those of regional neighbors Indonesia, Malaysia, Cambodia, and Thailand, but higher than in Asia (with the exception of China) [7,8].

While data about teen pregnancy can be approximated using the national birth registration system, it is impossible to gauge precisely the prevalence of teen pregnancy in Vietnam because of its associated stigma. An alternate way of estimating rates of teen pregnancy is by using data on abortions, which indicate that about 20% of the 300,000 abortions performed annually in Vietnam involve teenagers [9,10]; thus, it is possible that the actual incidence of pregnancy among teens is higher than official birth data suggest [9–11].

As elsewhere, teen pregnancy in Vietnam should be understood and addressed in its particular historical and socio-cultural context. Teenagers becoming pregnant outside of marriage embodies nuanced interactions between two significant social transformations in Vietnamese society: the emergence of teenagers as an unprecedented distinct social group [12–14], and a quiet "sexual revolution" occurring in Vietnam, both of which accompany modernization and globalization [15,16]. Nguyen [12–14] suggests that since the end of the Vietnam War in 1975, the concept of adolescence in Vietnam has gone through three distinct phases corresponding to three political-social-economic phases of the country: adolescents as miniature communists (1975–1986); adolescents characterized by romantic sentiments, puberty, and identity search (1986–1995); and adolescents as the new "teen Viet" and vanguards of capitalist consumption (1996–2005). These distinct conceptualizations of adolescence influenced thoughts, attitudes, and behaviors of each respective cohort of Vietnamese adolescents, especially in relation to their sexuality.

Despite inconclusive data documenting adolescent pregnancy in Vietnam, the frequent practice of "underground" abortions contributes to a common public perception that since having sex during teenage years is becoming a norm among young people without being fully informed about sexual behaviors, unwanted teen

pregnancy is increasing. Vietnamese government officials increasingly use words such as "alarming", "trouble", or "challenge" to talk about teen pregnancy, citing a steady rise in the annual number and incidence of teen pregnancies from 2.9% in 2009 to 3.2% in 2012, with 20% of all abortion cases in Vietnam being teenagers [17,18]. In popular media, stories about pregnant teenagers are often narrated with a melodramatic tone, adding to the anxiety of the larger Vietnamese society regarding sexual behavior among adolescents who are exposed to an unprecedented influx of Western sexual norms. Between public alarm over teenagers' sexual behavior and the relative lack of scientific data on adolescent pregnancy, there is little reliable knowledge about the incidence of teen pregnancy, and patterns of differential risk of and protection from early conception in contemporary Vietnam.

This study aims to address this gap in knowledge by examining the prevalence of and selected factors associated with teen pregnancy in Vietnam. Two broad questions were asked: what is the prevalence of teen pregnancy in contemporary Vietnam; and what selected social, family, and individual factors are associated with teen pregnancy in Vietnam? The study utilized two national surveys conducted in 2003 and 2008 to answer the two research questions within the context of fast political, economic, and social change in Vietnam in the last two decades.

2. Literature Review

2.1. Prevalence of Teen Pregnancy and Births in the Global Context

There is a lack of data necessary to draw accurate portraits of pregnancy among adolescents worldwide; Sedgh, Finer, Bankole, Eilers and Singh [19] identify only 21 countries with complete statistics on pregnancy and birth outcomes among adolescents (including live births, spontaneous abortions, and induced abortions). Nevertheless, available birth data shows great differences in the rates and prevalence of pregnancy between regions and countries. The average rate of teenage births ranges from the highest in Sub-Saharan Africa (143 per 1000 adolescent females), followed by the Americas (68), the Middle East and North Africa (56), and East and South Asia and the Pacific (56), to the lowest rates in Europe (25) [20].

Regional comparisons, while useful in indicating broad geographical patterns, do not reveal the wide disparities in adolescent pregnancies between and within countries resulting from their particular socio-political and cultural contexts. For example, in Sub-Saharan Africa, adolescent birth rates are 45 per 1000 teenagers in Mauritius, and 229 in Guinea [19]. In the Americas, the rate is 24 per 1000 in Canada, and 133 in Nicaragua [19]. The Middle East and northern parts of Africa, the eastern and southern parts of Asia, and the Pacific regions have the same average rates, including highs of 115 and 122 in Bangladesh and Oman, respectively, a low of 4 in Japan, and 18 in Tunisia [20]. In Southeast Asia, rates of teen pregnancy vary as

widely as approximately 88 in Laos, 64 in Timor Leste, and 22 in Singapore. Europe has the lowest average, with four in Switzerland and 43 in Romania [19]. In general, these differences in adolescent birth rates are associated with broad measures of national economic well-being. Currently, upwards of 95% of all births to adolescents occur in low- and middle-income countries.

Worldwide there are striking similarities in the negative social, economic, and health outcomes associated with childbearing teens. Although adolescents account for about one-tenth of births internationally, they suffer almost one-fourth of the total incidence of poor health outcomes associated with pregnancy and childbirth [1]. Physical diseases such as anemia, malaria, HIV, and sexually transmitted diseases, as well as postpartum hemorrhaging, obstetric fistula, and the risk of maternal death, are all associated with childbearing youths. Additionally, young mothers are at heightened risk for mental health disorders such as depression in comparison to women who bear children at an older age [20]. Younger women are also more likely to smoke and ingest alcohol during pregnancy, and thus to experience pre-term labor. Adolescent childbearing poses risks to their offspring, including an elevated risk for low birthweight and asphyxia [20]. Children of teen mothers are also at heightened risk for physical abuse and other conditions that carry long-term developmental consequences, as well as other health-related risks that can affect their overall well-being [20].

2.2. Factors Associated with Teen Pregnancy and Childbearing

Adolescent pregnancy and parenthood are not new phenomena worldwide; however, the circumstances in which young women become sexually active, conceive, and give birth, as well as the consequences of these behaviors, have changed considerably over time and across cultures. In many traditional kinship-based societies, such as in South Asia, the Middle East, and North Africa, girls are married as soon as they reach menarche, and begin childbearing soon after. Early conception in this milieu of early marriage has been culturally syntonic, indeed typically planned, and thus historically not considered to be a problem for the young woman or her children. In contrast, during the 18th and 19th centuries in Western Europe and North America, young women did not marry at young ages and were strongly discouraged from having premarital sex; however, when conception occurred, marriage quickly followed. Early pregnancy legitimized by marriage was not considered problematic for young women, even if the pregnancy was unplanned [21].

Since the middle of the 20th century, the experience of adolescence has undergone significant shifts in Western Europe, the U.S., and other developed nations. Now, some similar changes are taking place in developing countries, including Vietnam and its Southeast Asian neighbors. The convergence of the steadily declining age of menarche with greater expectations for educational attainment for women

has resulted in a longer period of fertility before marriage [22]. Other changes in social norms such as increased sexual freedom, individual autonomy from parental control, greater gender equality in the public and private spheres, and advances in contraceptive effectiveness have resulted in more young women becoming sexually active earlier. Not only is sexual activity commencing earlier, but it is also outside of marriage. In general, young women have more control of their personal choices regarding sexual behaviors and activity.

These changes in the developmental context of adolescence in the West, where most research has focused, have resulted in strikingly divergent patterns of adolescent pregnancy within and between some countries. These patterns are found in places where there is significant income inequality, such as in the United States. Such contextual differences include both individual characteristics and certain features of the larger society that can influence a teen's sexuality-related choices. Over the last several decades in numerous Western nations, teenage pregnancy has become more directly related to social and economic status. Despite the dramatic overall decrease in adolescent pregnancy over recent decades, the United States and the United Kingdom continue to have the highest rates of pregnancy among adolescents in developed countries outside of the former Soviet bloc. There are significant and continuing differences in patterns of sexual activity and contraceptive use among adolescents that are strongly associated with racial and ethnic minority status, poverty, and their attendant multi-dimensional disadvantages [23]. As the rates of conception and childbirth among teens and the stigma of single motherhood have all decreased, the current "problem" of teen pregnancy has become concentrated among the poorest and most disadvantaged young people [24].

In nations that have significant income inequality such as the United States, several individual characteristics of adolescents who are at higher risk of conceiving include: early age of initiation of sexual activity; low expectations for, weak attachment to, and poor performance in school; engagement in problem behaviors such as drug and alcohol abuse, as well as various types of delinquency; being easily influenced by peers who participate in problem behaviors; and problematic family contexts, such as the presence of domestic violence and weak parental bonding. Recent research finds that teens living in rural communities, especially those with limited economic resources, are at significant risk of early conception, further indicating that the very conditions that give rise to early childbearing are identical to those that decrease the life chances of young people [22,24].

2.3. Teen Pregnancy in Vietnam: Historical Context

Until recently, Vietnam's 4000-year history was marked by constant struggles against foreign invasion, especially China; thus, Chinese influence on Vietnamese culture, particularly Confucianism, Taoism, and the Chinese version of Buddhism,

took deep root. Confucianism in particular dictated that a woman must follow the rule of Three Submissions (*tam tong*): to her father when still living at home, to her husband when she gets married, and to her sons after her husband dies [16,25]. Confucianism also considered filial piety as one of the hallmarks of an individual's morality, and associated filial piety with being able to bear sons who could carry on the family name [26]. Until the early 20th century, young Vietnamese women's lives centered around marriage and reproduction, to the extent that they were expected to accept their husbands marrying multiple "little wives" in order to have sons [6,27,28]. Young women were also obliged to comply with arranged marriages, even if their husbands (young boys themselves) and in-laws thought of them mostly as maids in the house, and would wait the first few years of marriage to reach reproductive maturity to attain the full status of a wife [6,27]. In fact, many parents would promise their daughters to future in-laws just after birth, or when they were small children [29].

In this context, it was customary for young Vietnamese girls to get married and bear children in their teens regardless of whether they were psychologically or biologically ready. Once married, these young girls were considered adults with many family obligations. These family obligations included serving their husband and in-laws, taking care of housework, and working in the fields. Since there was no birth control, they often had one child rapidly after another. Until the 1960s, a typical woman in North Vietnam had an average of six children [30]. Most young women did not experience teenage years as a distinct developmental period in between childhood and adulthood, where an individual is occupied primarily with peers, school, first romantic relationships, and identity development before making the transition into adulthood [6,12]; rather, young Vietnamese girls traditionally transitioned directly from childhood to adulthood through marriage and/or childbearing.

These norms continued well into the 20th century even after the French colonized Vietnam. In 1945, the Vietnamese people established the Independent Democratic Republic of Vietnam, which is today called the Socialist Republic of Vietnam [31]. This young nation faced many problems, the largest being widespread poverty and approaching war. Consequently, between 1945 and the end of the Vietnam War in 1975, family planning and population policies were developed to achieve two primary purposes: to reduce poverty, and to save "human force" for war efforts [10,16]. During the wars, young women and men were encouraged to follow the Three-Delay Movement: delay falling in love, delay getting married, and delay having children [12]. Young women's reproductive health became a realm governed by the state, and the act of getting married and/or becoming pregnant was frowned upon as a selfish act made at the cost of the nation's well-being [32].

Following the end of the Vietnam War in 1975, 75% of the Vietnamese population was poor [33]. In response, the Vietnamese government issued a decree in 1978 recommending that families have no more than two children [32]. In 1984, the Vietnamese government enforced a law that each Vietnamese family was permitted to have a maximum of two children, with the two births spaced five years apart [32]. Families that violated the new law were punished with pay cuts, demotion, or they were banned from relocating to urban areas [34].

In parallel with strong family planning policies, the Vietnamese government also united the northern and southern educational systems by creating one universal 12-grade education system [12,13]. In the 1990s, the number of youths enrolled in secondary school, high school, and college increased by 66%, 63%, and 132%, respectively, creating for the first time in Vietnam's history a distinct group of young people who experienced a stage of extended education between childhood and adulthood [35]. These large-scale social policies also connected fewer births and higher education with "family happiness" (*hanh phuc gia dinh*), as well as better career prospects, sending a new message to young Vietnamese women that their lives were not centered around childbearing and rearing.

Vietnam adopted a market economy in 1986 in order to boost the economy, and by 1993, the poverty rate fell to 58% [33]. With an average annual GPD growth rate of 7.2% between 2002 and 2011, poverty fell to 14.5% in 2008 [36]. However, income inequality also rose quickly in Vietnam, and extreme poverty became chronic among certain groups. Ethnic minorities living in rural and mountainous areas had the highest rate of poverty at 52% [36]. Between 2002 and 2008, the poverty rate of the Kinh people fell from 23% to 9%, while in 2008, three major non-Kinh groups still had poverty rates of over 60% [37]. Poverty reduction campaigns have been slow to reach the ethnic minorities, complicated by the fact that many ethnic minority groups do not speak the Vietnamese language.

2.4. Sexual Behavior among Contemporary Vietnamese Adolescents

In Vietnam today, teenagers comprise a distinct group of the population, but have not been the subject of much research. In the Vietnamese media, news and information about the sexual and reproductive behaviors of Vietnamese adolescents are a frequent source of national attention and uproar, to the extent that it became a debate topic at several annual meetings of the National Assembly. Recent evidence finds that more Vietnamese teenagers are having sex outside of marriage and at earlier ages [38,39]. Moreover, similar to the patterns in Western nations, Vietnamese teen pregnancy increasingly occurs alongside rising occurrences of drug addiction, delinquency, high-risk sexual activity resulting in HIV/AIDS, and other behaviors, causing public concern across Vietnamese society. A report by United Nations Population Fund—Vietnam revealed that 20% of students are sexually active, but less

than 0.5% of them know how to avoid pregnancy [40]. Other research finds that 57% of Vietnamese youth report comprehensive knowledge of HIV transmission, far less than the national target of 95%, and less than other countries, while 36% have risk of discrimination against people living with HIV and 7% have high risk of contracting HIV themselves due to lack of knowledge [41]. About 47% of adolescents ages 15 and over report that they smoke and more than half of 150,000 people injecting drugs started using during their teen years [39].

The few studies of factors associated with teen pregnancy in Vietnam suggest that, similar to the situation in the United States and other countries with significant income disparity, poverty, dropping out of school, and "broken" families are the strongest predictors [42]. In a study in Ho Chi Minh City, Huynh Nguyen Khanh Trang concluded that being young, not getting married, not watching sex education programs on television, and not knowing the consequences of abortion are factors associated with teen abortion [42]. A study by Ngo Thi Kim Phung and Huynh Thanh Huong at Tu Du Hospital in Ho Chi Minh City showed that young girls living in rural areas are 5.7 times more likely than their urban counterparts to seek abortions, potentially because it is more difficult to hide a pregnant teenager in rural areas. They also found that unmarried pregnant teenagers are 17 times more likely than those who are married to seek abortions, while unemployed pregnant teenagers are 10.3 times more likely than those who are employed to seek abortions [42]. Additionally, girls who are unaware of their ovulation cycles are 2.3 times more likely to have an abortion than those who have this knowledge. Among ethnic minority groups in Vietnam, prescribing to early marriage customs and lack of information about reproductive health are also associated with teen pregnancy [9].

3. Methods

This study was designed to examine not only what selected factors predict teen pregnancy among Vietnamese youth, but also whether there have been changes in the risk factors attending the larger socio-cultural changes that come with modernization and globalization. The research uses secondary data analysis drawing upon the two waves (2003 and 2008) of samples from the Vietnam Survey Assessment of Vietnamese Youth (VNSAVY). VNSAVY is the largest and most comprehensive survey in Vietnam to examine health and well-being among Vietnamese youth and young adults, and is funded by the World Health Organization (WHO). The first VNSAVY (VNSAVY1) was conducted in 2003 with 7584 youths aged between 14 and 25 years living in 42 out of 63 provinces of Vietnam. The second VNSAVY (VNSAVY2) was conducted in 2008 with 10,004 youths aged between 14 and 25 in all 63 provinces and cities of Vietnam. This paper utilizes VNSAVY subsamples that include teenage girls, ages 14 to 19 years old. Our analytic sample sizes includes

2325 teenagers for VNSAVY1 (30.7% of the overall sample) and 3287 teenagers for VNSAVY2 (32.7% of the overall sample).

3.1. Variables

Teenage pregnancy. Teenage pregnancy was measured by the item "Have you ever been pregnant", which was asked of all female respondents regardless of their age. The answer options included Yes (1) and No (0).

Demographic backgrounds. The variables that captured the demographic information of the samples included age, ethnicity, education attainment, urban residency, and household ownership. Age was a continuous variable that ranged from 14 to 19 years old. However, as teenage pregnancy was distributed unevenly across age, we further binarily coded the age variable into "at or below 17 years-old" *vs.* "18 or 19 years old". Because the sample sizes for ethnic minority groups were small, the variable "ethnicity" was recorded into Kinh and other ethnicities (Kinh: 0 *vs.* Others: 1), despite the fact there are more than five ethnicity groups in Vietnam. Educational attainment was also dichotomized (Less than high school: 0 *vs.* High school or higher: 1). Urban residency was a binary variable (Rural: 0 *vs.* Urban: 1). Finally, to capture the economic status of teenaged girls' families, a composite score was created to summarize how many household items the teenage girls' families owned. These household items were on a list of 11 household items, such as a car, refrigerator, cell phone, and other common household goods. A boat, however, was originally listed on both waves of the survey but was later omitted due to additional analysis on its psychometric properties. The H coefficient of this item in the Mokken Scale analysis was lower than 0.3, representing the inability to measure this particular item with the rest of the items [43–45]. The Internet item was added in the 2008 VNSAVY survey, and was incorporated into the computation of household ownerships to reflect the rapid changes in Vietnamese households during this time period. To assist in comparisons across waves, the composite scores were further divided by the number of items incorporated in calculation for each wave of the survey (ten items in VNSAVY1 and 11 items in VNSAVY2). The composite scores in both waves ranged from 0 to 1, with higher scores representing greater proportions of listed items owned by the households.

Parental divorce. Parental divorce was computed by two items in both waves of VNSAVY. If a respondent answered "divorce" to either of the items "The reasons your biological father does not live with you" or "The reasons your biological mother does not live with you", she would be considered having experienced parental divorce. The variable parental divorce was binaurally coded (No: 0 *vs.* Yes: 1).

Sexual education by parent and at school. The variables "sexual education by parent" and "sexual education at school" were computed by a set of related items; however, the item formats were slightly changed between the two waves of the

survey. In VNSAVY1, a multiple-choice item asked respondents to select from which sources they "heard about the following topics, including family planning, pregnancy/menstruation, gender and sexual relationships, and love and marriage". The item listed 16 potential sources and asked respondents to select all that applied. The variable "sexual education by parent" was coded 1 if either "father" or "mother" was selected. The variable "sexual education at school" was coded 1 if respondents selected "teachers" in their responses. In contrast, in VNSAVY2 the four different topics listed above were probed in separate items. These four items asked respondents to name the top three information sources. The variable "sexual education by parent" was coded 1 if either "father" or "mother" was selected for any of the four topics. Similarly, the variable "sexual education at school" was coded 1 if respondents selected "teachers" in their responses for any of the four topics. Therefore, both variables, sexual education by parent and at school, were binaurally coded (No: 0 *vs.* Any: 1).

Internet use. Internet use was measured by one item in both waves of the survey question "Did you ever use the internet?" (No: 0 *vs.* Yes: 1).

Domestic violence. Domestic violence was captured by a set of related items in both datasets. If a respondent answered yes to either of the items "Have you ever been injured as a result of violence from a family member?" or "Has your spouse done any of the following things to you, including yelling, prohibiting you from doing certain things, and hitting", the variable "domestic violence" would be coded 1. The variable "domestic violence" was binaurally coded (Never: 0 *vs.* Any: 1).

Early sexual debut. Early sexual debut was measured by an item that asked at which age the respondents had their first sexual experiences. In the local Vietnamese context, we defined early sexual debut as having their first sexual experience at age 17 or younger. Teenage girls who have not had any sexual experiences would be considered not having early sexual debut. The variable early sexual debut was binaurally coded as a result (No: 0 *vs.* Yes: 1).

Positive outlook. Positive outlook was measured by a set of 10 related items in both waves of the survey; however, due to low overall reliability, six items were selected to compute the composite scores that optimized the reliability. The final reliabilities were 0.68 and 0.66 for wave one and wave two surveys, respectively. A few sampled items read "I have a few good qualities", "I will have a happy family in the future", and "I will have opportunities to do what I want". Respondents could answer "disagree" (1); "partially agree" (2); and "agree" (3) to each item. The composite score was a continuous variable and ranged from 1 to 3, with higher scores representing greater positive outlook.

Depressive symptomatology. Five related items were selected to measure the depressive symptomatology among the teenage girls. Sampled items read "Have you ever felt so sad or helpless that you stopped doing your usual activities?" and

"Have you ever felt really hopeless about your future?" The respondents answered "Yes" (1) or "No" (0) to each item. A composite score was created to sum up the six items. Additional Mokken Scale analysis suggested that the average H coefficients of these items were greater than 0.3 in both waves of survey, indicating these items were scalable to form an index measuring depressive symptomatology among Vietnamese youths [43–45].

Negative peer norms. Seven related items were used to measure perceived negative peer norms among Vietnamese teenage girls. Sample questions read "Is there any pressure from your friends for you to do the following: smoking" and "Is there any pressure from your friends for you to do the following: trying drugs". Respondents could answer "no pressure" (1); "a little pressure" (2); and "some pressure" (3) to each item. The reliability of these items in both waves of survey was very satisfactory (Cronbach's alphas = 0.90 and 0.87 in VNSAVY1 and VNSAVY2, respectively). A composite score was created that averaged the scores over the seven items. The composite score was a continuous variable ranging from 1 to 3, with higher values representing greater levels of perceived negative peer norms.

Positive peer norms. Similar seven related items were used to measure perceived positive peer norms among Vietnamese teenage girls. Sampled questions read "Do your friends encourage you to avoid smoking" and "Do your friends encourage you to avoid trying drugs". Respondents could answer "Yes" (1) or "No" (0) to each item. The reliability of these items in both waves of survey was very satisfactory (Cronbach's alphas = 0.93 and 0.94 in Waves 1 and 2, respectively). A composite score was created that averaged the scores over the seven items. The composite score was a continuous variable ranging from 0 to 1, with higher values representing greater levels of perceived positive peer norms.

3.2. Analytic Approaches

Descriptive statistics were first applied to estimate the prevalence rates of pregnancy as well as distributions of selected variables among Vietnamese teenage girls in both cohorts. Wald tests were utilized to evaluate differences in prevalence rates of pregnancy and distributions of selected variables across two waves of the survey. A logistic regression model was further applied in both waves of the survey to estimate the relationships between teenage pregnancy and selected variables within each cohort of teenage girls. Finally, Wald tests were used again to compare the estimated relationships across waves. To better account for complex study designs, survey weights were applied throughout the analyses. Jackknife was applied to calculate the standard errors for statistical inferences. Domain analysis was applied because in this study, only teenage girls aged 14 to 19 were included. All the statistical computations were carried out in a commercial software package, Stata 13, with SVY procedure [46].

4. Results

4.1. Prevalence Rates of Teenage Pregnancy and Overall Changes in Characteristics among Teenage Girls in Vietnam

Table 1 summarizes the descriptive analysis. The prevalence rates of pregnancy among teenage girls in Vietnam were about 4% in both waves of the survey, and were not significantly different at 0.05 levels (p-Value = 0.340), suggesting that the teenage pregnancy rates remained stable during the two time points. We re-estimated the prevalence rate of teenage pregnancy in the 2008 survey using the original provinces covered in 2003. The results (not shown) show that the differences between the two approaches are below 0.35%, which is negligible. Age distribution among pregnant girls in the two cohorts is summarized in Table 2. Kinh remained the majority ethnic group, consisting of 84% of the Vietnamese teenage girls across time points. Both waves indicated that only about 11% of the teenage girls resided in urban settings. The parental divorce rates also remained stable across both survey waves, with roughly 3% of the teenage girl population in both cohorts. The rates of early sexual debut also remained at about 2% of the teenage girls. The two cohorts of teenage girls also perceived similar levels of negative peer norms. Despite these similarities, there were some significant changes among the Vietnamese teenage girl population across the two cohorts.

Table 1. Demographic descriptions of Vietnamese teenage girls across two cohorts (2003 *vs.* 2008).

	2003 (%)	**2008 (%)**	***p*-Value**
Teenage Pregnancy	3.75	4.41 (4.75 ~)	0.340
Ethnicity			
Kinh	84.40	84.20	0.934
Others	15.60	15.80	
Education			
Less than high school	59.80	41.60	<0.001
High school or Higher	40.20	58.40	
Urban Residency			
Rural	89.20	89.50	0.889
Urban	10.80	10.50	
Parental Divorce			
No	97.00	94.77	0.339
Yes	3.00	2.56	
Sexual Education by Parent			<0.001
No	14.32	7.97	
Yes	85.68	92.03	

Table 1. *Cont.*

	2003 (%)	2008 (%)	*p*-Value
Sexual Education at School			<0.001
No	14.6	46.59	
Yes	85.4	53.41	
Internet Use			<0.001
No	84.72	60.85	
Yes	15.28	39.15	
Domestic Violence			<0.001
No	97.39	94.80	
Ever	2.61	5.20	
Early Sexual Debut			
No	97.94	98.39	0.347
Yes	2.06	1.61	
	Mean (SD)	**Mean (SD)**	***p-Value***
Age	16.34 (1.66)	16.19 (1.63)	0.006
Household Ownership	0.43 (0.22)	0.56 (0.19)	<0.001
Positive Outlook	2.61 (0.33)	2.70 (0.31)	<0.001
Depressive symptoms	0.92 (1.14)	1.45 (1.15)	<0.001
Negative Peer Norms	1.02 (0.13)	1.02 (0.11)	0.586
Positive Peer Norms	0.73 (0.40)	0.82 (0.35)	0.031

~: Calculation using original provinces covered in Survey Assessment of Vietnamese Youth (SAVY1). Data: Survey Assessment of Vietnamese Youth 2003 and 2008.

Table 2. Teen pregnancy rates by age in Vietnam (2003 *vs.* 2008).

Age	2003	2008
14	0.00%	0.00%
15	0.00%	0.00%
16	0.10%	0.87%
17	2.37%	3.77%
18	7.53%	9.99%
19	15.90%	20.13%

Data: Survey Assessment of Vietnamese Youth 2003 and 2008.

Overall, teenage girls in the 2008 cohort were more likely to receive high school-level education (40.20% *vs.* 58.4%, $p < 0.001$), to receive information regarding sexuality and relationships from parents (85.68% *vs.* 92.03%, $p < 0.001$), to have ever used the Internet (15.28% *vs.* 39.15%, $p < 0.001$), and to report experiences of domestic violence (2.61% *vs.* 5.20%, $p < 0.001$). In the second cohort, Vietnamese teenage girls also enjoyed more household goods (0.43 *vs.* 0.56, $p < 0.001$), had higher levels of positive outlook (2.61 *vs.* 2.70, $p < 0.001$), perceived higher levels of positive peer

norms (0.73 *vs.* 0.82, $p = 0.031$), but also suffered from greater levels of depressive symptomatology (0.92 *vs.* 1.45, $p < 0.001$). In the second cohort, surprisingly fewer teenage girls received information regarding sexuality and relationships from formal education (85.40% *vs.* 53.41%, $p < 0.001$). This may be partially due to the format changes of related items across the questionnaires.

4.2. Protective and Risk Factors for Pregnancy among Teenage Girls in Vietnam across Cohorts

Table 3 summarizes and presents the fitting results of weighted logistic regression models. In VNSAVY1, being 18 and 19 years old ($p < 0.001$), experiences of domestic violence ($p < 0.001$), and experiences of early sexual debut ($p < 0.001$) were associated with higher odds of pregnancy among the teenage girl population. Internet use ($p = 0.006$) and higher levels of depressive symptomatology ($p = 0.005$) were associated with lower odds of pregnancy. In contrast, in VNSAVY1I, being 18 and 19 years old ($p < 0.001$), having experiences of domestic violence ($p < 0.001$), and having experiences of early sexual debut ($p < 0.001$) were associated with higher odds of teenage pregnancy. Internet use ($p = 0.006$) was associated with lower odds of teenage pregnancy. Having more household goods ($p = 0.071$) and urban residency ($p = 0.084$) were marginally related to lower teenage pregnancy. Finally, the receipt of sexual education at school ($p = 0.021$) was associated with lower odds of pregnancy.

Table 3. Logistic regression with teenage pregnancy in Vietnam as the outcome (2003 *vs.* 2008).

–	2003			2008			Difference	
	A.O.R. [1]	**S.E.** [2]	***p*-Value**	**A.O.R.**	**S.E.**	***p*-Value**	**F** [3]	***p*-Value**
Age (18–19 *vs.* ⩽17)	47.56	24.22	**<0.001**	23.40	6.39	**<0.001**	1.52	0.222
Ethnicity (Others *vs.* Kinh)	1.33	0.50	0.44	1.27	0.34	0.362	0.01	0.927
Household Ownership	2.02	1.48	0.343	0.25	0.19	0.071	5.17	0.026
Urban Residency (Urban *vs.* Rural)	0.48	0.21	0.105	0.44	0.21	0.084	0.02	0.903
Parental Divorce (Yes *vs.* No)	1.28	1.13	0.785	0.76	0.50	0.682	0.22	0.639
Sexual Edu by Parent (Yes *vs.* No)	1.09	0.50	0.848	0.61	0.24	0.212	1.00	0.321
Sexual Edu at School (Yes *vs.* No)	0.87	0.31	0.693	0.42	0.10	**0.001**	2.84	0.097
Internet Use (Yes *vs.* No)	0.09	0.08	**0.006**	0.24	0.12	**0.006**	0.86	0.356
Domestic Violence (Yes *vs.* No)	21.26	12.12	**<0.001**	6.20	2.23	**<0.001**	3.06	0.085
Early Sexual Debut (Yes *vs.* No)	396.98	418.83	**<0.001**	64.69	40.61	**<0.001**	2.06	0.156
Positive Outlook	1.02	0.51	0.967	1.46	0.49	0.263	0.40	0.527
Depressive symptoms	0.61	0.10	**0.005**	0.83	0.10	0.144	1.90	0.173
Negative Peer Norms	2.51	2.16	0.289	0.67	0.72	0.709	0.98	0.326
Positive Peer Norms	0.78	0.26	0.449	1.53	0.56	0.249	1.62	0.208
Constant	0.00	0.00	<0.001	0.01	0.02	0.003	–	–
Joint Test	–	–	–	–	–	–	1.68	0.09

[1]: A.O.R. = Adjusted Odds Ratio; [2]: S.E. = Standard Error; [3]: F = F-statistics from Wald Tests; Boldface numbers indicates the *p*-Values smaller than 0.05. Data: Survey Assessment of Vietnamese Youth 2003 and 2008.

From these model-fitting results, it was clear that in both Waves 1 and 2, age, domestic violence, and early sexual debut were positively correlated with higher odds of teenage pregnancy among Vietnamese teenage girls, while sexual education at school, Internet use, and depressive symptomatology were significantly related to teenage pregnancy in either one or both cohorts. The Wald tests revealed that the estimated relationships between teenage pregnancy and selected factors were not significantly different across the two waves of the survey, except for household ownerships. Note that the relationships between household ownerships and teenage pregnancy were not significant at the 0.05 level in either cohort. The joint Wald test was also insignificant at the 0.05 level, suggesting that, overall, the relationships between teenage pregnancy and selected factors were stable across two cohorts. We also noted that sexual education in school was significantly associated with teenage pregnancy in the 2008 cohort but not in the 2003 cohort, and this difference reached significance at the 0.1 level. Similarly, the difference in the magnitude of relationships between domestic violence and teenage pregnancy across cohorts reached significance at the 0.1 level.

5. Discussion

Results of this study show that the prevalence of pregnancy among Vietnamese teenagers in the national surveys conducted in 2003 and 2008 was stable at 4%, or 40 pregnancies per 1000 adolescent girls aged 14 to 19. When VNSAVY2 was conducted in 2008, rates in Vietnam were lower than in less-developed Asian countries, such as Laos, Bangladesh, and Timor Lester, and higher than in highly westernized Asian countries such as Singapore, Japan, and Hong Kong [19]. Overall, Vietnam's rate of teen pregnancy is significantly lower than that of Sub-Saharan African countries, but is significantly higher than in most Western European countries (with the exception of England) and, notably, higher than the U.S. [2,4,47].

Although rates of teen pregnancy in Vietnam were similar in 2003 and 2008, there are important differences between the pregnant teens in these two cohorts. Age, experience of domestic violence, and early sexual debut were positively correlated with higher odds of teenage pregnancy for both cohorts; however, ethnicity, educational attainment, sexual education at school, Internet use, and depressive symptomatology were significantly related to teenage pregnancy only in the 2008 cohort. In 2003, teenagers who became pregnant tended to live in families with a history of domestic violence, started having sex earlier than their peers, and became pregnant between the ages of 15 and 18. They were also more likely to live in urban areas and did not receive sex education from their families or at school. In many ways, the profile of pregnant teenagers in Vietnam in the 2003 cohort resembled that of disadvantaged youth in poor urban neighborhoods in developed countries.

The pregnant teenagers in 2008 also reported a history of domestic violence but were more likely to be living in rural and/or remote mountainous areas. They did not have access to the Internet, tended to have lower levels of education, received little or no sex education at school, and reported depressive symptoms. Within the larger category of rural pregnant teens, they seemed to fall into two distinct sub-groups. One group consisted of teenagers from ethnic minorities, likely living in isolated mountainous areas where they had to travel far to attend school, and where they worked in the fields to help their parents earn a living. Since it was difficult for them to go to school, many of them eventually dropped out and began working full-time in the fields. They married in their late teens and subsequently became pregnant. For these teenagers, getting pregnant at 16 or 17 would not necessarily be problematic, but rather resulted from the normative expectations of traditional ethnic minorities living in the high mountains. The other group of pregnant teenagers in the 2008 cohort consisted primarily of young women who were not members of an ethnic minority, but also lived in rural, economically disadvantaged areas, and faced barriers to obtaining general education, including sex education. These young women might also consider early marriage and childbearing as normative in rural areas rather than a social problem.

The differences found between Vietnamese pregnant teenagers in 2003 and in 2008 paralleled differences in the general characteristics of teenagers, embedded in larger political, economic, and social changes of Vietnam in the last two decades. Within the five years that separated the two surveys, Vietnam experienced significant sociocultural shifts; thus, the two cohorts of teenagers were exposed to very different political, economic, and social contexts. Teenagers in the 2003 cohort came of age in the late 1990s and early 2000s, which was the beginning of globalization in Vietnam. At that time, only 3% of the population used the Internet, which was available only in urban areas [48]. Consequently, teenagers did not have direct access to foreign sources, news, or other information available by 2008. However, through pervasive distribution of teen magazines, newspapers (such as *Hoa Hoc Tro*), and national television and radio programs, Vietnamese teenagers in 2003 received a rather unified exposure to Western culture, particularly American teen culture [13,14]. During the early 2000s, the English term "teen" was first borrowed from the American media and appeared in the most influential newspapers targeting adolescents in Vietnam [14]. It first appeared in 2001 in *Hoa Hoc Tro,* and quickly spread to become a household word denoting a new social group in Vietnam: the "teen Viet". Thus, the youth coming of age in the late 1990s and early 2000s were the first generation exposed to the idea that the teenage years represented a distinct culture characterized by consumption, and accentuating one's identity through bodily beauty and accessories. This was also the first time that Vietnamese teenagers were exposed to the idea that

being "sexy" was "cool", rather than being an indicator of immorality or a barrier to academic achievement as in the past [14].

In contrast, the 2008 cohort included those who came of age when important aspects of globalization began to influence the daily life of Vietnamese. Only five years after 2003, the number of Internet users in Vietnam had increased seven times to nearly 21 million users, making Vietnam one of the fastest-growing countries in Internet use [48]. The Internet became ubiquitous in urban areas and much more accessible in rural areas, with young people between 14 and 24 accounting for nearly 40% of the users [49]. As a result, changes in teen culture often started in urban areas and diffused to rural and remote areas in the manner of circles and waves.

The outward exodus of teen pregnancy observed in this study might have been the result of a ripple effect of urbanization, modernization, and westernization in Vietnam, both in terms of socioeconomic improvement and cultural shifts. In particular, between the years 2003 and 2008, the average income in urban areas grew twice as much as that in rural areas [50]. For remote areas, the gap is even bigger. In fact, in many remote areas in Vietnam, living conditions have remained virtually unchanged over the last few decades. Malnutrition rates among ethnic minority children are twice those of the Kinh people. Only 13% of the two largest ethnic minority groups in Vietnam attend junior high school compared to 65% of the two majority groups [50].

The fact that urban Vietnamese youths stay in school longer compared to those in rural and/or mountainous areas might make urban youths delay marriage and childbearing. As a result, these youth become more careful in their sexual risk-taking. At the same time, improved economic conditions have led to an explosion in Internet access, which provides teenagers with easy and unprecedented access to a means of satisfying their sexual curiosity, as well as learning about risky sexual behaviors. The significance of this development is suggested by results of the final report of VNSAVY 1, which shows that Vietnamese teenagers used the mass media as a primary source of information, especially when it came to issues related to friendship, romantic relationships, and sexuality [38].

Urbanization, modernization, and westernization have also led to an import of Western sexual norms, including teenagers becoming more accepting of pre-marital sex. Through Western movies, news, music, and social media, Vietnamese teenagers in urban areas have learned that it is normal for teenagers in the Western world to have sex while in high school. They also have learned the negative consequences associated with teen pregnancy, even if they did not obtain comprehensive knowledge about safe sex. At the same time, young Vietnamese people are acutely aware that their parents and grandparents, indoctrinated with communist and Confucian ideologies that pre-marital sex is immoral and ruined the future of young women, strongly oppose such practices. As a result, urban

teenagers quickly absorbed Western sexual norms but also the benefits of informal sex education. In contrast to urban areas, rural and remote/mountainous areas are slow to benefit from economic improvement and the import of Western sexual norms, as they still preserve traditional customs of early marriage and motherhood. Such unequal patterns of change are evident in the expanding income inequality between urban and rural areas in Vietnam, with poverty currently concentrating on ethnic minorities living in mountainous areas [50] (World Bank, 2014).

6. Implications

What are the implication of these shifts in the differential risk of teen pregnancy in Vietnam? Studies have consistently shown that children born to teen mothers are more likely to develop short-term and long-term negative health outcomes. Teen mothers are living primarily in rural and/or remote mountainous areas where there are limited health resources. As a result, Vietnam should develop new formal and informal services in rural areas to support teen mothers. At the same time, teen mothers who are following the traditional patterns of their communities in becoming mothers at young ages might not feel marginalized or stigmatized, and do not wish to seek services available to them. Moreover, Vietnamese children are often raised and cared for by the whole extended family or village; this would result in an informal support system for young mothers. This might mean that Vietnam needs a comprehensive intervention plan that addresses not only the socioeconomic but also the cultural and religious factors that lead to teen pregnancy and motherhood. Vietnam may also need long-term community-based intervention programs that employ local people (commune health staff, village elders, local monks/nuns/priests/spiritual leaders) rather than Western public health campaigns and measures. Promoting education and developing strong, focused sex education programs at schools in rural and/or mountainous areas may be important as well.

The above findings suggest that Vietnam might face challenges in reducing teen pregnancy in the years to come if there remain social, economic, and cultural segregation in the country; thus, for Vietnam to reduce teen pregnancy, there must be localized as well as large-scale national strategies to improve overall socio-economic conditions in all geographic regions in the country.

Limitations and Future Research

This study has several limitations. First, data of the study are cross-sectional, which limits the ability to establish a causal direction between independent variables and dependent variables. Second, the survey questionnaires used for the two waves were worded slightly differently in a few items, thus participants might have responded differently depending on their interpretation. In particular, for the 2008 survey, sex education at schools was incorporated under the umbrella item of

"sex education through formal channels", which also included formal public health propaganda in the mass media, and neighborhood-based health education. As a result, researchers were not sure about the unique impact of sex education at schools on teen pregnancy for the 2008 cohort. We were also unable to establish whether or not the pregnant teens were married because of the ways the survey questions on pregnancy and marital status were structured. However, teen pregnancy rates were almost zero through age 17 and very high at ages 18 and 19, indicating that pregnancies among Vietnamese teenage girls might be marital. Most significantly, there could be under-reporting about teen pregnancy by survey participants due to the stigma associated with engaging in sexual activity at early ages, and pregnancy during adolescence. However, even with these limitations, the study yields insights that are helpful in understanding teen pregnancy in the context of the fast and profound changes in Vietnam. Future studies can address these limitations and combine quantitative research with qualitative research in order to allow in-depth understanding of teen pregnancy from the Vietnamese teenagers' viewpoint.

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A Call to Action: Developing and Strengthening New Strategies to Promote Adolescent Sexual Health

Martha J. Decker, Nancy F. Berglas and Claire D. Brindis

Abstract: Through considerable efforts and investments of resources, adolescent pregnancy and birth rates in the United States have decreased significantly over the past two decades. Nonetheless, large disparities persist for many populations of youth. Reducing unintended adolescent pregnancies is considered a "winnable public health battle," but one that will require innovative thinking and continued persistence. This paper reviews the recent research literature and innovative programmatic efforts to identify six promising strategies that address the challenge of adolescent pregnancy in new ways. These strategies aim to: (1) understand and address the complexity of adolescent lives; (2) expand the provision of quality sexual health education; (3) engage youth through technology and media; (4) increase access to contraceptives and other sexual health services; (5) create tailored interventions for populations with special needs; and (6) create a supportive policy environment. By building upon lessons learned from past efforts, we can move the field toward the development, strengthening, and promotion of future strategies that enhance the sexual well-being of all adolescents.

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1. Introduction

Adolescent pregnancy and birth rates in the United States and in many high-income countries have decreased significantly in the past two decades [1,2]. Since its peak in 1991, the adolescent birth rate in the United States has declined by a remarkable 57% for female ages 15 to 19, with declines among all racial and ethnic groups [1,3]. This reduction has been attributed to a variety of proximate determinants, including improved contraceptive use, delay of first sex, and decreased sexual activity [4,5]. Other underlying factors may include increased access to comprehensive sexual health education and a transition from the abstinence-only model; media depictions of teen pregnancy and childbearing; changing demographics; and economic changes [4,6,7].

Despite this overall progress, unintended pregnancy among adolescents has persisted as a preeminent public health challenge, with certain populations and areas

disproportionately affected [7]. Large disparities remain in adolescent birth rates as well as access to reproductive health information and services. These disparities are associated with geographic location [1], socioeconomic status [8], and race and ethnicity [3,9], among other characteristics. For example, adolescents in rural areas are more likely to give birth than teens in urban areas [10] as are young Black and Hispanic females as compared to white females [9]. When other variables, such as income and education, are accounted for, many of these disparities by race/ethnicity or location are reduced. Other adolescent populations facing disproportionately high birth rates are those that are also at increased risk for other negative health outcomes and who are underserved by the existing health and educational systems. Adolescents who are homeless, runaway, in foster care, or in the juvenile justice system have higher rates of pregnancy and sexually transmitted infections (STIs) than other sexually active adolescents [11–13].

The Centers for Disease Control and Prevention has deemed adolescent pregnancy one of a small number of "Winnable Battles" for public health; that is, a public health issue with established evidence-based interventions that has the potential for far-reaching change [14]. Organized, strategic interventions are required to develop a broad and multilayered approach to address the complexities underlying unintended adolescent pregnancy and promote the sexual health and well-being of all adolescents.

Building on the progress thus far and recognizing the continued need for further advances, this paper presents six key strategies to further improve and accelerate the current downward trend of adolescent birth rates. These proven and promising strategies are drawn from recent research and programmatic efforts that address adolescent pregnancy at multiple levels, from individual adolescents' knowledge and personal development to larger systemic issues such as health care access. This ecological approach to adolescent reproductive health and sexuality recognizes the concurrent interactions and multi-directional influence of the community, school, family, peers, and individual on health behaviors and outcomes [15]. The six strategies, summarized in Table 1, address the broader community and developmental concerns of youth, increase knowledge and skills through sexual health education, use new technology and media to access information, increase availability of reproductive health services, tailor services to the needs of specific groups, and create a more supportive policy environment. In some cases, these strategies have been recommended and incrementally implemented for decades, but still have ways to improve or be more broadly enacted. Others are newly emerging and need further development to best harness their power and potential. Strengthening existing strategies and developing new ones requires synergies across disciplines and a systematic approach to implementation.

Table 1. Summary of key strategies to promote adolescent sexual health and examples of innovations from research and practice.

Strategy	Innovations
1. Understand and address the complexity of adolescent lives	• Strengthening communities • Understanding family dynamics • Addressing relationship dynamics
2. Expand the provision of quality sexual health education	• Incorporating adolescent development • Embracing adolescent sexuality • Promoting healthy relationships • Integrating gender and rights
3. Engage youth through technology and media	• Accessing sexual health information online • Building computer- and web-based sex education • Connecting through social media • Creating entertainment-education for adolescents • Using mobile technology
4. Increase access to contraceptives and other sexual health services	• Building relationships between providers and adolescents • Promoting youth friendly services • Offering services in alternative settings
5. Create tailored interventions for special populations	• Engaging males • Serving youth with developmental disabilities • Strengthening services for youth in juvenile detention • Reaching unstably housed and foster youth • Providing inclusive services for sexual minority youth • Responding to the needs of immigrants • Supporting expectant and parenting adolescents
6. Create supportive policy environment	• Promoting best practices and evidence-informed policies • Working at the local level • Protecting adolescent confidentiality and access to care

For all of the suggested strategies, the needs, opinions, and voices of youth must be at the center of development and assessment. Seeking and incorporating the perspectives of youth themselves is critical to ensuring that programs and policies are appropriate, engaging, and effective.

2. Understand and Address the Complexity of Adolescent Lives

How adolescents progress through their development is greatly affected by the social, economic, cultural and familial context in which they live [16]. A socioecological perspective recognizes that adolescent well-being is contingent upon multiple aspects of the physical and social environment as well as personal characteristics [17]. Adolescents are constantly navigating multiple environments from their local neighborhood to school to virtual locations, all with different social networks and norms. The choices that adolescents make are strongly influenced by their own personal values as well as the customs and values they see among their peers, family, and community. Adolescents are situated on a continuum of risk, which may change over time, and have varied levels of knowledge and needs for services. Programs and policies must contend with this complexity to address the underlying causes of adolescent pregnancy effectively.

2.1. Strengthening Communities

Worldwide, youth who have more educational and economic opportunities available to them are more likely to delay sexual initiation and to use contraception when they become sexually active [18]. Communities with higher social capital, which includes trust, cooperation, common goals, and supportive interactions among members, have been shown to have lower teen pregnancy rates [19,20]. Similarly, youth who live in neighborhoods with high poverty, higher rates of violence, and lower social capital are more likely to experience teen pregnancy [21]. Social capital can be built by creating safe spaces for families and residents to interact, promoting partnerships across youth-serving agencies in the community, and generating widespread community awareness that supports investment in youth as an instrumental component of community development. Connecting teen pregnancy and pregnancy prevention into broader community issues creates a more comprehensive approach to addressing adolescent health and development. Ecological approaches recognize the intertwined influences of family, peers, schools, media and policies on the behavior of adolescents, and aim to create positive effects by engaging multiple levels of an adolescent's environment synergistically [22,23].

Within the field, interventions addressing multiple determinants of sexual behavior should result in greater impact, but the development and evaluation of such interventions remains rare [22]. In one example, the *Children's Aid Society-Carrera* program in Harlem provided a multi-year afterschool program including job training, sports, and arts and resulted in lower rates of sexual initiation and pregnancy for adolescent female participants, relative to a comparison group [24]. Further research is needed to identify best practices and measure outcomes of neighborhood initiatives.

2.2. Understanding Family Dynamics

Adolescent childbearing is also strongly influenced by family characteristics, structures, and interactions [7]. Parental-child connectedness and parental supervision, for example, decrease the risk of adolescent pregnancy [25]. In one survey of youth, the majority stated that parents are the strongest influence on their decisions about sex, and that they want more open communication about sexual and reproductive health from their parents [26]. Parents need to have these conversations with their children early and often. Programs that work directly with parents to build effective communication skills around sexuality, support parent-adolescent relationships, and help parents develop monitoring strategies have shown promise [27]. Because many youth do not live with both biological parents, programs need to work with other adult caregivers and role models to ensure that youth receive sufficient mentoring, supervision, and communication about personal values and sexuality.

In addition, adolescents who are from families where their mothers or siblings were teen parents are more likely to become teen parents themselves [7,28]. Programs that identify and work with adolescents who have a family history of teen pregnancy can provide information and support. In California, for example, female participants in the former *Adolescent Sibling Pregnancy Prevention Program* not only had significantly lower rates of pregnancy and sexual initiation than comparison females, they also had reduced school truancy [28].

2.3. Addressing Relationship Dynamics

Across the years of adolescence, young people develop closer connections to their peers and, in time, typically engage in sustained romantic relationships with partners [16], half of them sexually intimate [29]. Sexual relationships may be serious or transitory, with contraceptive and condom use differing based on relationship type [30]. Navigating the dynamics of a new relationship, including negotiating sexual activity and contraceptive use, can be challenging, especially for those dating older partners. Unequal power dynamics between partners can impact every aspect of a relationship, particularly around decision making and the threat of violence [31]. Intimate partner violence disproportionately affects adolescents and young adults [32]. Young women who experience intimate partner violence are less likely to use condoms or other contraception, resulting in a greater risk of unintended pregnancies and STIs [33]. In addition to addressing healthy relationships as part of sex education and parent-child communication programs, clinical settings can play an important role in screening and interventions for violence and reproductive coercion [34]. Interventions focusing on young men may help reduce sexual and physical violence or coercion that can lead some young women to feel pressured to have sex [35]. In addition, the importance of active consent prior to engaging in

sexual activity has gained traction in programs and policies, particularly in university settings. Further work is needed to determine how to best present this concept to adolescents.

3. Expand the Provision of Quality Sexual Health Education

All adolescents are in need of medically accurate, developmentally appropriate, and relevant information and guidance to help them successfully face decisions about their sexuality, relationships, and sexual health. Parents are, and will always be, an essential source of information and values-clarification during this period, but the role of formal sex education in the classroom or other settings remains critical. Sex education offers an opportunity for young people to gain knowledge, dismiss persistent myths, practice communication and negotiation skills, question portrayals of sex and gender in the media, and contextualize their broader experiences as they make their own individual choices. However, there is often a disconnect between these components and what is actually provided to most adolescents. Nearly all adolescents (95%) in the United States receive some formal sex education in a school, community, or faith-based setting by the time they are 18 [36], but this statistic masks the great variability in both the quality and frequency of sex education that adolescents receive [37], as well as the different goals and content that underlie approaches to sex education.

Researchers, policymakers, funders, and advocates have dedicated considerable effort to identifying sex education programs that have had a positive impact on adolescents' sexual behaviors and have created collections of evidence-based interventions that communities can select for replication. Effective programs outline clear goals, address multiple risk and protective factors, create a youth-friendly environment, engage youth in multiple activities to build communication and negotiation skills, and employ quality teaching methods [23,38]. Rigorous studies have identified little evidence to support the efficacy of abstinence-only education programs in their primary goal of delaying adolescents' age of sexual initiation [39]. In contrast, research has consistently found that discussions of contraceptive and condom use in sex education programs do not increase adolescents' likelihood of having sex, as some feared [38].

A new generation of approaches aspires beyond the narrow focus of teen pregnancy prevention and STI prevention programs, promoting broad-scale efforts that integrate discussions of gender, sexual orientation, healthy relationships, pleasure, and media literacy [40–42]. European approaches to adolescent sexuality have long emphasized comprehensive sex and relationships education that incorporates these topics, builds skills, and values individual responsibility in sexual decision-making [43]. Much has already been learned about sex education through decades of research and practice, and much more can be done to increase access to

quality programming in all communities. These comprehensive, health-promoting approaches to sex education will require further conceptualization, implementation, and research moving forward.

3.1. Incorporating Adolescent Development

Too often, programs address the potential vulnerabilities of adolescents without embracing their individual strengths and assets as a means to encourage healthy sexuality [44]. New work is emerging on the developmental appropriateness of sex education that incorporates critical research from developmental and brain science and informs goals, content, and timing. Most sex education interventions do not address the emotional and motivational factors that affect adolescents' sexual decision-making, even though these play an essential role in their sexual risk behaviors [45]. Youth need to understand the types of decisions they may need to make "in the moment," for example by role-playing the potential for being swept away within a party context or having unprotected intercourse as a result of alcohol use and pressure from a new partner. Sex education programs can also work with adolescents to address the competition between their short-term and long-term goals (e.g., physical intimacy *vs.* pregnancy prevention). Programs using a positive youth development approach recognize youth resources and protective assets rather than focusing exclusively on risk. These programs can help youth to strengthen relationships and abilities, develop a more positive view of their future through academic and career opportunities, and interact with supportive adults. Youth learn to act on the complementary skills and knowledge provided through sex education to better negotiate sexual activity and contraceptive use and avoid unhealthy relationships [46]. Promoting resiliency for youth who have been exposed to risk or negative experiences can help them to successfully respond to challenges [47]. Additional work is needed to understand how program developers and sex educators can integrate the latest findings from developmental and brain science and lessons learned from positive youth development efforts into practice.

3.2. Embracing Adolescent Sexuality

Most existing sex education interventions, regardless of the guiding framework, view restraint from sexual activity as the ideal sexual behavior for adolescents. Some, however, suggest a positive view of sexuality that sees consensual sex in adolescence as developmentally normative and even healthy [42]. These proponents argue that a positive view of adolescent sexuality does not ignore the impact of pregnancy or disease, but rather assumes that most youth have the capacity to deal with these risks. It reflects the experiences of Western Europe, where adult acceptance of adolescent sexuality results in adolescents' planning for their sexual experiences, setting boundaries and wishes, negotiating interactions with partners, and seeking

support from parents and other caregivers when needed [40]. The integration of these concepts and values in the U.S. context has been rare.

3.3. Promoting Healthy Relationships

Typically, sex education programs have targeted information and skills-building to the individual adolescent outside the context of romantic relationships. A focus on intimate relationships may help youth contextualize lessons about sexual behaviors, as well other important facets of relationships, such as respect, trust and communication, including communication regarding protected sexual activity. In response to the disproportionate rates of intimate partner violence among adolescents and young adults, a number of education programs have been developed that aim to prevent victimization and perpetration through changing social norms and increasing awareness of services. For example, *Safe Dates*, a school-based dating violence prevention program, has been rigorously evaluated and found positive long-term effects on psychological, physical and sexual dating violence victimization and physical violence perpetration [48]. By broadening its content to address both healthy and unhealthy relationships, sex education can also promote positive social norms. Coyle, *et al.* [49] examined relationship characteristics as "instructional leverage points" for sex education with younger adolescents. Findings suggest that grounding sexual behaviors in the context of relationships that adolescents are currently or soon will be experiencing can strengthen their ability to access and use information about sex and contraception when needed.

3.4. Integrating Gender and Rights

International efforts have led the way in developing approaches to sex education that unify discussions of sexual health, gender, and human rights for adolescents [50,51]. These gender- and rights-based interventions are guided by an understanding of the critical role of gender and power dynamics in sexual behaviors and by the principle of youth as holders of their own sexual rights [52]. They recognize gender equality and social context as critical factors in sexual health and offer opportunities for adolescents to learn about, discuss, and reflect these issues. A recent systematic review of intervention studies indicated that addressing gender and power in program content result in greater program effectiveness [53]. In the United States, positive effects have been found in clinic-based interventions with adolescent girls in Atlanta [54], as well as a school-based intervention in Los Angeles [55], though few others have been developed or rigorously evaluated to date.

4. Engage Youth through Technology and Media

There is little question of the prominent role that media and technology play in the lives of today's adolescents for purposes of communication, entertainment,

creativity, and information. Ninety-two percent of teens report using the internet every day, and more than half are online several times a day [56]. By understanding how media and technology are used by adolescents, we can better harness their potential as tools for improving adolescent sexual health [57,58]. Advocates and program developers have long promoted reaching teens "where they are"; the worlds of media and technology are a further step toward that vision.

Embracing media and technology offers many advantages for the promotion of adolescent sexual health. They can offer adolescents anonymity in seeking information about sensitive subjects at the moment of need, connect isolated youth with like-minded peers, and potentially skirt the ideological battles of school-based sex education by offering information and potential interventions online. Nonetheless, concerns about adolescents' consumption of media and technology—both in quantity and content—must be taken seriously. Adolescents may be exposed to sexually explicit images, unwanted sexual advances and solicitation, cyber-bullying, and unsafe online relationships. There is almost no evidence on the impact of new media exposure on adolescent sexual health [59], but there are important risks to be considered and investigated.

Adolescents need support and education to become savvy consumers of media. They may undervalue the importance of connecting face-to-face with an adult who listens to them and considers their individual needs. They need guidance to locate sexual health information that is accurate, appropriate, and relevant. A key question for the future will be how to unite the power of media and technology with the known successes of in-person support and services.

4.1. Accessing Sexual Health Information Online

A new national survey found that the vast majority of adolescents have gone online to seek health information, whether to research a school assignment, learn to take care of their health, check symptoms, or find information for friends and family [60]. A number of high quality, youth-friendly sexual health websites have been developed or expanded in recent years—including *Sex Etc.*, *Scarleteen*, *StayTeen*, *Go Ask Alice*—that provide unbiased comprehensive information on relationships, sexual behaviors, contraception and condoms, violence, and other topics [61]. The National Campaign's Bedsider.org incorporates a website, social media, mobile technologies and games that allow young women to compare methods of contraception, find nearby health centers, and sign up for birth control or appointment reminders sent by email or text. Young women who learned about *Bedsider* were less likely to have unprotected sex and more likely to use an effective contraceptive method compared to similar women in a control group [62].

There are currently no guidelines for online sexual health information to help ensure that content is accurate and appropriate for youth. Such guidelines could

expand the inclusion of topics beyond those of pregnancy and STI prevention, such as sexual orientation, gender identity, healthy relationships, and pleasure. Sexual minority youth, in particular, search for information online that they cannot easily access in their schools and communities [63]. Further research is needed to examine how teens search for and assess the credibility of websites to maximize the likelihood they will find information that is accurate, youth-friendly, respectful, unbiased, and relevant.

4.2. Building Computer- and Web-Based Sex Education

Some curriculum-based sex education is also incorporating technology, either through computer activities within a school program or as a separate option outside the classroom. Technology-based programs may fill critical gaps in information for youth in communities where comprehensive, evidence-based interventions are not being implemented due to political pressures. They also have the potential for customizing individual content and incorporating interactive features, which may promote engagement in learning and reinforcement of lessons learned in the classrooms or clinician's office, for example. These efforts may also benefit from greater fidelity and decreased costs in implementation, as well as flexibility in dissemination relative to school-based interventions [64–66]. A notable challenge has been the recruitment and retention of participants throughout the course of an intervention, resulting in less intensity of exposure (dosage) than intended [64].

Technology-based programs have decreased sexual risk behaviors among participants, including reduced sexual activity, increased condom use, and reduced numbers of sexual partners [66]. Most evaluated interventions, however, have been geared toward older adolescents and young adults. A recent program, *It's Your Game-Tech*, was developed for younger adolescents from a standard curriculum and resulted in positive effects on knowledge, attitudes, self-efficacy and perceived norms about sex, but no overall effect on delaying sexual activity [65].

4.3. Connecting through Social Media

Social networking sites are used by nearly 90% of teens as a means of connection and communication, with most teens having a presence on more than one site [56]. Girls, in particular, are major consumers of social media. While social networking sites are extremely popular and widely used in advertising, their feasibility and effectiveness as a means of sexual health promotion is not clear. Organizations have tended to use social networking to promote clinic locations and hours, advertise health campaigns, refer to services, and connect groups of teens with similar interests (e.g., peer health educators), but not commonly as a means to provide comprehensive sexual health information [67]. Concerns about privacy seem to hamper teens' interest in a more interactive intervention approach via social

media [58,60]. The *Just/Us* intervention for high-risk youth successfully recruited and delivered STI prevention messages using Facebook, which resulted in positive effects on condom use in the short-term, although results were not sustained six months later [68].

4.4. Creating Entertainment-Education for Adolescents

The entertainment industry has devoted considerable airtime to the depictions of adolescent sexuality through scripted and reality television, often without any discussion of risk. In contrast, entertainment-education programs aim to change awareness, attitudes and behaviors through theory-based educational content framed in an engaging way. Entertainment-education programs have long been used in other countries to promote safe sex behaviors [69]. Likeminded efforts within in the U.S. have been rare, particularly for adolescents, although this trend is beginning to shift. Sexual health organizations and Latino advocacy groups collaborated on the development of Hulu's teen drama series *East Los High*, which portrays the turbulent effects of relationships, sex, pregnancy, and HIV on its young Latino characters. Among the most popular of recent reality shows, MTV's *16 and Pregnant* and *Teen Mom* follow adolescents through their pregnancies and early stages of parenthood. Some researchers have estimated that the shows resulted in a nearly 6% reduction in teen births over an 18 month period, or one-third of the overall decline in the United States during that time period [6,70].

4.5. Using Mobile Technology

The vast majority (88%) of adolescents have access to a mobile phone, and nearly three-quarters (73%) have access to a "smartphone" with internet capability [56]. Text messages offer a fast and inexpensive way to communicate and connect adolescents with sexual health information. Adolescents are well-versed in its use, with most (63%) sending texts daily [56]. There are few differences in mobile phone access by gender or race/ethnicity, although youth from lower-income families are less likely to own a phone with internet and texting capabilities [56].

Text-based interventions have been developed to increase sexual health knowledge, promote access to services, and ultimately promote healthy sexual behaviors. These are often developed as partnerships between technology and public health entities. YTH partnered with the San Francisco Department of Public Health to develop *SEXINFO*, a text messaging service designed to connect African American youth with information on STIs, contraception and services [71]. The *BrdsNBz* North Carolina Text Line responds to youth's texts about sex, relationships and puberty with confidential, individualized responses from a trained health educator within 24 h and is expanding its reach to other states [72].

5. Increase Access to Contraceptives and other Sexual Health Services

Much of the great decline in teen births in recent years has been attributed to gains in adolescents' use of more effective contraceptive methods [4]. Increasing access to contraception, as well as other sexual health services, has been an important and successful public health strategy for reducing the negative consequences of risk sexual behaviors. With the advent of long-acting reversible contraceptive methods (LARCs, *i.e.*, the IUD and implant), there are opportunities to build on these positive trends and continue the recent declines in adolescent pregnancy. The landmark *Contraceptive CHOICE Project* in St. Louis, for example, resulted in significantly reduced rates of pregnancy, birth, abortion through the provision of free contraception and education regarding LARC methods to adolescents [73].

Many adolescents, however, struggle to access to the high-quality sexual health services they need to protect themselves from sexual risks. Numerous barriers to care persist, including adolescents' lack of awareness of local service availability and eligibility, out-of-pocket costs if adolescents do not access subsidized reproductive health services, limited access to transportation, inconvenient service hours, embarrassment, and concerns about confidentiality. In addition, health care providers and pharmacists may be uncomfortable providing contraceptive services to adolescents. When barriers are overcome, sexual health services can have a tremendous impact on adolescent health. With the implementation of the 2010 Affordable Care Act, there are greater opportunities to eliminate traditional barriers to accessing reproductive health care through the inclusion of annual preventive visits and providing contraceptives without co-payment [74].

5.1. Building Relationships between Providers and Adolescents

Health care providers are important sources of sexual health information, counseling and services for adolescents. The provider-patient relationship is critical to creating a positive and satisfying visit that results in improved use of contraception. Adolescents can be hesitant to ask about sexual health issues, and too often providers do not initiate these conversations due to personal discomfort, concerns about legal or ethical issues, or limited time [75]. The more that clinicians raise topics related to sex, sexuality, and violence during confidential health care visits, the greater the likelihood that adolescents will share personal information regarding their need for contraceptive care and other support. Assuring confidential services also contributes to greater engagement and continuity of care [76].

The attitudes of providers can have an impact on an adolescent's contraceptive choice and continuation [77]. For example, although LARC methods are recommended as a first-line choice for adolescents, providers are less likely to recommend LARC to adolescents in comparison to older clients [78,79]. Providers may view LARC as inappropriate for adolescents due to perceived physiological constraints, costs, or

the perception that adolescents will discontinue use prematurely [80]. Provider attitudes towards LARC for adolescents can be improved by disseminating evidence for LARC for adolescents, dispelling misconceptions, and training providers on insertion techniques [80]. Similarly, some providers assume pelvic exams are required in advance of contraceptive provision or that return visits are required for continued receipt or refills of contraceptives.

Clinical practice guidelines can help providers understand their role in promoting adolescent sexual health, but providers may not follow them due to lack of familiarity, uncertainty with how to implement guidelines in practice, inconsistency between guidelines, personal disagreement with specific guidelines, lack of confidence, or disbelief that guidelines will lead to behavior change [81]. In addition, these guidelines have notable gaps. For example, they often do not address the role of providers in helping to screen and refer for additional health issues that impact reproductive health services and patient compliance, such as mental health and substance use, or better integration of STI and HIV/AIDS screening and treatment as part of the reproductive health visit. Efforts are needed to consolidate evidence-based guidelines, clarify their purpose to providers, and promote their use in clinical practice.

5.2. Promoting Youth Friendly Services

Health services must be appropriate, acceptable, equitable, and effective to meet the needs of adolescents [82]. A proliferation of evidence-based research has emerged to provide a framework for how youth-friendly services should be provided to improve access, utilization, and increased returns to health facilities [83,84]. Strategies aimed at reaching these goals include appropriate clinic hours (after school and weekends), transportation, measures for confidentiality, non-judgmental provider attitudes, ability to obtain all services at one site, and free or low costs of services [83]. For example, California's *Family Planning Access, Care, and Treatment (Family PACT)* program offers a "one-stop shop model" linking the ability to enroll adolescent clients at point of service, confidentiality protocols, removal of cost barriers, culturally sensitive services, and comprehensive reproductive health services for both females and males [85,86]. A number of studies have shown youth-friendly interventions can improve awareness, access, and use of reproductive health services, and increase follow up returns [83]. A national survey of publicly-funded family planning facilities found that facilities with staff trained in youth friendly services had increased rates of discussions about contraceptives and increased contraceptive and LARC provision to adolescent clients in comparison to non-youth-friendly sites [84].

5.3. Offering Services in Alternative Settings

Adolescents with the greatest barriers to accessing health services in formal health facilities may be better served through alternative or out-of-facility health services including school-based health centers, mobile clinics, and street-based outreach. There is strong evidence supporting that out-of-facility services can be feasible, acceptable, and effective when providing reproductive health services for youth [87]. For example, a Louisiana statewide program used street outreach workers to deliver education and distributed over 500,000 condoms over a two-year period to neighborhoods with youth at high risk for adolescent pregnancy and STIs [88]. This program significantly increased the proportion of youth reporting condom use at last sex in comparison to neighborhoods without the interventions [88]. Similarly, school-based health centers can be a key access point to expand exposure to reproductive health education and counseling [89]. Studies show school-based health centers that provide on-site reproductive health services can increase use of contraceptives, reduce pregnancy and repeat pregnancy, and decrease drop-out rates and absenteeism of pregnant and parenting teens [90–92]. While school-based health centers are an attractive option, there are fewer than 2500 sites across the United States [93]. In California, a web-based condom access project allows youth aged 12 to 19 years to find teen-friendly locations where condoms are available for free, or confidentially request that condoms be sent to them by mail if they live in counties with high STI rates [94].

Internationally, countries have implemented policies to allow oral contraceptives to be available over-the-counter. These global efforts provide evidence that over-the-counter accessibility meets safety criteria, improves access to contraceptives, and encourages contraceptive continuation in comparison to prescription-based requirements [95]. A recent survey found that 73% of female adolescents in the United States support over-the-counter access to oral contraceptives, with 61% stating that they would be interested in obtaining oral contraceptives this way [96]. Although emergency contraception is available without a prescription in the United States through providers and pharmacies, many adolescents continue to have limited knowledge of this option. Increasing awareness of emergency contraception, improving provider and pharmacist attitudes towards its provision, and decreasing logistical challenges is an important step in expanding access for adolescents, particularly in rural areas and in countries where it remains restricted or illegal [97,98].

6. Create Tailored Interventions for Special Populations

While all adolescents should receive quality sexual health education, be treated with respect by health providers, and have access to affordable contraceptives and other services, certain groups remain notably underserved through existing

programs and policies. Some adolescents are at a much higher risk for a range of negative health outcomes, including substance abuse and violence, that directly impact their reproductive behaviors and outcomes. Others have been neglected or overlooked through traditional curricula, research, and provider biases. Speaking with adolescents about their specific needs and using data to identify populations at greater risk can help to tailor interventions to make them more appropriate and responsive.

Several groups of adolescents are at disproportionate risk for pregnancy as well as other related health issues and require new approaches to better meet their needs. Some adolescents may belong to multiple categories such as an individual who runs away and also interacts with the juvenile justice system. For all of these groups, their unique circumstances and experiences should inform the development of tailored interventions. Clinic staff and health educators working with adolescents must be aware of the differing backgrounds of the youth they serve. While they are not able to fully respond to all of the social, educational, and developmental issues these youth may have, they can play an important role in helping to identify community programs for referrals and can also work with programs to be a referral resource when they serve young people who need health care. Furthermore, programs should be evaluated on their appropriateness and effectiveness for the different groups, with further consideration of additional factors including geography, age of the adolescent, and race/ethnicity.

6.1. Engaging Males

While the critical role that adolescent and young men play in avoiding unintended pregnancy and STIs, as well as promoting healthy relationships, has been noted for decades, relatively few resources have been designated for this population. Like their female counterparts, adolescent males who father a child are less likely to complete high school and are disproportionately African-American and Hispanic [99]. Partner dynamics, gender norms, and relationship context all have a strong influence on sexual and contraceptive behaviors, and research suggests that involving both partners in contraceptive decision-making increases the use of effective methods and dual protection through the use of condoms and another method [100]. Nonetheless, reproductive health services and services often exclude young men [101], and males using these services may perceive services as oriented towards female needs. Services can be designed to be more "male-friendly" by including more comprehensive services, facilitating positive provider attitudes towards adolescent males (including young fathers), and holding male-only clinic hours.

Efforts also need to emphasize young men's shared responsibility and promote their active involvement in sexual and reproductive decisions, the prevention of STIs, and responsible parenthood. Successful outreach strategies for reaching young

men include working in male-only settings, such as juvenile halls, and hiring male outreach staff who reflect the community [102]. Programs that focus on helping young men grow into responsible adults, partners, and fathers, teach skills such as interpersonal communication, job readiness, and health service utilization; and may include service learning opportunities [103]. For young fathers, programs should provide co-parenting strategies and support in balancing new responsibilities.

6.2. Serving Youth with Developmental Disabilities

Although many youth with developmental disabilities are, or have strong intentions of becoming, sexually active, they have lower knowledge about sexual health and are less likely than other adolescents to talk with parents or peers about pregnancy, STIs, and sexuality [104,105]. Those who are sexually active are at higher risk of pregnancy than their peers and have lower confidence in their capacity to have safe sex [106]. Adolescents with developmental disabilities have less access to media information, can have difficulties with abstract thinking and relationship negotiation, and often experience limited personal agency or dependence on caregivers [106]. Many teachers and adult caregivers are untrained or feel uncertain about ethical constraints of teaching about the topic, are limited to teaching short, physiologically factual interventions, or face challenges building skills that transfer beyond the classroom [105,107]. Few sexual health programs with students with developmental disabilities have been evaluated, resulting in limited guidance for health educators, special education teachers and parents [108]. Sexual health programs that are designed for and reflect the experiences of students with developmental disabilities are needed, along with adaptation tools for general sexual health programs.

6.3. Strengthening Services for Youth in Juvenile Detention

Youth residing in juvenile justice facilities consistently report high rates of sexual risk behaviors including number of partners, inconsistent use of condoms, and early sexual debut [109,110]. A study in Texas detention centers found that over 30% had already been or gotten someone pregnant [111]. They also report high rates of substance use, which increases odds of sexual risk behaviors including having sex with multiple partners, exchanging sex for money or drugs, and inconsistent condom use [109,112]. Furthermore, many youth in detention have serious mental health issues, often co-occurring with substance abuse [110]. For many youth in the juvenile justice system, the incarceration period represents their only significant contact with the health care system [110]. Therefore, this presents a unique opportunity to test, treat, educate, and connect high-risk youth to health care services and community resources [113]. A sex education program that includes motivational interviewing and a focus on substance use has shown positive outcomes in this setting [114].

6.4. Reaching Unstably Housed and Foster Youth

Adolescents who are homeless, who have run away, or who live in temporary foster care settings face an increased risk for pregnancy, childbearing, and STIs [11,13,115,116]. Adolescents in foster care are more than twice as likely to become pregnant than those not in foster care [13,116]. Adolescents living on the streets often employ survival strategies that include trading sex for goods and protection, are more susceptible to forced sexual activity, and frequently have limited access to health services [115]. Relationship dynamics also play a role in the sexual behavior of young women who are marginally housed; many rely on their male partners for emotional and financial support, which limits their power in negotiating condom and contraceptive use [117]. Current research has noted the lack of effectiveness of most programs aimed at improving sexual and reproductive health outcomes of this population [118]. Because of the multiple factors that influence homeless adolescents' sexual health outcomes, it is important to take a holistic approach in addressing their needs [115,118]. This includes increasing access to clinical services and psychological counseling, as well as providing a safe space where they feel comfortable and respected [115,118]. Furthermore, training foster care parents, staff at shelters, and providers on how to effectively talk to adolescents about sex, pregnancy and related issues may help to lower sexual activity and pregnancy among this group, as well as to strengthen relationships [116].

6.5. Providing Inclusive Services for Sexual Minority Youth

Sexual minority youth, those who are lesbian, gay, bisexual, and transgender, (LGBT), are at increased risk for unintended pregnancy and STIs [119,120]. However, most sexual health programs for adolescents focus on sexual behaviors between heterosexual partners for the purpose of unintended pregnancy and STI prevention [121]. Comprehensive sexual health education should be inclusive of sexual minority youth by including information regarding sexual orientation and gender identities, resources for LGBT youth, detailed information on STI prevention, and discussions of healthy relationships [121]. Medical institutions need to have policies and practices in place to identify LGBT-friendly providers or to provide professionals with the training necessary to increase their own level of comfort, as well as creating safe and welcoming environments for LGBT youth [122].

6.6. Responding to the Needs of Immigrants

Foreign born adolescents, particularly those of Hispanic origin, are disproportionately represented among total adolescent births [9,123]. Although foreign-born adolescents frequently initiate sexual intercourse later in life, they are less likely to use contraception and more likely to report a pregnancy as intended in comparison to

U.S.-born adolescents [123,124]. When navigating relationships, decisions about sex, contraception, and pregnancy, immigrant and refugee youth may find themselves bridging two cultures and value systems [125]. Immigrants and refugees often experience language barriers, cultural discordance in reproductive health services, restricted access to health insurance or health care services, and limited perceptions regarding their ability to engage in decision making [125,126]. Evidence-based interventions targeted at foreign-born youth can decrease pregnancy risks by including culturally relevant sex education to address specific cultural and family structure issues [126]. While schools may not always be able to include this targeted approach, community programs may represent viable options where such topics can be discussed. Health care providers should receive training in the varied cultural norms in their community, have access to professional translation services, and strive to increase the diversity of their workforce [126]. Using *promotoras*, community-based health educators, is another promising approach to increase outreach and awareness of reproductive health services, though more research is needed on efforts with adolescents [125].

6.7. Supporting Expectant and Parenting Adolescents

Expectant and parenting adolescents often struggle with considerable challenges that accompany pregnancy and parenthood during this developmental period. These challenges include balancing school and parenting responsibilities, as well as obtaining social support from family, friends, and partners [127,128]. Additionally, adolescent mothers are at greater risk for a rapid subsequent pregnancy [129]. Several evidence-based strategies have been proposed to address the specific needs of this population. For instance, developing support systems within schools, including case management, daycare options, and school-based health centers to foster academic achievement and create pathways to post-secondary education and careers [91,127,130]. Offering immediate postpartum insertion of LARCs is another cost-effective approach to avoiding subsequent unintended pregnancies [131]. Existing programs are generally geared toward adolescent mothers and often exclude adolescent fathers. Creating male-friendly services, including specific male-sensitive outreach, rapport-building, ongoing case management, and co-parenting strategies will better support young fathers and increase their parenting involvement [101].

7. Create Supportive Policy Environment

Policies at the local, state, and federal level impact adolescents' access to reproductive health information and services as well as broader life choices and the communities in which they live. At every level, these policies may act as barriers or facilitators to reduced adolescent pregnancy.

7.1. Promoting Best Practices and Evidence-Informed Policies

At the local, state, and federal level, funding should reflect best practices from the field and the strongest available evidence from research studies. Because adolescent sexuality is a highly charged political and emotional topic, related governmental policies may be created with limited evidence of effectiveness or appropriateness. For example, the Colorado Family Planning Initiative significantly increased LARC use among young women, resulting in lower fertility and abortion rates [132]. Despite this impact and estimated cost savings, the state legislature voted not to provide additional funding to sustain the program.

At the federal level, the government has provided funding for state and local teen pregnancy prevention activities for several decades [133]. The Obama Administration has allocated millions of dollars annually for states and communities to replicate previously evaluated sex education interventions, as well as assess new innovative strategies that can add to the evidence base. Partisan debates between proponents of funding for abstinence-only education *versus* more comprehensive sex education programs have continued over the last decade, despite lack of evidence supporting the former in delaying adolescents' age of sexual initiation, their primary goal [39]. From 2005 to 2008, while many other programs were cut, federally funded abstinence-only programs received $150 million [133].

Similarly, ideological debates regarding Title X, the federal grant program that provides family planning services for low income individuals, are common during budgetary planning, despite estimates of considerable cost savings through preventative services [134]. Recently, 16 states have proposed legislation that may block public funding for Title X [135]. It is likely that debates over public funding for sex education and reproductive health services will continue to reflect the ambiguity by legislative bodies regarding the support for such services.

7.2. Working at the Local Level

At the local level, school districts often determine the specific sexual heath curriculum offered or whether any is offered at all. Although 93% of parents nationwide support school-based sex education [136], school administrators and school boards often cite conservative local values as a rationale to not offer any programming. Parents and other local activists have successfully challenged school districts to ensure their children receive medically-accurate, age-appropriate sex education [137]. Similarly, the decision of whether or not school health clinics can dispense condoms and other contraceptives is typically determined by the school district. According to the National Assembly on School-Based Health Care, approximately half of school health clinics are prohibited from providing condoms or contraception to youth [93].

7.3. Protecting Adolescent Confidentiality and Access to Care

Fears about confidentiality keep many adolescents from disclosing sensitive health information and may prevent them from seeking care. The practice of sending explanation of benefits that detail patient and service information to policyholders can jeopardize minor's privacy rights. As the need for reproductive health services expands with increasing numbers of young adults receiving coverage through the Affordable Care Act, strategies for providers and insurers to maintain patient confidentiality are being developed in some states and health systems across the country. Widespread creation of an "opt in" approach to receiving an explanation of benefits, as well as attention to implementation and enforcement of policy changes are recommended [138].

In some states, new restrictive laws have significantly challenged individuals' access to reproductive health services including abortion, particularly for those with limited resources. Reproductive health legislation enacted in Texas has limited the services adolescents can obtain without parental consent and simultaneously decreased eligibility for undocumented immigrants [135]. Other states have enacted laws protecting the confidentiality of minors, enabling minors to seek services without parental involvement, and mandating that sex education provides information on contraception [139].

8. Conclusions

This paper highlights six promising strategies, drawn from recent research and programmatic innovations, that aim to decrease adolescent pregnancies and promote adolescent sexual health. The underlying causes of adolescent childbearing are complex and, therefore, our response must be multifaceted. Many of the risk factors for teen pregnancy—including poverty, limited educational and recreational opportunities, and limited access to health services—are themselves interconnected. While adolescent pregnancy rates have shown substantial improvement over recent decades, trends in related health issues, most notably STIs, have been mixed [140]. Rather than citing declining birth rates as a justification for reductions in funding, programs and policies need to persist in their efforts and expand their scope to encompass related issues of health and development. The field needs to grow beyond its traditional place of providing information-related programs, to a larger view that aims to support and nurture adolescents as they navigate important developmental stages and prepare for the transition to young adulthood. In many cases, adults working with adolescents will need further training and capacity building to encompass this broadened vision.

Each of the strategies proposed warrant further examination to ensure that they are appropriate for the selected population and maximize impact. Some of the promising interventions cited in this paper have been conducted only on a small

scale. These require thoughtful preparation and analysis for successful replication and scalability. Other newer strategies, particularly those using technology and new media, need further program development and research to better understand their challenges and potential. The quest for evidence-informed programs is an important one. We need to continue to explore the types of efforts that can affect sexual behaviors, improve our existing programs, and replicate these promising practices in new contexts and with diverse populations of youth. To that end, significant resources need to be secured to ensure that comprehensive sex education and reproductive health programs are based on the substantial body of research that has already been undertaken. There is also considerable room for growth, both in terms of improving the strength of the research evidence that is collected, as well as continuing to conceptualize new approaches for helping young people improve their sexual health. Including young people in the development of these strategies is critical to the acceptability and effectiveness of health messages and approaches.

At the local, state, and federal level, adolescent pregnancy prevention efforts will always compete with other funding priorities. Stakeholders representing multiple perspectives and with different backgrounds (including educators, policymakers, parents, and youth) must work together strategically. While the majority of the proposed strategies are proximal in their relationship to pregnancy prevention (for example, improved comprehensive sex education and access to reproductive health services), more distal factors are also key to diminishing the incidence of unintended pregnancy. These may include policies that support investments in education, violence prevention, and job training for both parents and adolescents.

Currently, much of the work and funding for programs targeting adolescents remain fragmented with little or no coordination. Too often those engaged in adolescent pregnancy prevention may not have an understanding of what strategies are needed in substance abuse prevention or violence prevention, even though these impact adolescent decision making. Underlying each of these potential risk related behaviors is the need for access to appropriate resources, mentoring and role models, and supportive environments. Reducing the silos between fields of research and interventions will bring critical components together, including elevating a focus on reducing disparities, promoting human rights, and encouraging responsible adolescent development. Similarly, improved efforts at communication and collaboration can more quickly diffuse lessons learned, promising interventions, and research results—thus, leading to a positive feedback cycle benefiting all involved.

In addition, sectors that are not traditionally considered as partners also need to be engaged. Providing internship opportunities for youth requires the involvement of local businesses, breaking the cycle of community violence necessitates the engagement of police and the justice system, and increasing academic success requires concerted efforts to assure equity in educational opportunities. Rarely

are the public and private sectors brought together to leverage existing resources and approaches that treat the adolescent as a whole. When these varied sectors work together on a common vision, the potential for collective impact is much greater than the individual parts. This type of approach can address many of the underlying factors influencing youth decision-making and positively impact not only adolescent pregnancy rates, but also other critical issues necessary for a successful transition to adulthood.

It is critical that we continue to build on our considerable progress in reducing adolescent pregnancy. Through thoughtful examination, synthesis, and diffusion of the many lessons of recent research and innovations in practice, we will be able to make further advances in promoting the sexual health of all adolescents.

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Evaluating Teen Pregnancy Prevention Programs: Decades of Evolving Strategies and Practices

Susan Philliber

Abstract: This paper reviews the changing strategies for both process and outcome evaluations of teen pregnancy prevention programs over the past few decades. Implementation evaluations have emphasized discovery of what program attributes are most effective in reducing teen pregnancy and its antecedents. Outcome evaluations have moved from collecting data to measure knowledge, attitudes, and program satisfaction to measuring behavior change including postponement of sexual involvement, increased used of contraception, or reduction in teen pregnancy. High quality randomized control trials or quasi-experimental designs are being increasingly emphasized, as are sophisticated analysis techniques using multi-variate analyses, controls for cluster sampling, and other strategies designed to build a more solid knowledge base about how to prevent early pregnancy.

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1. Introduction

Over the past four decades one of the likely contributing factors to reduced rates of teen pregnancy in the United States has been the search for and discovery of programs that are effective in preventing this behavior. More and more programs with at least one credible evaluation have been found to prevent teen pregnancy or its sexuality-related antecedents. There has also been a search for the characteristics of effective programs. Evaluators have tried to learn which programs work best for various populations, and have documented the magnitude of program effects on early pregnancy or its antecedents. While the 1970's were characterized by attention to programs for pregnant and parenting teens, by the 1980's, the search for effective prevention programs was being fully pursued [1].

In more recent years, organizations began to produce lists of effective programs, using various criteria. In 2004, the National Campaign to Prevent Teen Pregnancy (the National Campaign) published a guide intended to provide education about these lists and about how programs were selected for inclusion [2]. The publication stressed a movement away from weak or non-empirical evaluation criteria and the adoption of more rigorous standards:

> Credible lists were not based on process evaluation data (that is, they do not simply assess client or staff satisfaction with the program, whether the program was delivered as planned or attendance patterns); intuition about program effects; faith in a particular approach or method; political or religious inclination; or rhetoric about what should or might work. Criteria for program selection should be based on the rigor of the evaluation design and methods, as well as the strength of the findings. [2] (p. 3)

Their sentiments reflected a movement away from program satisfaction data and the reliance instead on high quality research.

One of the most dramatic developments in teen pregnancy prevention programming and evaluation was made possible because the 2010 federal fiscal year budget included $110 million for an evidence-based Teen Pregnancy Prevention Program requested by Health and Human Services (HHS). This program was to be implemented by a newly created Office of Adolescent Health (OAH) within the Office of the Assistant Secretary for Health, and was to coordinate its efforts with the Administration on Children and Families (ACF) and the Centers for Disease Control and Prevention (CDC) [3].

OAH was directed to spend $75 million to replicate teenage pregnancy prevention programs proven effective through rigorous evaluation (Tier 1). For the first time a governmental office was required to identify such programs, and thus, to develop standards by which to make such a judgment. OAH was also tasked with spending $25 million through research and demonstration grants to develop, replicate, refine and test innovative models for preventing teen pregnancy (Tier 2).

In that same year, OAH and its contractor defined the standards to be used for calling a program Tier 1 and identified 28 programs shown through rigorous evaluation to have an impact on important sexual behavioral outcomes, such as delaying sex, using contraception or preventing teen pregnancy. By February 2015, OAH listed 37 such programs on this list. These now appear in a searchable data base so that potential implementers can select a program that has been tested with the intended target group and is a program for which they have the capacity and resources [4].

The purpose of this paper is to review the evolution of the evaluation of teen pregnancy programs from the late 1980's to the present, examining both process and outcome evaluations. The OAH standards for effective evaluations of teen pregnancy prevention programs are reviewed, as are current remaining evaluation challenges including recruitment, data collection, the use of randomized designs, and loss to follow-up in longitudinal studies.

2. Early Evaluations

As in the evaluation of other programs, teen pregnancy prevention programs have most commonly measured changes in knowledge, changes in attitudes, or changes in behavior among young people. Examples of these variables are knowledge about sexuality or physiology, changes in attitudes toward contraceptive use, or changes in sexuality behaviors such as age at first intercourse or use of contraception.

In the earliest years of teen pregnancy program evaluation, it was common for evaluators to use data collection instruments that elicited adolescent perceptions of the program (an attitude). Examples of such items are:

- I like the program.
- I have learned a great deal that is helpful.
- I would recommend this program to my friends [5].

Perhaps positive answers to these attitudinal questions provide the basis for other positive outcomes among young people, but these are measures of program satisfaction or youth attitudes, rather than measures of youth outcomes. When outcome measures were used in early evaluations, changes in knowledge were more often measured than changes in behaviors. Data on program implementation were largely confined to student attendance information.

3. Advances in Documenting Program Implementation

Over the years, several evaluators have tried to delineate the attributes of effective programs. Describing the components of programs helps to define exactly what is being evaluated. Then, if these attributes are found to be related to positive program outcomes, evaluators have empirical evidence that these are important program characteristics and this information can then guide future program development.

Table 1 illustrates some general criteria thought to influence the effectiveness of prevention programs. This list, produced in 1989, comes from a review of four types of programs affecting youth: Child abuse and neglect, poor school performance and school failure, teenage pregnancy, and teenage substance abuse programs [1].

Each of the factors is general rather than particular to teen pregnancy prevention, having come from several youth development literatures. While some of these factors may seem like common sense, when this list appeared, even seemingly easy criteria to meet—like being able to reach an at-risk population—was challenging since research on who was getting pregnant was still sparse and data on the optimal timing, duration, and intensity of programs were all but absent.

Table 1. Factors Influencing the Effectiveness of Prevention Programs.

(1) The capacity to identify a population at risk for the problem to be prevented.
(2) The ability to reach an at-risk population with the program.
(3) The appropriateness of the timing of the preventive intervention.
(4) The duration and intensity of the program.
(5) How broadly or narrowly the program is focused.
(6) Experiential learning techniques in educational programs.
(7) Parental involvement in programs focusing on children or adolescents.
(8) Skill and training level of prevention program staff.
(9) Program structure and integration/collaboration with the other community services.
(10) Simplicity/complexity of prevention messages.
(11) Avoiding negative effects of prevention programs.

In 1994, ETR Associates produced a "Consumer's Guide" to sexuality education curricula [6]. While this guide did not cover other kinds of teen pregnancy prevention programs, sexuality education was the most common intervention at the time. The authors chose curricula to review that were school-based, published since 1985, available for review, and focused on more than one sexuality issue (such as sexuality transmitted disease, sexual abuse or other issues). They used the guidelines of the Sex Information and Education Council of the United States (SIECUS) and writing from American School Health Education as their criteria for evaluation of curricula [7,8]. Moreover, they developed guidelines for four stages of youth development: ages 5–8, ages 9–12, ages 12–15, and ages 15–18. As shown in Table 2, the Guide examined content, philosophy, skill building strategies, and the teaching methods used by each program reviewed.

Also rated were the following:

- Comprehensiveness (breadth and depth)
- Content accuracy and currency
- Skills building variety (breadth and depth)
- Methods variety
- Developmental appropriateness
- Cultural sensitivity
- Ease of implementation
- Evaluation
- Appearance/production quality, and
- Overall quality.

Table 2. Categories Rated for Sexuality Education Curricula by ETR in 1994 [6].

Content	
Puberty	Sexual expression
Body image	STD transmission
Gender roles	Abstinence
Reproduce anatomy/physiology	Pregnancy prevention
Conception and birth	STD prevention
Sexual identity and orientation	HIV prevention
Relationships	Sexual exploitation
Parenting	Reproductive Health
Philosophy	
Healthy sexuality	Abstinence
Responsibility for decisions	Using protection if sexually active
	Philosophy not clear
Skill-Building Strategies	
Personal values	Community resources
Self-awareness/self-esteem	General communication skills
Influences on decisions	Assertiveness skills
Consequences of decisions	Refusal skills
Peer norms	Conflict-management skills
Perceived pregnancy risk	Decision-making skills
Perceived STD/HIV risk	Planning/goal setting skills
Teaching Strategies	
Ground rules	Cooperative learning/small groups
Anonymous question box	Case studies/scenarios
Teacher lecture	Skills practice and rehearsal
Large-group discussion	Audiovisual materials
Student worksheets	Community speakers/involvement
Journals/story writing	Peer helper component
	Parent/guardian involvement

Each of these criteria had sub-dimensions to be rated. For example, to get the highest rating for cultural sensitivity, the curriculum in question had to have no stereotypic references about gender, race/ethnicity, family types, sexual orientation, or age, and had to have a variety of social groups and lifestyles depicted, as well as taking into account the cultural and ethnic values, customs and practices of the community.

While each of the criteria was chosen from a review of available literature at the time, most of this literature was descriptive. These guidelines then, were not based on high quality studies showing that curricula meeting these criteria had better outcomes than curriculum absent these attributes. Still this was an attempt to get closer to understanding what program features were most likely to actually reduce teen pregnancy or its antecedents. Over time, program implementation

studies then, have focused more specifically on the core components needed for teen pregnancy prevention and thus become more relevant to those who design or select such programs for use in their own communities.

In 1997 the National Campaign continued work intended to help would-be program implementers to choose programs that had promise to reduce teen pregnancy. They published a report entitled *No Easy Answers* [9], emphasizing high quality outcome evaluations using experimental or quasi-experimental designs. The report focused chiefly on high quality outcome studies but included some discussion of program content or delivery styles. Based on a descriptive review of these programs, the review concluded:

> both the studies of antecedents and the evaluations of programs suggest that there are no simple approaches that will markedly reduce adolescent pregnancy. Instead, if pregnancy prevention initiatives are to reduce pregnancy markedly, they must have multiple effective components that address both the more proximal sexual antecedents of adolescent sexual behavior as well as the more distal antecedents involving one or more aspects of poverty, lack of opportunity and family dysfunction, as well as social disorganization more generally. [9] (p. 46)

By 2007, in the second update of this review (the first published in 2001), Kirby and the National Campaign published under the somewhat more encouraging title *Emerging Answers* and included an entire chapter on the characteristics of effective curriculum-based programs [10]. While the numbers of programs included in the review increased substantially from the first review in 1997, the characteristics of effective programs were offered for only the curriculum-based sex and STD/HIV education programs—A group of eight programs with strong evidence of positive impact on sexual behavior, pregnancy, or STD rates. Kirby divided their desirable characteristics into three groups (see Table 3): The process for developing the curriculum, its contents, activities and teaching methodologies, and the process of implementation.

Note that in this 2007 review, content and activities are grouped and are not specific. This framework calls for "clear health goals" for example, rather than specifying specific topics such as puberty or conception, as the ETR guide had suggested. The 2007 list of characteristics of effective curricula also included the processes by which the program was developed as an important factor in its likely success—a relatively new consideration in the literature. While there is yet much research to do, the search to define what elements create programs that successfully reduce teen pregnancy has become more and more empirically based and has focused on the reduction of early pregnancy and its antecedents more specifically.

Table 3. Characteristics of Effective Curriculum-Based Programs, Kirby in 2007 [10].

Process of Developing the Curriculum	
• Involved multiple people with experience in theory, research, sex and STD/HIV education	• Activities consistent with community values and available resources
• Assessed relevant needs and assets of target group	• Program was pilot-tested
• Used a logic model specifying health goals, behavior affecting these, risk and protective factors and activities to change these	
Contents of curriculum and activities or teaching methodologies	
• Clear health goals	• Safe social environment for young people
• Focused narrowly on specific behaviors leading to these	• Multiple activities to change risk and protective factors
• Addressed sexual psychosocial risk and protective factors	• Instructionally sound teaching methods
	• Age, culturally, and sexual experience appropriate
	• Covered topics in logical sequence
Process of Implementing the Curriculum	
• At least minimal support from appropriate authorities such as school districts or health departments	• When necessary, activities to recruit and retain teens and overcome barriers to their participation
• Used educators with desired characteristics who were trained and provided monitoring, supervision and support	• Implemented virtually all activities with reasonable fidelity

4. A Demand for Fidelity

Perhaps most importantly, *Emerging Answers* 2007 specifically listed implementation fidelity as important. The field had begun to realize that development of effective teen pregnancy prevention programs would be for naught if these programs were not implemented as intended. In fact, in recognition that lack of fidelity to a well-researched program was common, the National Campaign, along with other agencies funded by the Centers for Disease Control and Prevention (CDC), began an Initiative to learn about and try to lessen barriers to faithful implementation of programs. The National Campaign called its effort *Putting What Works to Work*. As part of this Initiative, a descriptive survey was completed with 614 program implementers, local and state teen pregnancy coalition members, funders, and state officials who funded teen pregnancy prevention programs, asking whether they were implementing programs found to be effective with fidelity and if they were not, why not [11].

When asked to cite specific barriers to program implementation, a large number of respondents referred to: (1) the political climate at the time advocating strongly for "abstinence only" programs; (2) a greater focus placed on other issues affecting youth including AIDS, education and/or poverty; and (3) a distrust of science-based findings. This survey was during a time of substantial conflict in the nation over whether young people should receive "comprehensive" sexuality education or "abstinence only" education. Some of those surveyed believed that at least some evaluations had political agendas and should be viewed with skepticism.

Still, a majority of all groups, except funders, felt that the rigorous evaluation and proven effectiveness of new approaches was very important in choosing a teen pregnancy prevention program. Interestingly, among funders only 45% believed rigorous evaluation was very important. No one believed that these factors were completely unimportant [11].

These projects on "implementation science" began to focus on how to get those adopting programs to use new and effective approaches to preventing teen pregnancy. The questions asked had some similarities with the literature on the adoption of innovations. The chief question was—"If we know what works, why don't we implement it?" The study described above revealed several barriers, including:

- Lack of resources to purchase or receive training in successful programs;
- Local barriers to full implementation such as a school board forbidding a field trip to a contraceptive clinic;
- Programs seen as out of date or inappropriate for a given population;
- Modification of programs to fit the time available, the setting, or the population of a given community, and a quite frequent reason,
- "I just wanted to make the program my own [11]."

Thus, programs that had been theory-based, pilot-tested, designed for given populations, and focused on known risk and protective factors relative to teen pregnancy were refashioned. Sometimes, program implementers would take a chapter of one curriculum, two chapters from another, and then add their own favorite activities—still calling their program by its original title. As might be imagined, this began to alarm program developers as these "edited" programs might have had only a slight resemblance to the original theory and content. Some evaluations did not document these program alterations and thus, many such changes are likely to have been undetected.

This led program owners and founders to begin to establish "certification standards" for those who wanted to use their programs [12]. Some developed "minimum standards" that had to be met to call a program by its original name. By 2010, when OAH issued its first round of Funding Opportunity Announcements to fund replications of programs previously found effective, these announcements included language about the monitoring and maintenance of fidelity [13]. OAH defined a set of measures that all grantees were required to collect and report: Participant attendance, sessions implemented, facilitator fidelity logs including information on activities implemented as intended or whether adaptations were made and observations of at least 10% of the actual program sessions by independent, outside evaluators [14].

This new-found emphasis on faithful replication of a program also pressured program designers and owners to specify exactly what constituted fidelity to their programs. The field began to ask program developers to name "the essential elements" of their programs [15]. Could the program be offered in another language? Was every activity necessary? Could some chapters of the curriculum be skipped? Very few programs could provide evidence to answer these questions because they did not have multiple evaluations of their programs offered with and without certain of their components. Most programs on existing lists of effective programs had been evaluated only once, often with the program developers keeping a close eye on implementation fidelity.

Still the past decades have seen an increased consciousness about, and new strategies to implement, evidence-based programs while being true to their original philosophy, content, intensity, and delivery styles [16,17]. And, from the newest round of program replications funded by OAH, new evidence should emerge about how successful evidence based programs are when they are and are not implemented with fidelity.

5. Upgrading Outcome Studies

The early years of the struggle to reduce rates of teen pregnancy in the United States were marked by the recognition of the poor quality of available research and

evaluation data and multiple recommendations for increasing both the quality and quantity of data on potential success strategies (e.g., [18]).

In a 1986 brief to Senator John Chafee, who requested available information on what strategies might be effective in reducing teen pregnancy, the U.S. General Accounting Office (GAO) wrote:

> "The information on the effectiveness of preventing pregnancy is limited. . . . School-based teenage health clinics that include family planning services are frequently associated with reduced teenage birthrates but have not provided conclusive evidence that the programs were responsible for such declines. The information on the effectiveness of comprehensive service programs is limited". [19] (pp. 20–21)

Three years later another summary of evaluations of teen pregnancy prevention programs lamented:

> "While there are excellent examples of prevention program effectiveness studies...the number of such studies is small. Such studies are expensive and difficult to carry out. Consequently the evaluation components of many prevention programs . . . have been weak or poorly designed. . . . Often the program outcome indicators measured . . . do not include the central problem the program is attempting to prevent (e.g., teenage pregnancy . . .)". [1] (p. 17)

This criticism is still somewhat true of teen pregnancy prevention studies. Of the 37 programs currently on the HHS list of effective programs assessed with high quality designs, only four have measured and found an actual difference in pregnancy or birth rates between their program and comparison or control groups. Other programs have made the list by finding outcomes such as "had sex in the past 3 months" or "reductions in number of sexual partners"—both related to teen pregnancy but not actually measures of this outcome.

Even as late as 1995, a Child Trends summary of recent research reported relative to the data on determinants of teenage contraception use:

> " . . . much of this work is of poor quality. . . . studies are often based on tiny and non-representative samples . . . Studies are often cross-sectional, when prospective analyses are needed to identify determinants of contraceptive use and non-use. . . . bivariate analyses are often presented, although multivariate controls are needed . . . ". [20] (pp. 60–61)

At the conclusion of the *No Easy Answers* review in 1997, Kirby made similar observations about the extant evaluation research:

> " . . . studies conducted to date are simply too few to evaluate each of the different approaches, let alone the various combinations of approaches. . . . Far too often studies have not used experimental designs; have had sample sizes that were too small . . . have used exploratory analytic techniques instead of confirmatory techniques, . . . have failed to control for clustering of youth in schools or agencies . . . or have failed to report and publish negative results". [9] (p. 45)

In this report, Kirby also complained about the failure to replicate single evaluations of programs thus limiting knowledge about to whom and under what conditions these programs might or might not produce positive outcomes. In his 2007 review, Kirby cited many of the same problems with existing research on how to prevent teen pregnancy [10].

Still, there has been progress. As noted above, the most dramatic step to improve the search for programs that are effective in preventing teen pregnancy was taken by HHS through OAH. In 2010, they received over 1000 applications to either replicate the evaluations of existing evidence based programs or to test new and promising strategies to prevent teen pregnancy. They funded 75 organizations in 32 states for replication work [14]. These studies were intended to expand the populations on which such programs were tested and to see, particularly for some of the older ones, whether they still seemed effective. They also tested programs that had not been rigorously evaluated previously, but which had promising early results. Funding was provided to evaluate these programs using randomized control trials or quasi-experimental designs so as to increase the numbers and quality of teen pregnancy program evaluations.

OAH emphasized fidelity and put into place a variety of mechanisms to help promote strict delivery of the program as intended, including site visits, observations of program sessions, training for replicators, and adherence to a set of standards for the implementation sites.

OAH designed and required a set of performance measures both for programs and participants. The grantee-level measures included reporting of both informal and formal partners working with grantees, training provided to facilitators, dissemination of manuscripts or presentations, and program delivery measures such as number of participants reached, the dosage of the program they received and fidelity in delivery of the program [21].

In addition HHS designed and monitored—through its subcontractor Mathematica Policy Research—a set of evaluation and analysis standards designed to improve many of the past research and evaluation practices. These standards were developed to provide transparency about how effectiveness of programs was being determined and to improve standards generally. A brief description of these standards appears in Table 4 [22].

Table 4. The Office of Adolescent Health Evaluation Research Standards.

Criteria Category	High Study Rating	Moderate Study Rating	Low Study Rating
Study design	Random or functionally random assignment	Quasi-experimental design with a comparison group; random assignment design with high attrition or reassignment	Does not meet criteria for high or moderate rating
Attrition	What Works Clearinghouse standards for overall and differential attrition	No requirement	Does not meet criteria for high or moderate rating
Baseline equivalence	Must control for statistically significant baseline differences	Must establish baseline equivalence of research groups and control for baseline outcome measures	Does not meet criteria for high or moderate rating
Reassignment	Analysis must be based on original assignment to research groups	No requirement	Does not meet criteria for high or moderate rating
Confounding factors	Must have at least two subjects or groups in each research group and no systematic differences in data collection methods	Must have at least two subjects or groups in each research group and no systematic differences in data collection methods	Does not meet criteria for high or moderate rating

The standards call for random assignment or at least quasi-experimental designs, low attrition from the sample at follow-up intervals as well as little differential between the follow-up rates for treatment and control groups, controls for baseline equivalence of samples, low rates of group reassignment, and similarity of data collection methods in both treatment and control groups. Thus, the designs receiving the highest ratings are randomized control trials meeting all of these standards, whereas those with moderate ratings are quasi-experimental designs or randomized control trials that do not meet these additional criteria. Those with moderate ratings also do not have to meet the standards for attrition or reassignment because their weaker designs already include group differences that might bias the impact estimates and they are thus, not eligible for the highest ratings.

In addition, to be selected for inclusion on the list of evidence-based programs, each program must have a behavioral impact on pregnancy, STIs, or sexual risk behaviors such as sexual activity, contraceptive use or number of sexual partners.

Evaluations measuring only knowledge or attitude change are not included. Clearly these criteria for outcomes are vastly different from measuring whether young people liked the program.

As this work proceeded, a series of briefs was produced by OAH providing guidance on such topics as how to meet the highest research standards, how to avoid sample attrition, how to analyze data when attrition is present, and how to control for cluster sampling [23]. They discuss theory-driven interventions that focus on risk and protective factors associated with teen pregnancy and recommend sound analysis practices to declare that an intervention is effective. And these standards are likely to become even more sophisticated and demanding in the future.

6. Some Remaining Barriers to High Quality Teen Pregnancy Prevention Evaluation

Because such interventions have been most common, much of the writing cited above has focused primarily on curriculum-based approaches. But these are not the only kinds of teen pregnancy prevention interventions. There are parent-child communication programs, school-based clinics, comprehensive youth development programs, community based programs, use of mass media, and other approaches, each of which may or may not include a curriculum. The evaluations of these programs face some common obstacles, perhaps worth mentioning here as the work of our future.

Recruitment or Targeting—As noted by the very earliest attempts to delineate the characteristics of effective programs to prevent teen pregnancy, these programs must be able to reach the population at risk of early conceptions and births. Effective recruitment depends on identifying who these young people are, knowing where to find them, devising effective strategies to recruit them, and then engaging them in an effective intervention.

Decades of research have now made it clear that teen pregnancy is not equally common in all communities. Table 5 cites an abbreviated list of the factors among young people that are related to early pregnancy [10] (p. 52):

Table 5. Factors predictive of early pregnancy.

Communities (e.g., exposure to violence and substance abuse)	Families (e.g., single parent families, poor relationships with parents, parents who do not model responsible values about sex and contraception, low level of parent education)
Friends and peers (e.g, poor performance in school, drug use, permissive and unprotected sex)	Romantic partners (e.g., an older boyfriend)

In the real world of program implementation however, programs might miss the most "at-risk" youth if they work with the schools that are most cooperative or choose youth programs that are not attracting these young people. Even if these young people are at the sites chosen for programs, they may have after-school jobs to contribute to the family income, they may provide after school child care for their younger siblings, or have other interests and priorities that make them not only hard to recruit but hard to hold. Young people in "alternative schools" may be there only briefly or be sporadic in their attendance, resulting in their receiving low doses of the intended program.

Parent-child communication programs are particularly likely to have recruitment and engagement challenges. While a frequent mantra among some in the U.S. is that parents should be the first and most important sex educators of their children, these programs are often difficult to deliver, since parents may not want to attend multiple sessions at night or on the weekends or they cannot take part due to child care or work demands. Thus, their evaluations may suffer from small sample sizes or sparse attendance.

Data Collection—Assuming that we reach the population most in need of some teen pregnancy prevention intervention, care must be taken in data collection. Many programs want to operate in schools, where there are assembled groups of youth. But sexuality education interventions often face resistance from principals, teachers, and superintendents who are fearful of parental backlash. Such programs often have to secure active parental consent for their children to participate, and certainly for their children to be part of an evaluation collecting data on sexual behaviors. The students too, need to have such sensitive data collected with assurances of confidentiality. And questions asked of these young people must be on their reading level and take account of their cultural backgrounds and language proficiency. Failure to collect data with protocols considering these challenges can lead to false or incomplete information.

Randomization—The evaluators of teen pregnancy programs are well aware that a randomized control trial is the "gold standard" or the most respected research design to show that a program was the likely cause of any differences between young people who received the program and young people who did not. Pre-post designs without such controls may show change but do not persuade us that the program is the likely cause of that change.

Randomization also enables control over factors unmeasured. For example, if a group of young people who all tried to get into a program are randomized so that some get the program and others serve as controls, we are at least comparing a group of young people who all had the motivation to join the program.

Consider the challenges, however. Random assignment is widely disliked by program staff since they have to deny services to some young people, while

appearing to favor others. Because they are often acquainted with the students being randomized, it is usually best to let an outside evaluator carry out this assignment so that the choice is actually random and not personal. Another strategy is to randomly assign units such as schools, school classes, or youth recreation centers to either receive or not receive the program. All of these randomization strategies tax resources since students receiving little or no intervention must be followed for data collection over time.

Loss to Follow-Up—In any study of teen pregnancy prevention, following young people for longer periods of time allows measurement of how long any discernible program effects might last or measurement of how long it takes for program effects to appear. But the most at risk students are often mobile, particularly in poorer, high risk neighborhoods. When a study begins with 100% of those assigned to the program and control groups or with only 90% to 80% of the intended sample since all of the parents did not consent to their children's participation, and then over subsequent years more and more of them are lost, the study loses its quality (see OAH standards above). Particularly if the loss to follow-up is higher in the program or control groups or if the loss is particularly common among one type of student—say the boys, for example—what began as two well-matched and comparable groups can degenerate into unmatched, small, and thus, non-comparable samples.

The evaluation community is beginning to develop new techniques for stemming this loss. Use of multiple data collection strategies (in-person, telephone, on-line, or in-home surveys), multiple attempts to contact students to obtain data, use of incentives for teachers or youth workers and students, all enhance sample retention.

High mobility in schools where programs are being offered can also complicate the evaluations of school based clinic programs or school based curricula. In some schools serving the students at highest risk for teenage pregnancy, the mobility rate of these students during a given year can be 40% or more. Thus, those who received the intervention are gone by the time of the post-survey and new students may not have yet had any intervention or services from these programs. Schools rarely have a foolproof mechanism for collecting accurate pregnancy data both because of student turnover and because pregnant students often drop out of school without disclosing their reasons for doing so. These are some of the evaluation struggles that yet plague programs, on and off school grounds.

7. Conclusions

Evaluation of teen pregnancy prevention programs has come a long way in the past few decades. This is challenging research in the real world, not manipulations in a bell jar or vacuum. It requires care for human subjects (most often the youth to whom we are offering programs) and because of the importance of the results, it

demands our best strategies and most rigorous methods. Teen pregnancy prevention programs are often offered to the students most at risk in a community—the poorest, often discriminated against young people—who do not need to be wasting time in a program simply because we "think" it works or even because they enjoy it.

We are now way past "testimonial" evaluation, in both the program and funding communities. Those who pay for such programs are likely to ask us about our analysis strategies, our loss to follow-up, and the fidelity with which the program was implemented. But in a discipline where a randomized control trial (RCT) was an infrequent event and where evaluators have often complained about the scarcity and poor quality of the available evaluations, things are improving. This may mean that some programs that were selected as having strong evaluations with a positive behavioral impact on a teen pregnancy related behavior, will come off the lists of evidence based programs if further replications show them not to be replicable or to no longer be effective with the young people who are currently most at risk of teen pregnancy.

Going forward there is yet much to do. Our emphasis on high quality research designs that meet sound scientific standards should continue. While the past decades have seen authors try to create lists of the necessary elements for programs to successfully prevent teen pregnancy, we still have few actual tests of these hypotheses. More should be invested in using research to discover the particular strategies and content that will make these programs successful. And we yet know very little about which programs are best for which young people. It is unlikely that the same program will be equally resonant with all ethnic and cultural groups, all ages of youth, young people in foster care, lesbian, gay and transgendered youth, and other subgroups.

Over the past several decades studies of programs to prevent teen pregnancy and its antecedents have improved in their strategies, sampling, statistical techniques, and thus, the reliability of their conclusions. These improvements have not come cheaply—they will continue to tax our resources, energy, and commitment. Given the dire consequences of early pregnancies for our nation's youth, the quest to find what will prevent this event seems a worthy one in which to make future investments.

Conflicts of Interest: The author declares no conflicts of interest.

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Predicting Youths' Adherence to Treatment and Retention in Teenage Pregnancy Prevention Interventions

Elaine M. Walker

Abstract: Internal and external validity are threatened when subjects fail to complete an intervention and when they are lost at follow-ups. Accordingly, researchers and intervention staff continually strive to identify predictors of attrition and non-compliance. The present study investigated the success of models that incorporate program, family, and individual characteristic variables in predicting treatment adherence and retention at six months in a sample of 1319 youth who participated in an abstinence-only intervention, as well as the relative importance of the predictors in explaining retention and adherence among Hispanic and non-Hispanic youth. The findings indicated that the likelihood of completing the intervention was greater for youths whose mothers or someone who functioned as a mother did not work. The effect of this predictor was consistent across all models in which it was tested. In addition, youth who planned to have sex were more likely to withdraw from the intervention than were youth for whom the opposite was true. Youth satisfaction with the intervention successfully predicted the likelihood of completion. Retention at six months was influenced by youth completing the intervention, having a non-working mother, and being satisfied with the program. Results from the discriminant analyses suggested that the predictors varied in importance for Hispanics and non-Hispanics. For Hispanics, having a non-working mother and satisfaction with the intervention were critical to their decisions to complete the intervention and to return for the six-month follow-up. For non-Hispanics, parental attitudes regarding sex, youths' intentions to have sex, and youths' gender were significant predictors.

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1. Introduction

In teenage pregnancy prevention interventions, sample attrition can seriously compromise claims of internal and external validity. When subjects lost to a study sample differ significantly from those who remain, the generalizability of findings beyond the intervention may be applicable only to those who are similar in characteristics to the final analysis sample [1]. Further, if attrition—and

specifically, differential attrition rates—become high, the analytical sample may differ considerably from the initially randomized sample, which could negatively affect claims of validity [2]. Under such conditions, studies are likely to produce biased estimates of program effects. Therefore, given the potential threats to validity and statistical power posed by attrition, program planners and researchers tend to devote considerable resources to maximize retention and minimize attrition, particularly in longitudinal study designs [3]. However, despite these efforts, retention continues to be a source of frustration in many preventative and health interventions involving adolescents and pre-adolescents. For example, Karlson and Rapoff's [4] review of 40 randomized cognitive behavioral studies in pediatric populations published between 2002 and 2007 found that the mean attrition rate was 20% for initial follow-up and 32% for extended follow-up, with a range of 0%–54%. Bennett and Assifi's [5] systematic review of 19 abstinence-only and abstinence-plus interventions implemented between 1998 and 2001 yielded attrition rates ranging from a low of 2% to a high of 35%.

The integrity of an intervention becomes problematic not only when attrition is high, but also when there is low adherence to treatment. Subjects randomized to a treatment are expected, under ideal conditions, to complete the full dosage. However, as research has shown, for a variety of reasons—including loss of interest and characteristics of both the subject and intervention—some subjects fail to adhere to the treatment protocol [6]. Low compliance rates are particularly worrisome during efficacy trials, as such rates can mask the effects of an intervention [7]. However, statistical and methodological solutions are available for dealing with problems of attrition and adherence. For example, intent to treat (ITT) models have become acceptable and recommended approaches in randomized control trials (RCTs). Under ITT models, subjects are included in the final analytic sample irrespective of whether they adhere to the intervention protocol or are lost at follow-ups. These models generally produce conservative estimates of program effects.

Notwithstanding advances in the statistical handling of loss to program and evaluation samples, researchers continually strive to identify those subjects who are most likely to leave an intervention prematurely and the reasons for their withdrawal. For example, models for predicting treatment adherence and loss to follow-ups have been extensively tested in home-based healthcare [8] and substance abuse interventions [9]. In the case of home-based interventions, reported attrition rates are found to be generally high, averaging 50%; with incidences of non-completion and loss to follow-up being particularly problematic among underserved and at-risk families [8]. Brand and Jungmann [10] investigated the factors that contribute to high attrition among disadvantaged first-time mothers in Germany enrolled in Pro-Kind, which is a home-based intervention that provides prenatal, postnatal, and social services. They conducted a series of hierarchical logistic regression

analyses in which process factors (low maternal engagement, time spent on program content, participant satisfaction with the program) and demographic factors were the major predictors. The results indicated that process variables explained three times the amount of variance associated with attrition than did personal characteristics. Similar findings were noted by Damashek *et al.* [11] in a study of a home-based child maltreatment prevention program in the US.

In this regard, the recruitment and retention of minorities in intervention studies have been of particular concern among health researchers [12–14]. However, the primary focus has been on the adult population. Results from these studies reveal that retention of adult minority participants in clinical trials is influenced by both program and participant characteristics [13,15]. For example, Brown *et al.*'s [15] investigation of the factors that determine minority women's involvement in clinical trials found that practical issues such as transportation, work and family responsibilities, and economic hardships were mitigating factors in their decision to participate and remain in trials.

Although past efforts have been directed at minority adults, there is a growing body of studies devoted to understanding strategies for recruiting and retaining minority youth in both clinical trials and other programs (e.g., adolescents' mental health). However, few studies have attempted to explain retention and treatment adherence among minority youth participating in teen pregnancy prevention interventions. On the other hand, several studies have addressed issues regarding risk-related health behaviors such as HIV prevention and drug and alcohol abuse [16–18]. Findings from these studies have reinforced the results from those conducted on the adult population.

Villarruel *et al.* [18] examined factors associated with retention of Latino adolescents in an HIV sexual risk reduction intervention. Responses to open-ended questions suggested that major facilitators of participation were perceived support from peers, family, and teachers. On the other hand, barriers to both participation and retention included conflict with family and personal obligations, in addition to intervention characteristics. Clark *et al.*'s [19] exploration of factors affecting African-American adolescents' willingness to be recruited and participate in health-related interventions revealed similar results. Specifically, intervention features such as the time, location, and setting of the interventions, the type of incentive offered, the characteristics of the instructors, and the adolescent's own attitudes and beliefs, as well as family problems were identified as important determinants of whether youths would enroll in and complete an intervention. In their study of middle school students, Morean *et al.* [20] investigated how well behavioral incentives and personal characteristics predicted interest in a tobacco prevention program. Students were more likely to report interest in participating if they were younger, non-Caucasian, highly impulsive, and/or highly self-regulated

students. Gender and current smoking status did not affect reported interest. Incentives that increased interest included frequent, inexpensive awards and electronic prizes, such as monthly video games. Cash incentives were not as influential in predicting participation interest.

Differences in the saliency of these predictors (family, intervention, and demographic variables) among ethnic and racial groups have been noted in various studies [21]. In a randomized study on middle school families residing in an urban area, Coatsworth *et al.* [21] found that while family context variables were significantly associated with retention for both African-Americans and Hispanics, they were more important for Hispanic families than they were for African-American families. It was suggested that these findings underscored the importance of culture in the Hispanic community. Indeed, in a study that examined the extent to which family culture influences students and families of Mexican-American origins in a school-based intervention to prevent academic disengagement and mental health problems, cultural sensitivity, language preference, and acculturation status were significant factors in program engagement and completion [22].

Thus, regarding the association between adherence and retention on the one hand, and those among program, family, and personal characteristics on the other, the findings from the studies reviewed in this article indicate that these variables contribute to both adherence and retention. However, their importance may vary according to the racial and ethnic characteristics of participants. Given the relative paucity of similar studies in the field of teen pregnancy interventions, the present study investigated: (i) the success of models that incorporate program, family, and individual characteristics in predicting treatment adherence and retention at six months in a sample of 1319 youths who participated in an abstinence-only intervention; and (ii) the relative importance of the predictors in explaining retention and adherence among Hispanic and non-Hispanic youths—in light of recent findings which indicate higher teen birth rates for Hispanics than for any other racial group [23]. In fact, according to Faccio and Fish, [23] 34% of all teen births in the US are to Hispanics. The need for such a study is compelling given the substantial investment at the federal level in teen pregnancy prevention programs, as well as the fact that despite declining rates, births among individuals under the age of 19 remain higher in the US than they are in any other Western country [24].

2. Methods

The article is based on data from a replication teenage pregnancy prevention study in which 1319 students were randomly assigned to one of two treatment arms: an abstinence-only or general health curriculum (counterfactual). The goal of the intervention was to determine if results initially found in the efficacy trial—delay in sexual debut—could be replicated in a different context. The initial study

occurred with a predominantly African-American middle school population of youth aged 10–11 in Philadelphia. The replicating study, funded by the Office of Adolescent Health in the US Department of Health and Human Services from 2010 to 2015, was conducted in New York state with a more heterogeneous population consisting of Hispanic, White, and African-American youth of similar ages. Youth were assessed at baseline, posttest, three, six, and 12 months. Prior to the onset of the intervention, Institutional Review Board approval was secured.

The *Promoting Health Among Teens! Abstinence-Only Intervention (PHAT-AO)*, the treatment arm of the intervention, had four major content foci: (i) the relationship between goals and dreams and adolescent sexual behavior; (ii) importance of knowledge regarding the causes, transmission, and prevention of HIV, sexually transmitted diseases (STDs), and teenage pregnancy; (iii) the centrality of beliefs and attitudes about abstinence, HIV, STDs, and pregnancy; and (iv) the necessity of developing skills and self-efficacy including negotiation-refusal skills. The program provided opportunities for youths to practice and receive reinforcement and support. The content was covered over two consecutive Saturdays in eight one-hour modules. The counterfactual curriculum addressed the following: (i) the relationship between goals, dreams, and health; (ii) the importance of exercise and healthy eating for health; (iii) how exercise and healthy eating help the body to function properly, and (iv) how negative substances can be detrimental to healthy body functioning. Similar to the sexual health curriculum, time is provided for practice, reinforcement, and support for making healthy choices. Youth living more than a mile from the intervention sites (which were eight schools in the district) were provided with transportation. Breakfast and lunch were served on each program day.

2.1. Recruitment and Retention Recruitment Strategies

Both active and passive strategies were used to recruit eligible youth [25,26]. Eligibility was based on areas of the city with the highest incidence of teenage pregnancy. Schools were the primary venues for actively recruiting youths. Presentations were made at back-to-school nights for parents, as well as at assembly programs for eligible sixth- and seventh-graders. Recruitment packets with informed consent forms were sent home with students. In order to incentivize the return of the forms, pizza parties were held for the classes with the highest return rates. Passive recruitment strategies included spots on local television public programming and flyers in the community. Over the 5 years of the program, 6469 packets were sent home. About half (54%) of these were returned (see Figure 1), 314 did not pass screening (students either did not speak English or had a special education classification), and 45% of parents declined to have their child participate. Of the 1612 youths with parental consent who passed screening, 82% were randomized to one of the intervention arms; 18% did not attend the program. The consort diagram

presents the number of randomized youth eligible for inclusion in the follow-up data collection at the time of this study. It is instructive to note that follow-up data collection was based on the anniversary of post completion of the intervention. Thus, in the current article, only 1108 youth were eligible to be included in the six- month analytic sample.

A multiplicity of approaches was used to ensure retention. Youths were provided with incentives in the form of Barnes & Noble gift cards, opportunities to win movie tickets, iPads, and gift cards to the local supermarket when they completed the intervention and returned for each of the follow-up data collection sessions [27]. Additionally, youth received birthday cards and congratulatory cards for accomplishments. Periodic mailings reminding youth of follow-up sessions were conducted in conjunction with personal phone calls to families both the day before and the morning of data collection. For students who lived more than a mile from the program sites, transportation to and from the sites was provided. For students who failed to attend a regularly scheduled follow-up data collection date, alternative modes of participating in the follow-up were made available, such as answering the questionnaire over the phone, participating in a follow-up session in the neighborhood library and in school during a free period, or participating before or after school.

2.2. Participants and Procedures

Approximately 63% of youth in the study were of Hispanic origin, 25% were African-American, 9.6% were White, and 8% other. Males constituted 47% of all randomized youth. The average age of participants was 11 years. Among all participants, 52% spoke English at home, 29% spoke Spanish, 14% spoke Spanish and English, and 3.4% spoke a language other than English or Spanish. Further, 56% lived with both biological parents or in families in which their guardians were married. Finally, 75% had working mothers and 80% had fathers who were employed.

On the first Saturday of the intervention, students were randomized on site after assenting. Upon completing the baseline questionnaire, randomized students received instruction from a facilitator—a graduate student in public health—in either the sexual health or general health arm of the intervention. Program classrooms consisted of no more than eight students. At the end of both Saturdays, youth completed a debriefing instrument. The *PHAT-AO* is based on an ITT model, and therefore, all randomized students were surveyed and resurveyed at posttest, three, six, and 12 months, irrespective of whether they completed the intervention or missed any of the follow-up data collection points.

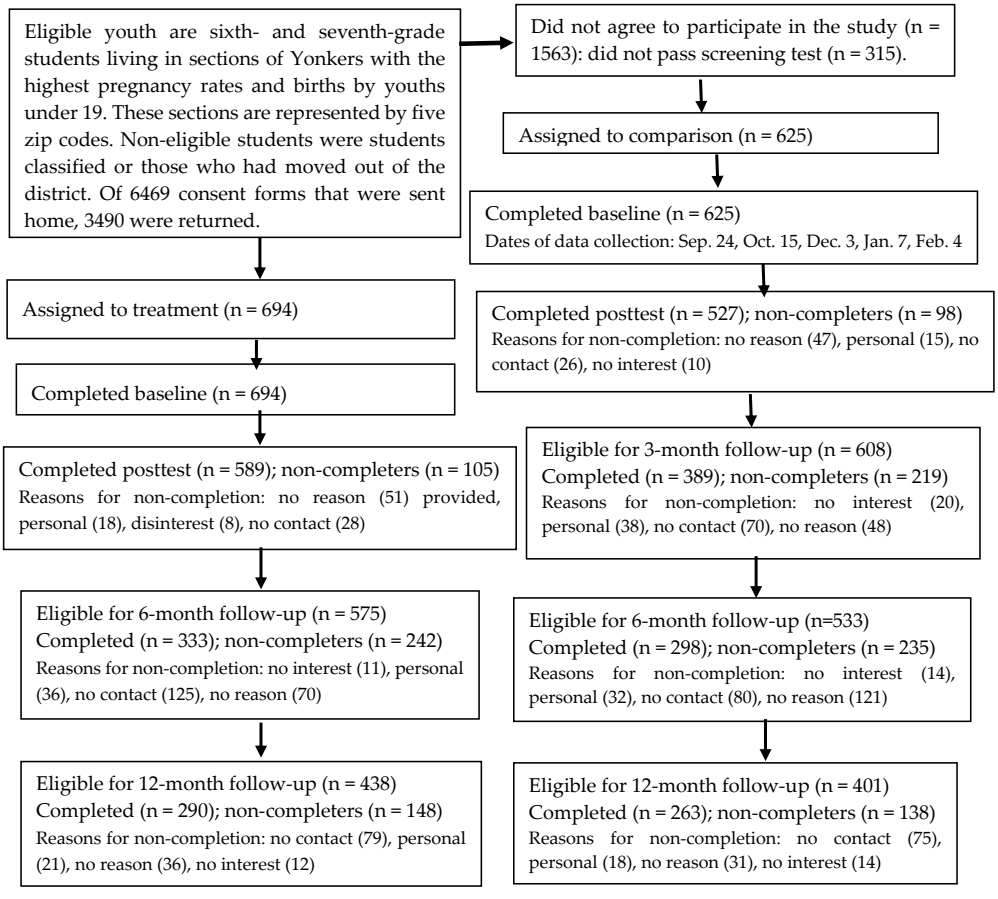

Figure 1. Consort diagram.

2.3. Measures

2.3.1. Outcomes

In this study, the primary outcomes were *adherence to treatment* and *retention*. The full sample (1319) was used for the primary outcome adherence to treatment and a subsample of youths (1108) in the analyses addressed retention. Adherence to treatment was defined as completion of the two-Saturday program, and it was coded (1) to represent whether youths attended both Saturdays and completed the intervention. Retention was defined as participating in the six-month follow-up (coded 1 for yes). Under the ITT model, all youths randomized were eligible for inclusion in the six-month follow-up, regardless of whether they completed the intervention. This data point was selected because attrition was greater at six months (42%) than it was at three (33%) and 12 months (30%). Further, participation in the

six-month follow-up was the strongest predictor of retention at 12 months, which was the final analytical point for determining effectiveness (β = 0.33, 0.22, and 0.19 for the six-month, three-month, and posttest measurements, respectively).

2.3.2. Covariates

All covariates were measured at baseline and before randomization. The following were the covariates for which the effects on the outcomes were estimated. For *family context*, two measures of youth family context were included: (1) whether the mother works (coded 1 for yes); and (2) parental disapproval of sex, as assessed by a single categorical item (coded 1 for yes and 0 for no). *Intervention context* was measured by an index with 17 items. Youth were asked to evaluate the intervention along a number of dimensions including the facilitators who taught the curriculum, benefits gained from participating in the intervention, level and comfort of involvement in the various activities, and whether they would recommend the program to another youth. Items were on a five-point Likert scale with five representing strong positive beliefs about the intervention. The index had a Cronbach's reliability coefficient of 0.879. *Behavioral disposition* was measured by youth' intentions to have sex in the next three months, which was a dichotomous variable (coded 0 for no and 1 for yes). *Youths' demographics* were captured by two variables: age and gender.

2.4. Statistical Analysis

The analysis was carried out in two stages. First, hierarchical multivariate logistic regressions were used to predict adherence and retention at six months. Separate analyses were conducted for each of the outcomes. The same covariates were used for the two outcomes, and the models were specified similarly, except for retention, where adherence to treatment was used as a covariate. For the outcome variable of interest—treatment adherence—family context was entered in the first model, the second added student characteristics and intentions to have sex in the next three months, and the final model added youths' reactions to the intervention. An additional model was tested for retention at six months in which treatment adherence was introduced as a covariate in the last model. Missing data were handled through multiple imputations with the pooled odds ratios (ORs) reported in the tables. Youth demographic variables (gender, age, Hispanic origins) and randomized condition were used to impute missing values for the outcome variables. Twenty imputed data sets were generated.

Hosmer–Lemeshow goodness-of-fit tests indicated that all the tested models adequately fit the data. Second, to complement the logistic regression, discriminant function analysis was conducted to test whether the predictors used in the logistic regression models were similar in importance for Hispanic and non-Hispanic youths.

Box's M test for homogeneity of the covariance matrices resulted in the use of separate group covariances in the classifications. Follow-up contrast testing based on independent *t*-tests and chi-square was conducted to determine whether there were differences in predictors between completers and non-completers for Hispanics and non-Hispanics [21]. As a precautionary step, analyses with randomized status as a covariate were run. As expected, this variable was not significant.

3. Results

3.1. Logistic Regression Analysis: Predicting Treatment Adherence

The likelihood of completing the intervention was greater for youth whose mothers or someone who functioned as a mother did not work (OR (95% CI), 0.645 (0.424, 0.988); (OR (95% CI), 0.640 (0.418, 0.578); and (OR (95% CI), 0.649 (0.424, 0.994) in models 1, 2, and 3, respectively) as compared to youth with a working maternal parent/guardian. The effect of this predictor was consistent across all models (See Table 1). The second family context variable—parents' disapproval of teen sex—was not significant in any of the models. Youth intention to have sex in the next three months was significant in model 2, but not in model 3 (p = 0.052). Youth who planned to have sex were more likely to withdraw from the intervention than were youth for whom the opposite was true (OR (95% CI), 0.572 (0.333, 0.981). Finally, in model 3, youth satisfaction with the intervention predicted the likelihood of completing the intervention (OR (95% CI), 1.021 (1.002, 1.040). The odds of completing the intervention improved with increasing levels of satisfaction, such that for each unit increase in satisfaction, youth were about 1.021 times more likely to receive the full dosage of the intervention (8 h).

Table 1. Predicting Treatment Adherence from Family Context, Youth Characteristics, Intervention Context, and Behavioral Disposition (n = 1319).

	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
Family context	Model 1	Model 2	Model 3
Mother working	0.645 (0.424, 0.988) *	0.640 (0.418, 0.578) *	0.649 (0.424, 0.994) *
Parents disapprove of sex	0.967 (0.522, 1.791)	1.180 (0.622, 2.240)	1.277 (0.645, 2.325)
Youth demographics		-	-
Gender	-	1.352 (0.955, 1.913)	1.333 (0.941, 1.887)
Age		1.030 (0.868, 1.222)	1.052 (0.887, 1.249)
Behavioral disposition		-	-
Intention to have sex	-	0.572 (0.333, 0.981) *	0.584 (0.324, 0.999)
Intervention context	-	-	-
Satisfaction with intervention			1.021 (1.002, 1.040) **

Note. OR = odds ratio, CI = confidence interval. * $p < 0.05$; ** $p < 0.001$.

3.2. Discriminant Function Analyses: Adherence

Results from the discriminant analyses indicated a discriminant function that statistically distinguished between completers and those who withdrew from the intervention for both Hispanics and non-Hispanics. For Hispanics, the canonical correlation was $R = 0.16$, and $\chi^2(6) = 353.713$, $p < 0.001$. The percentage of cases correctly classified was 61%, about 11% higher than what would have been expected by chance (50%). For youth who completed the intervention, the predictors resulted in a successful classification of 61%, but for those who withdrew, this value was reduced to 56%. As seen in Table 2, the predictors that best discriminated between Hispanic youth who completed the intervention and those who did not were age (−0.657), satisfaction (0.575), gender (0.398), and mother working (−0.306). All four had coefficients above 0.30. Findings from the contrast tests indicate that non-completers were slightly older, had a lower satisfaction rate, and were more likely to be males and have mothers who worked.

Table 2. Discriminant Function Analysis of Treatment Adherence: Structure Matrices ($n = 1319$).

Hispanics		**Non-Hispanics**	
Predictor	**Discriminant Function**	**Predictor**	**Discriminant Function**
Age	−0.657	Intention to abstain	0.720
Satisfaction	0.575	Age	−0.452
Gender	0.398	Parents disapprove of sex	0.358
Working mother	−0.306	Mother works	0.314
Intention to have sex	−0.210	Gender	−0.313
Parents disapprove of sex	0.148	Satisfaction	−0.103

From the coefficients in Table 2, it is apparent that the relative importance of the variables that distinguish non-completers from completers among non-Hispanics differs somewhat from those previously discussed for Hispanics. For non-Hispanics, intention to have sex in the next three months was the most critical factor in determining why some students disengaged prematurely from the intervention while others did not. This is followed by age, parental disapproval of sex, whether the mother worked, and gender. Similar to Hispanics, age, mother works, and gender all contributed to the discriminant function. However, unlike Hispanic youth, satisfaction with the intervention made no meaningful contribution to the discriminant function. The discriminant function was found to be statistically significant, $\chi^2(6) = 303.6236$, $p < 0.001$, and $R = 0.19$. The percentage of cases that were correctly classified was 68%, an 18% improvement over chance and 7% higher than

Hispanics. The linear combination of the predictors resulted in a correct classification of 72% for those who completed the intervention, but only 47% for those who failed to complete. Non-Hispanic youth who discontinued their participation in the intervention tended to be ones who planned on having sex in the next three months, were older than their peers, perceived their parents as not disapproving of sex, had working mothers, and were males.

3.3. Logistic Regression Analysis: Predicting Retention at Six Months

As can be seen in Table 3, the effects of the mother working continued to be a significant predictor in three of the four models predicting retention at six months OR (95% CI), 0.733 (0.552, 0.973), OR (95% CI), 0.735 (0.553, 0.977), and OR (95% CI), 0.743 (0.559, 0.988) in models 1, 2, and 3, respectively). Youth who were successfully followed up at six months were likely to have non-working mothers. Although none of the individual characteristics was significant, the effect of age was marginally above the 0.05 significance threshold. The likelihood of successfully retaining a youth at six months also increased significantly if that youth was satisfied with the intervention. Higher satisfaction with the intervention predicted greater likelihood of being retained OR (95% CI) 1.015 (1.000, 1.030). With every unit increase in satisfaction level, youths were 1.015 times more likely to participate in the six-month follow-up. Finally, the odds of being retained at six months was about 3.5 times greater if a youth had completed the intervention OR (95% CI) 3.747 (2.609, 5.381) than if s/he did not.

Table 3. Predicting Retention at Six Months from Family Context, Youth Characteristics, Intervention Context, Behavioral Disposition, and Treatment Adherence (n = 1108).

	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Family context	Model 1	Model 2	Model 3	Model 4
Working mother	0.733 (0.552, 0.973) *	0.735 (0.553, 0.977) *	0.743 (0.559, 0.988) *	0.783 (0.588, 1.044)
Parents disapprove of sex	0.812 (0.522, 1.2657)	0.806 (0.512, 1.270)	0.826 (0.524, 1.301	0.787 (0.495, 1.251)
Youth demographics				
Gender	-	0.849 (0.661, 1.090)	0.838 (0.652, 1.078)	0.789 (0.609, 1.022)
Age		0.866 (0.748, 1.003)	0.880 (0.760, 1.019)	0.873 (0.758, 1.005)
Behavioral disposition				
Intention to have sex	-	0.879 (0.562, 1.375)	0.893 (0.574, 1.391)	0.991 (0.629, 1.562)
Intervention context				
Youths' satisfaction with intervention	-	-	1.015 (1.000, 1.030) *	1.012 (0.998, 1.027)
Treatment adherence	-	-	-	3.747 (2.609, 5.381) **

Note. OR = odds ratio, CI = confidence intervals. * $p < 0.05$; ** $p < 0.001$.

3.4. Discriminant Function Analyses: Retention

Only two predictors contributed meaningfully (*i.e.*, coefficient values equal to or greater than 0.30) to discriminating between attritors and non-attritors for Hispanics and non-Hispanics. For Hispanics, these were completing the intervention and whether their mothers worked; and for non-Hispanics, compliance with the intervention and gender (See Table 4). In both cases, the discriminant functions were statistically significant: $R = 0.247$, $\chi^2(7) = 841.175$, $p < 0.001$ and $R = 0.30$, $\chi^2(7) = 773.801$, $p < 0.001$ for Hispanics and non-Hispanics, respectively. Approximately 64% of all cases were classified correctly for Hispanics, with 85% of youths in the original sample who were retained at six months being successfully classified. However, among those youths who were lost at six months, only a third of those students' attrition could be explained by the predictors in the analysis. Hispanic youths who were retained at six months were likely to have completed the intervention and lived with non-working moms.

Table 4. Discriminant Function Analysis on Retention at Six Months: Structure Matrices ($n = 1108$).

Hispanics		**Non-Hispanics**	
Predictors	**Discriminant function**	**Predictors**	**Discriminant function**
Treatment adherence	0.925	Treatment adherence	0.770
Working mother	0.332	Gender	−0.434
Satisfaction	0.253	Working mother	−0.230
Age	−0.218	Satisfaction	0.221
Gender	−0.195	Parents Disapprove	−0.134
Intention to have sex	−0.089	Age	−0.114
Parents disapprove of sex	0.043	Intention to have sex	0.001

While treatment adherence was also a strong contributing variable to the discriminant function for non-Hispanics (0.770), its effect, as can be seen in Table 4, was less powerful than it was for Hispanics (0.925). Nevertheless, it played the same role in distinguishing between youths—that is, non-Hispanic youth who were retained and those who were not. Youth retained at six months were likely to have received the full dosage of the intervention. The failure to retain females at six months was substantial among non-Hispanics. Among the youths lost to the study at six months, 60% were females. Overall, the discriminant function resulted in 62% of the youth being successfully classified, with a slightly higher classification rate of 67% for those retained, and a lower rate (54%) for those who were not.

4. Discussions

Previous research has identified family, personal, and intervention characteristics as potential explanatory factors in treatment adherence and retention in behavioral interventions. Moreover, in some studies, the effects of these variables have been found to differ based on the ethnic and racial backgrounds of subjects. The goal of the present study was to test the relevance of these variables for understanding adherence and retention in teenage pregnancy prevention research, an approach that has been overlooked in the field. Family context variables, and in particular having a working mother, was associated with youths' completion of the intervention and retention at subsequent data collection points. This finding corresponds with prior research showing that among low- and moderate-income families, labor market and family pressures can negatively affect children's involvement in extracurricular activities [8,12,15,28].

Because the *PHAT-AO* was a strict replication of a previous evidence-based intervention, adapting the timing of the intervention to better align with the needs of families was not initially considered, although subsequent modification to the initial start time was done. The data did not allow us to determine why having a working mother was such a critical barrier to adherence and retention in the present study, nor could we identify whether working mothers were single parents as well. We speculate that the early starting time of the program, notwithstanding the availability of transportation and subsequent change in time, coupled with the fact that the intervention occurred on a Saturday, might have conflicted with competing family obligations [3].

The present findings also provided confirmatory support for studies in which the effects of intervention context on adherence and retention were significant. Not surprisingly, overall satisfaction with the various components of the intervention significantly predicted the likelihood of youth completing the intervention and being retained at six months; although for the latter outcome, once we introduced adherence as a covariate, its impact was lessened. There is a well-established body of literature documenting the importance of subjects' reactions to an intervention as a measure of implementation success. Although the brevity of the *PHAT-AO* provided minimal opportunity for bonding between youths and the project to occur over time, concerted efforts were made during implementation to promote a positive relationship between youth and the facilitators. In spite of this, the use of appointment reminders, extrinsic incentives, and so forth, retention remained problematic. In order to boost retention and adherence, future providers of brief teenage pregnancy interventions may consider some of the various approaches and models used to engage participants and families in other health fields. These include the Strategic Structural-Systems Engagement approach, which acknowledges resistance to treatment adherence and attrition as a natural process and incorporates

this acknowledgement into the program theory [29], and motivational interviewing, which continually addresses the ambivalence that subjects face regarding an intervention [30].

The influence of the various covariates in the study differed by ethnicity and culture. For example, youth personal characteristics were more important in explaining the decision to withdraw from the intervention among Hispanics as compared to non-Hispanics. Conversely, attitudes toward sex, both on the part of the youth (intention to have sex) and in terms of family sexual mores (disapproval of adolescent sex) figured prominently as reasons for non-Hispanics' withdrawal. Similarly, in addition to treatment adherence, gender was a critical discriminating variable for explaining retention at six months among non-Hispanics. For Hispanics, the critical discriminating variable was living with a working mother. An implication of these findings is that teenage pregnancy interventions targeting multi-ethnic communities should develop strategies that are sensitive to the unique culture of their diverse participants. Research has shown that the teen birth rates differ significantly among Hispanics, African-Americans, and Whites, with Hispanic females having the highest rates [27,31]. Further, Hispanic parents are less likely to discuss sex and reproductive health with their children than are parents from other ethnic groups [32,33].

Two other important findings in this study were (i) the complex relationship between adherence and retention and (ii) the inability of the models to generate comparable classification rates for non-completers and attritors to that observed for those who completed and those who were retained in the intervention at six months. It is clear that while treatment adherence and retention are related, they also measure different underlying behaviors, as evidenced by how they are differentially influenced by the variables in this study. This suggests that they should be treated as separate outcomes in future studies. Further, intervention providers should strategize on how best to address each factor individually. Finally, improving the classification rate for non-completers and attritors will require the identification of additional variables for inclusion in future models.

5. Conclusions, Limitations and Future Research

This study sought to fill a gap in the field of teenage pregnancy prevention, as there are few studies, if any, that have sought to predict youth who are most likely to complete an intervention and be retained in subsequent follow-ups. However, there are limitations to the study. First, as previously alluded to, we still do not have a thorough understanding of the reasons why some youth discontinued their participation. The use of qualitative techniques could have strengthened our understanding. Regarding family background, there were no measures of family structure, such as number of siblings, size of households, work patterns

of guardians/parents, head of household status, and so forth. The inclusion of these measures would have helped us to explore further the effects of working mothers on treatment adherence and retention. Additionally, we did not incorporate measures of religiosity and parenting styles—both of which could help to explain differences between Hispanics and non-Hispanics. Finally, given the low prevalence rate of sexual initiation in the present study, we were unable to determine if sexual activity was related to either retention or adherence. Therefore, we recommend that future studies consider including this variable as well as those that were omitted from the current study in their models. Notwithstanding these limitations, the present findings help to clarify why some youth who are at the greatest risk of having a child while still in their formative years are likely to participate and engage in interventions that seek to prevent such an occurrence from happening.

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