

International travel, contraceptive use, and sexual behavior:
A mixed methods study of female university students

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Dedication

This work is dedicated to the people who matter most: Dominick, Charlotte, and Elsa.

Abstract

Background

Adolescence and young adulthood are critical life stages for maintaining sexual and reproductive health (SRH), especially for women. There is a vast research literature dedicated to the determinants of young women’s SRH and related risk behaviors—e.g., contraception and condom use. While the factors influencing women’s SRH are broadly understood, it is less clear how risk mechanisms operate within specific contexts. Illuminating the unique settings that exacerbate or mitigate young women’s SRH risks could guide the development of more potent interventions.

This dissertation examines young women’s SRH in the context of international travel. Traveling to a foreign country precipitates an abrupt shift in women’s psychosocial, physical, and cultural environments that may, in turn, influence SRH risk behaviors. Existing studies focus on travelers’ sexual behaviors in predominantly European and clinic-based samples. Data for women are mostly limited to prevalence estimates. Notably, no published studies report on women’s use of contraception, other than condoms, during international travel. With few studies comparing travelers with non-travelers, it is also unclear whether SRH outcomes are attributable to travel itself or if high-risk individuals disproportionately engage in international travel.

Data Source

We conducted a mixed-methods study of female university students who had traveled outside the United States in the past three months (“Traveler”) or planned to do so in the next three months (“Pre-Traveler”). Participants had a history of sex with men and considered the United States their home country. For the quantitative study, Travelers, (n=340) and Pre-Travelers (n=170) completed a cross-sectional online survey about their SRH and recent or upcoming trip (“index trip”). In the retrospective portion of the survey, Travelers reported on their index trip and Pre-Travelers for a recent period of similar duration in the United States. The qualitative study consisted of in-depth, semi-

structured interviews with 25 Travelers and 19 Pre-Travelers. This dissertation is presented in three manuscripts, whose aims, methods, and results are described below.

Manuscript 1

Aim: To evaluate whether traveling internationally increases young women's risk of adverse SRH outcomes, compared to not traveling. *Methods:* Using multivariable modified Poisson regression, we estimated relative risk of contraceptive lapse (errors or non-adherence) and new male sexual partnership associated with international travel (Travelers) versus staying in the United States (Pre-Travelers). *Results:* During international travel, women were no more likely to lapse on their contraception (RR 1.05, 95% CI 0.83—1.32) but were 70% more likely to report a new male sex partner (RR 1.71, 95% CI 1.07—2.74).

Manuscript 2

Aim: To describe the prevalence and correlates of contraceptive lapse among young women during international travel. *Methods:* In this exploratory analysis of surveyed Travelers (n=340), we examined crude bivariate associations between contraceptive lapse and potential correlates in three domains: baseline/pre-travel variables, travel characteristics and experiences, and SRH-related travel variables. Correlates associated with lapse at $p < .20$ were evaluated using multivariable modified Poisson regression, including two sensitivity analyses restricted to pill users and women who had sex while traveling. *Results:* Prevalence of contraceptive lapse was 29% overall and especially high among pill users (50%) and travelers who had trouble communicating with male sex partners about contraception (57%). Multivariable correlates of lapse were: using the pill (RR 4.51, 95% CI 2.57—7.94) compared to other or no contraception; trip duration of >30 days versus 1-7 days (RR 2.02, 95% CI 1.14—3.57); having trouble communicating with a male sex partner about contraception (RR 1.79, 95% CI 1.16—2.75); a high perceived impact of language barriers (RR 1.77, 95% CI 1.02—3.08); and perceiving local access to abortion as difficult (RR 1.67, 95% CI 1.22—2.27). There was a trend toward increased lapse risk among participants who had difficulty maintaining their contraceptive schedule while traveling across time zones (RR 1.38, 95% CI 1.00—

1.91). Findings were generally similar in sensitivity analyses except for attenuation in the effect for pill use among sexually active travelers (RR 2.47, 95% CI 1.14—5.35).

Manuscript 3

Aim: To characterize the spectrum and antecedents of young women's sexual and contraceptive behaviors during international travel. *Methods:* We analyzed qualitative interview transcripts to identify themes related to: (1) Participants' pre-travel expectations of sex; (2) The circumstances surrounding their sexual encounters with men while traveling; (3) Negotiation of condoms and contraception with these sex partners; and (4) Facilitators and barriers affecting contraceptive adherence. *Results:* Participants frequently expected to be abstinent during travel, citing myriad rationales that included personal values, no perceived opportunities for sex, and the nature of the trip. Some Travelers had unexpected sexual encounters, which were typified by health-promoting behaviors but also by unprotected sex, substance use, and condom errors. New sexual partnerships were fueled by increased attention from men, situational disinhibition, and heightened intimacy among travel companions. We observed an array of contraceptive considerations brought on by international travel—e.g., procuring extra supplies, adjusting schedules, and maintaining use during air travel—and obstacles that triggered contraceptive lapses and discontinuation. The logistical requirements of travel magnified differences between contraceptive methods: challenges were most acute for pill users, while women with intrauterine devices appreciated their maintenance-free contraception.

Conclusion

Young women may be at higher risk of new sexual partnership during international travel, while contraceptive lapse is frequent in both travel and non-travel settings. During international travel, risk of contraceptive lapse varies by women's chosen contraceptive method as well as trip-specific factors. Pre-departure counseling by clinicians and other travel specialists should address travel-related barriers to women's contraceptive use, prepare women for the possibility of unexpected sexual encounters, and encourage behavioral strategies that prevent both unintended pregnancy and sexually transmitted infections.

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List of Abbreviations

BHS	Boynton Health Service
BSSS	Brief Sensation-Seeking Scale
CDC	US Centers for Disease Control and Prevention
EC	Emergency contraception
FDA	Food and Drug Administration
HPV	Human papillomavirus
IUD	Intrauterine device
LAC	Learning Abroad Center
SRH	Sexual and reproductive health
STI	Sexually transmitted infection
UK	United Kingdom
UMN-TC	University of Minnesota-Twin Cities
US	United States

Preface

The manuscripts presented in this dissertation were prepared independently for submission to peer-reviewed journals. As such, there is redundancy in content between the manuscripts and the introductory material in Chapter 1.

Chapter 1

Introduction

I. The Sexual and Reproductive Health of Young Women in the United States

Sexual and reproductive health (SRH) is especially salient during women's adolescence and early adulthood. Just over half (54%) of women in the United States are sexually active by age 18 and 74% are by age 20.¹ Major cultural shifts in marriage, cohabitation, and family formation have occurred over the past half-century. Women are postponing or forgoing marriage, are cohabiting more frequently outside of marriage, and are delaying their first birth (to age 26, on average).^{2,3} Taken together, these trends underscore why avoiding health risks associated with sexual relationships—namely, unintended pregnancies and sexually transmitted infections (STIs)—is paramount for young women who have sex with men. Indeed, epidemiological data indicate that adolescent and young adult women bear the brunt of these adverse outcomes.

A. Public health significance of unintended pregnancy and STIs in the United States

Public health entities⁴—and most sexually active people⁵—support the notion that pregnancy is best when planned. Yet, 45% of pregnancies in the United States are unintended at the time they are conceived and, despite indications of a decline from 2008-2011,⁶ this percentage has remained relatively stable over the past 20 years.⁷ In 2011, there were 2.8 million unintended pregnancies, or 45 per 1,000 women of reproductive age.⁶ About half of all US women have one by age 45.⁸ The consequences of unintended pregnancy are myriad: they disproportionately end in abortion, compromise the socioeconomic well-being of families, and are associated with poor outcomes for mothers and children including delayed prenatal care, prenatal substance use, low birthweight, maternal depression, and children's poor mental health.^{9,10} The sequelae of unintended births are particularly acute for parenting youth whose educational and vocational trajectories are hindered by childrearing responsibilities.¹¹

The impact of STIs on individuals and society is often underappreciated due to the stigma surrounding them. HIV remains incurable despite therapeutic advances that have stemmed morbidity and mortality. Other viral STIs such as herpes simplex virus and human papillomavirus (HPV) also have potential life-long effects. HPV is responsible for nearly all cases of cervical cancer, 95% of anal cancers, 70% of oropharyngeal cancers, 65% of vaginal cancers, 50% of vulvar cancers, and 35% of penile cancers.¹² When left untreated, bacterial STIs such as chlamydia can cause pelvic inflammatory disease, ectopic pregnancy, and tubal infertility.¹³ During pregnancy, STIs carry risk of miscarriage, stillbirth, premature birth, low birthweight, and neonatal infections.^{14,15} The financial costs of STIs are considerable—\$15.6 billion for the 19.7 million Americans diagnosed in 2008.¹⁶ HIV accounted for more than 80% of those costs.

B. Descriptive epidemiology of unintended pregnancy and STIs in the United States

Adolescence and early adulthood are peak risk periods for adverse SRH outcomes. The proportion of pregnancies that is unintended is highest among 18- to 19-year-old women (76%) and also higher among women ages 20-24 (59%) relative to the national average (**Table 1**).⁶ These proportions are also disproportionately high among cohabiting women (56%) or never-married, non-cohabiting women (81%) compared to married women (24%).⁶ National incidence rates of unintended pregnancy are also highest among women ages 18 to 29, and 20-29 year-old women contribute the greatest volume of unintended pregnancies.⁶ The epidemiology of unintended pregnancy is also

Table 1. Incidence of unintended pregnancy and sexually transmitted infections among women by age, United States

Age:	Unintended pregnancy—2011 ⁶		Chlamydia—2015 ¹⁷	Gonorrhea—2015 ¹⁷
	% of all pregnancies	Rate per 1,000	Rate per 100,000	Rate per 100,000
15-19	75%	41	2,994	442
15-17	72%	20	--	--
18-19	76%	71	--	--
20-24	59%	104	3,730	547
25-29	42%	76	1,619	302
TOTAL ^a	45%	45	646	107

^aDenominator includes US women ages 15-44 for unintended pregnancy and all ages for STIs.

notable for significant disparities by income and race/ethnicity. Rates for African American women exceed whites at all income levels.⁶ At the same time, rates for women living below the federal poverty level exceed 90 per 1,000 in all racial/ethnic categories.⁶

The US Centers for Disease Control and Prevention (CDC) estimates that youth ages 15 to 24 account for 50% of the nation's incident STIs.¹⁸ In 2008, this amounted to 9.8 million cases of chlamydia, gonorrhea, syphilis, herpes, HPV, hepatitis B, HIV, and trichomoniasis among young people.¹⁹ The morbidity of chlamydia and gonorrhea infections is particularly high for young women (**Table 1**). In 2015, 29% of reported chlamydia cases among women were in 15-19 year-olds and 57% were among women in their twenties; proportions were similar for gonorrhea.¹⁷ For both infections, incidence rates among young women are many times greater than the overall rate.

C. Key determinants of young women's sexual and reproductive health

There is a voluminous literature dedicated to the determinants of young women's SRH. Like other aspects of human health, SRH is multifactorial.

In the 1970s, Bronfenbrenner articulated an "ecology of human development" wherein multiple levels of the social environment interact to shape an individual's behavior.²⁰ His seminal work has inspired many iterations of the ecological or "social ecological" model, which public health practitioners are increasingly using to understand health behaviors and design effective interventions,²¹ including for SRH.²²⁻²⁴

We propose a social ecological framework to illustrate the key domains and factors affecting young women's SRH (**Table 2**). Each factor influences the likelihood of one or more SRH outcomes—sex with male partners, contraception use, condom use, acquiring STI, becoming pregnant, or having an abortion. Below, we briefly summarize the literature pertaining to these determinants, with select citations.

Policy. The policy landscape includes many potent factors that govern the legality, availability, and accessibility of SRH services. First, funding allocated through the federal budget supports SRH programs dedicated to prevention, diagnosis, and treatment. Publicly funded programs including Medicaid and Title X helped avert an estimated two million unintended pregnancies, one million unintended births, and nearly

700,000 abortions in 2010.²⁵ Second, federal and state laws affect women’s access to contraception. As of January 2013, the contraceptive coverage mandate under the Affordable Care Act requires insurance plans to cover the full range of contraceptive drugs and devices approved by the US Food and Drug Administration (FDA) without co-pays. An evaluation of state laws from 1998-2010 found that insured women in states requiring coverage of FDA-approved contraceptives were significantly more likely than women in other states to be using effective contraception; no association was found for uninsured women.²⁶ Third, policies define the conditions under which women access the SRH services they desire. Women who wish to use a hormonal method of contraception (e.g., the pill) must first visit a healthcare provider and obtain a prescription. Providers, researchers, and legislators have argued that this requirement constitutes a barrier to

Table 2. Key determinants of young women’s sexual and reproductive health*

Policy Factors	<ul style="list-style-type: none"> Laws defining legality and accessibility of SRH services Public funding for SRH services Coverage of SRH services by health insurance plans Drug and device regulations
Community Factors	<ul style="list-style-type: none"> Cultural norms Religious teachings Media messages Formal education systems Availability and cost of SRH services
Interpersonal Factors	<ul style="list-style-type: none"> Peer and family norms Parental monitoring Encounters with healthcare providers <p><i>Male sex partners:</i></p> <ul style="list-style-type: none"> Relationship duration, level of commitment, concurrency Communication & cooperation in contraceptive use Contraceptive knowledge, skills, & attitudes Biological: Fertility, infection status
Individual Factors	<ul style="list-style-type: none"> Biological: Age, fertility, cervical ectopy, immune status, comorbidities Contraceptive knowledge, skills, & attitudes Substance use Values and religiosity Health insurance Financial resources

*Outcomes=having sex with men, using contraception/condoms, pregnancy, STI, and abortion.
 EC=emergency contraception; SRH=sexual and reproductive health; STI=sexually transmitted infection.

access and that pharmacists and self-screening checklists can ensure women's safety.^{27,28} Fourth, abortion is one of the most controversial and legislated medical procedures in the United States. Federal and state laws address every facet of abortion care including the gestational limits for procedures, clinicians' counseling scripts, and the width of facilities' hallways.²⁹ Lastly, there are regulatory policies affecting SRH services. Drugs, medical devices, and diagnostic tests are regulated under the FDA and undergo extensive review before being approved for market distribution. While health risks are sometimes identified during post-market surveillance, these processes help ensure the safety and effectiveness of SRH services that women access through clinics or retail locations.

Community. This level considers women's physical and social environments (beyond peers and families, described below). First, whether defined by geography, cultural identity, or something else, all communities have norms that delineate sanctioned behaviors. Within religious communities, norms are often conveyed explicitly in teachings about sex, contraceptive use, and abortion. Other norms are not easily attributable to a source, but are nonetheless widely recognized and often reinforced in the media (e.g., gender roles, premarital sex). In studies of US adolescents, community norms exert independent effects on SRH risk behaviors.^{30,31} Second, formal education systems foster the literacy and numeracy skills that women use to make SRH decisions. Lastly, healthcare providers are a vital community resource for sexually active young women. The affordability, convenience, breadth, and quality of SRH services offered in a woman's community serve to catalyze her contraceptive intentions.³²⁻³⁴

Interpersonal. Influential members of women's social spheres include peers, family members, and healthcare providers. Norms within peer groups and families are strong predictors of youth's decisions regarding sex, contraception, and abortion.^{24,34,35} Parental monitoring is linked to delays in sexual debut and adolescents' lower STI risk; it's unclear whether parental effects persist into early adulthood.²⁴ Healthcare providers are a primary source of information for young women during visits for primary care, contraception, and STI services.³⁶ Provider counseling fosters the many prevention behaviors that undergird women's sexual and reproductive well-being.^{32,34}

Sex is a dyadic event that involves male partners in several ways. First, an eligible sexual partner must exist in a woman's social network. Second, women cite partner

preferences as one factor affecting their decision to have unprotected sex.³⁴ Women's contraceptive choices also depends on relationship factors such as duration, level of commitment, and concurrency (vs. monogamy).³⁷ In newer or less committed partnerships, women are more likely to use condoms because they provide simultaneous protection against pregnancy and STIs. As relationships become more serious, pregnancy prevention becomes the dominant motivation and couples trade condoms for more effective contraceptive methods.³⁷ Third, sex-dependent contraceptive methods such as condoms and withdrawal depend on successful communication with, and cooperation from, male partners. Fourth, new partners are predictive of incident STIs in longitudinal studies of female adolescents³⁸ and university students.³⁹ Preventing pregnancy and STIs requires communication, negotiation, and trust between partners—qualities that may be lacking in a new partnership. Lastly, there are biological characteristics: infertile and STI-negative partners eliminate the risk of pregnancy and STI acquisition, respectively.

Individual. Several individual-level factors relate to biology. First, sexual initiation is a developmental milestone that becomes increasingly probable with age. In a nationally representative survey conducted in 2009, only 6% of 14 to 15 year-old females reported vaginal sex in the past month compared to 62% of 20 to 24 year-olds and 74% of women ages 25 to 29—the highest percentage by age category.⁴⁰ Trajectories of sexual risk also accelerate through adolescence and peak in the early 20s.^{41,42} Second, women in their 20s are at peak fertility, having achieved menstrual regularity but not yet experienced age-related fertility declines.⁴³ Third, young women are more likely to have cervical ectopy, a hormonally mediated phenomenon hypothesized to facilitate STI acquisition.⁴⁴ Fourth, women's immune status affects their susceptibility to infection. Those who receive the bivalent or quadrivalent HPV benefit from virtually complete (95%) protection.⁴⁵ However, women are at risk of re-infection from bacterial STIs because they confer no long-term immunity. Lastly, women's co-morbidities affect their medical eligibility for specific contraceptive methods,⁴⁶ and their decisions to continue using a given method highly depend on which side effects they experience.³⁴

Women's contraceptive knowledge, skills, and attitudes influence which method(s) they select and how well they adhere to that method(s).³² Method choices carry significant implications for pregnancy and STI prevention. Nearly 7 in 10 US women

aged 15-24 who use contraception rely on either the pill or condom, methods that require high behavioral compliance and are thus prone to user error.⁴⁷ Only 0.3% of women will become pregnant with a year of perfect pill use, but 9% will under scenarios of “typical” use.⁴⁸ The gap in effectiveness between perfect and typical use is even greater for condoms (2% vs. 18%).⁴⁸ Furthermore, women dissatisfied with pills or condoms are less likely to use them consistently.⁴⁹ In a cohort study of family planning clinic patients, women who initiated long-acting reversible contraception (intrauterine device or implant)—methods requiring no ongoing behaviors—had significantly higher rates of 12-month continuation and satisfaction compared to women who started the pill, patch, or ring.⁵⁰ Women’s expectations and preparations also influence whether they use any method: running out of supplies, not having contraception on hand, and not expecting to have sex are associated with engaging in unprotected sex.³⁴

Other miscellaneous factors round out this level of our framework. First, substance use is known to impair decision-making and is often implicated in youth’s risky decisions. However, its causal relationship with sexual risk-taking (e.g., unprotected sex) and SRH outcomes remains unclear.⁵¹⁻⁵³ Second, normative influences from the community and interpersonal domains are filtered through a woman’s moral-ethical framework and the depth of her religious beliefs. Lastly, access to SRH services depends on women’s insurance status and their personal financial resources.

II. International Travel as a High-Risk Context for Young Women’s Sexual and Reproductive Health

A. Increasing prevalence of international travel

International travel is increasingly popular among US residents. In 2016, over 68 million trips originated from the United States, an 8% increase over 2013.⁵⁴ Travel to Mexico or Canada comprised 56% of these trips, with destinations outside of North America accounting for the remainder. In a 2015 survey of international travelers conducted by the US Department of Commerce, 53% reported vacation as their primary purpose, 27% visiting friends or relatives, and 10% business or convention travel.⁵⁵ Women comprised 50% of all travelers, up from 39% in 2000.⁵⁶

For youth, one popular form of international travel is studying abroad. In the 2014-2015 academic year, 314,515 US students studied abroad for academic credit and 22,181 traveled internationally for work, internships, or volunteering.⁵⁷ The number of students participating in study abroad programs has more than tripled over the past 20 years.⁵⁷

B. Clinical perspectives on the health risks of international travel

Traveling to another country brings unique health considerations. The CDC's Travel Health website, a popular resource for expectant travelers and healthcare providers, makes recommendations for managing travel health risks based on destination.⁵⁸ Travelers with "more complex itineraries or...health problems" are advised to seek care from a travel medicine clinic prior to their departure for vaccinations, prophylactic medications, and counseling on how to stay healthy during travel.⁵⁸ Many travel risks are infectious in nature—e.g., malaria, rabies, yellow fever, and pathogens transmitted through food and water—but others include sunburn, altitude sickness, motor vehicle accidents, drowning, and violence.

Over the past two decades, the SRH risks of international travel have garnered increasing concern. Clinical practice guidelines for travel medicine frequently emphasize pre-departure counseling on STI prevention.⁵⁹⁻⁶¹ In comparison, unintended pregnancy has received considerably less attention as a travel health concern. The CDC's Travel Health website did not explicitly address pregnancy prevention or contraceptive counseling until the spread of Zika virus in 2016; even then, recommendations center on pregnant women, couples planning to conceive, and travelers to Zika-endemic regions.⁶² In their more extensive "Yellow Book" written for travel medicine health professionals, the CDC urges providers to "caution the traveler to avoid activities that can lead to [STIs], unwanted pregnancy, or bloodborne infections" and "remind travelers to use condoms if they have sex."⁶¹ Yellow Book recommendations do not include assessment of female travelers' current contraceptive methods or the adequacy of their contraceptive supplies for the trip's duration. However, some clinical practice articles⁶³⁻⁶⁵ and a textbook on travel medicine⁶⁶ underscore the importance of contraceptive counseling

during the travel medicine visit. Commentaries by Glasier⁶⁷ and Patton⁶⁸ in 1999 advocate for advanced provision of EC as a critical health service for female travelers.

C. Potential impact of international travel on young women’s sexual and reproductive health

We posit that SRH determinants take on a unique structure in the context of international travel and amplify some of the risk pathways we described above for women’s routine (non-travel) settings. While some elements of the conceptual framework in **Table 2** carry forward to the travel context—e.g., women’s contraceptive knowledge—travel may introduce many novel factors (**Table 3**), particularly at levels above the individual. We highlight some potential, travel-specific influences below.

Policy. Nations have unique policy infrastructures and SRH laws are particularly variable between countries.⁶⁹ Travelers may not be able to access the SRH services they are accustomed to in the United States. Abortion is essentially legal throughout most of Western Europe, Australia, and Central Asia, but highly restricted in other regions.⁷⁰ Foreign countries might also lack regulatory structures for monitoring the safety of drugs and devices, both pre- and post-market. The CDC warns travelers of the potential for counterfeit medications abroad.⁷¹ Thus, even when locally accessible, SRH supplies (e.g., contraception and condoms) may be of questionable safety and effectiveness. Laws regarding drugs and alcohol are also relevant, for example: which substances are legal; the age at which they can be purchased and consumed; and the locations and times they are sold. More permissive substance laws, such as minimal legal drinking ages of 16-18 throughout Europe,⁷² may foster substance use and relatedly, sexual risk-taking. Lastly, travelers may have difficulty accessing local SRH services due to coverage (or lack thereof) under their health insurance plans.

Community. International travelers are often immersed in environments that are starkly different from their home country. First, cultures with more permissive norms around casual sex and substance use may encourage travelers to engage in riskier behaviors. Second, women who need SRH services while traveling are affected by their availability and cost. For women traveling to remote or underdeveloped areas, access to services may be hampered by poor transportation infrastructures. Third, crime—a

Table 3. Potential determinants of young women’s sexual and reproductive health in the context of international travel*

Policy Factors	Local laws regarding SRH services and substance use Local regulatory policies for drugs and devices Coverage of international SRH services under health insurance plans
Community Factors	Cultural norms regarding SRH, gender roles, and substance use Local healthcare infrastructure Local transportation infrastructure Local crime rate Local STI/HIV prevalence
Interpersonal Factors	Social network during travel Degree of autonomy / supervision Encounters with US and local healthcare providers <i>Male sex partners:</i> Language Norms regarding SRH and gender roles Relationship timeline Sexual assault
Individual Factors	Perceptions of anonymity, liminality, disinhibition Substance use during travel Pre-travel expectations and preparations Shifts in daily routines Knowledge of local SRH resources Biological: Menstrual cycle regularity, travel illness

*Outcomes=having sex with men, using contraception/condoms, pregnancy, STI, and abortion. EC=emergency contraception; SRH=sexual and reproductive health; STI=sexually transmitted infection.

concern for any international traveler—may include theft of luggage or purses that contain women’s contraceptives. Lastly, local STI/HIV prevalence affects women’s risk from having sex with a local partner. During travel, women may be exposed to pathogens that are not endemic to the United States.

Interpersonal. International travel might also change the composition of women’s immediate social environments. Travelers’ social networks—traveling companions, new acquaintances, and perhaps local residents—are potential sexual networks. Young female travelers with more autonomy may have more opportunities for exploring sexual partnerships compared to women on highly supervised trips. Both US travel medicine providers and healthcare providers in the travel destination can potentially influence women’s contraceptive use while abroad. Local providers’ counseling messages about SRH and management of SRH conditions may depart from practices in the United States.

As with SRH in general, travel sexual partners can be expected to play a prominent role in women's SRH. Unique aspects of travel partnerships include possible language barriers as well as discrepant norms regarding partners' roles and responsibilities in preventing pregnancy and STIs. Qualitative research with female leisure travelers suggests a role for "time compression" in the rapid intensification of travel partnerships.^{73,74} Compressed courtships may not engender the familiarity, trust, and rapport that underlie couples' pregnancy and STI prevention practices. Unwanted sexual experiences are also a risk while traveling abroad.^{75,76}

Individual. First, we consider the psychosocial environment of international travel. Travel is frequently a novel and exciting experience that provides an escape from the demands of everyday life. Researchers have conceptualized the psychological state of travel as one of "situational disinhibition,"^{77,78} "the relaxation of social and moral constraints,"⁷⁹ liminality,⁸⁰ and anonymity.⁸¹ These conditions may cause travelers to engage in behaviors—e.g., casual sex, unprotected sex, substance use—that they ordinarily would not. Indeed, fun and relaxation are often the primary motivation for taking a trip overseas. Second, travelers' preparedness with contraceptive supplies depends on whether they expect to be sexually active. Third, long travel itineraries and restructuring of daily routines may disrupt women's pill-taking schedules. Fourth, even travelers with high contraceptive knowledge and self-efficacy may not know where to find SRH services locally. Timely access to EC is critical for travelers who have unprotected sex and want to avoid pregnancy. Finally, we consider biological factors specific to travel. Flying across multiple time zones disrupts travelers' circadian rhythms, resulting in jet lag⁸² and potentially, changes in the menstrual cycle.⁸³ Diarrhea and vomiting, common complaints among international travelers,⁶⁰ may decrease the absorption and efficacy of contraceptive pills.⁸⁴

D. Empirical findings related to women's sexual and reproductive health during international travel

We reviewed the literature for any quantitative studies examining any of six SRH outcomes among populations of female international travelers: **new sexual partnership**, **unexpected sex**, **unprotected sex** (inconsistent or no condom use), **contraceptive use**,

unintended pregnancy, and STI acquisition. We included studies that reported the **prevalence** or **correlates** of these outcomes, as well as those evaluating international travel as a **risk factor** (i.e., comparing travel with non-travel.) Our search yielded 38 articles⁸⁵⁻¹²¹ representing 34 samples of women and a 2010 meta-analysis⁷⁹ that pooled data from 15 of these samples. Studies reporting prevalence and correlates, the most frequently reported estimates, are summarized in **Tables 4 and 5**, respectively. Most studies include both genders, but we only feature data for women in the tables. These findings consist mostly of unadjusted prevalence estimates because many authors pool male and female travelers in their analyses of SRH correlates. The literature is comprised of predominantly European samples recruited from STI clinics, hostels, and other high-risk settings. Only one study was based on a sample of exclusively US residents (Peace Corps volunteers).¹¹³ We summarize the evidence below, mostly just for women, but we highlight select results derived from combined samples of male and female travelers.

New sexual partnership. New sexual partnership is the most commonly reported outcome. A few studies report on “casual” partners, but usually include new partners in their definitions. Pooling data from 13 studies of female travelers, Vivancos et al. estimate a prevalence of 19.5% (95% CI 12.4–27.8%). The wide range in estimates—from 2% to 62%, including 11 studies not featured in the meta-analysis—reflects the heterogeneity in sample characteristics. Studies also vary in their prevalence calculations. For example, some include women with regular partners (a low-risk group for new partnerships) or do not describe the relationship status of their sample. Others count non-travelers in their denominators when calculating prevalence of new travel sex partners among clinic attendees or population-based samples.^{86-88,94,98,100,117} The studies also vary in the type of travel considered—for instance, any in past 12 months versus a single trip.

Seven studies report correlates of women’s new travel partnerships and all control for one or more variables in their analyses. Three of these studies^{87,98,117} use long reference periods for travel (lifetime or past 5 years), consider correlates that might have occurred after travel, and feature non-travelers in their reference groups. In the remaining, higher-quality studies examining more recent travel,^{102,109,114,116} the most consistent correlates are younger age and having a pre-travel expectation of sex. Analyses of mixed-gender samples identify the following statistically significant ($p < .05$) positive

Table 4. Summary of studies reporting prevalence of sexual and reproductive health outcomes among female international travelers

Citation	Design	Sample	Travel type	Results
Vivancos 2010 ⁷⁹	Meta-analysis	15 studies of women's sexual behavior during foreign travel	Various	New sex partner: 20%, 95% CI 12-28% (pooled from 13 studies) ^a <ul style="list-style-type: none"> Unprotected sex: 62%, 95% CI 53-71% (pooled from 4 studies)^a
INCLUDED IN VIVANCOS ET AL:				
Abdullah 1998 ⁸⁵	Cross-sectional	86 women departing Hong Kong airport. Ages 18-65. ^b 57% married. ^b 27% Chinese, 55% Caucasian. ^b	Any in past 12 months; destination N/S	New sex partner (stranger ^c): 41%
Arvidson 1996, ⁸⁶ 1997, ⁸⁷ Mardh 1996 ⁸⁸	Cross-sectional	996 family planning clinic patients in Sweden. Mean age=26. Relationship status during travel N/S.	Lifetime; destination N/S	New sex partner: 28% ^a Positive STI test: Any (26%), HPV (11%), chlamydia (10%)
Batalla-Duran 2003 ⁸⁹	Cross-sectional	70 UK residents departing Tenerife airport in 2002. Ages 15-62 (mean: 30). ^b 51% in a relationship.	Recent trip to Tenerife	New sex partner: 39%
Bellis 2004 ⁹⁰	Cross-sectional	661 UK residents departing Ibiza airport. Ages 16-35. 24% traveled with regular partner. ^b	Recent trip to Ibiza	Any sex partner: 54% <ul style="list-style-type: none"> Unprotected sex: 43%
Bloor 1998 ⁹¹	Cross-sectional	Population-based sample of 392 UK residents ages 18-34 ^b who traveled without a partner.	Any in past 2 years; destination N/S	New sex partner: 4% <ul style="list-style-type: none"> Unprotected sex: 25%
Carter 1997 ⁹²	Cross-sectional	112 STI clinic patients in Glasgow. Ages 17-55 (mean: 26). 34% traveled with partner. ^b	Any in past 3 months; 74% Western Europe*	New sex partner: 20% <ul style="list-style-type: none"> Unprotected sex: 50%
Croughs 2008 ⁹³	Cross-sectional	1,049 travel clinic patients in Belgium. Ages 16-50 (mean: 29). ^b 61% traveled with partner. ^b	Recent trip ≤4 weeks long; 31% Africa, 23% Asia, 21% Turkey*	New sex partner: 2% <ul style="list-style-type: none"> Unprotected sex: 71% Unexpected sex: 75%
Daniels 1992 ⁹⁴	Cross-sectional	116 STI clinic patients in the UK. Ages 18-64 (mean: 27). Relationship status during travel N/S.	Any in past 6 months; various destinations	New local sex partner: 9% ^a <ul style="list-style-type: none"> Unprotected sex: 75%

Table 4. Summary of studies reporting prevalence of sexual and reproductive health outcomes among female international travelers

Citation	Design	Sample	Travel type	Results
Hawkes 1994 ⁹⁵	Cross-sectional	303 tropical medicine clinic patients in the UK. Mean age: 29. Relationship status during travel N/S.	Most recent trip in past 2 years; various destinations	New sex partner: 16%
Hawkes 1995 ⁹⁶	Cross-sectional	199 STI clinic patients in the UK. Mean age: 30. ^b 72% single. ^b	Recent trip in past 3 months; destination N/S	New sex partner: 18%
Mendelsohn 1996 ⁹⁷	Cross-sectional	216 STI clinic patients in the UK. Ages 17-45 (median: 25). ^b Relationship status during travel N/S.	Any in past 6 months; 72% Europe	New sex partner: 19% • Unprotected sex: 58%
Mercer 2007 ⁹⁸	Cross-sectional	Population-based sample of 6,399 UK residents sexually active in past 5 years. Ages 16-44. ^b Relationship status during travel N/S.	Any in past 5 years; various destinations	New sex partner: 7% ^a
Nemoto 2007 ⁹⁹	Cross-sectional	132 Japanese tourists, students, and temporary workers. Ages 18-59. ^b 15% married. ^b	Past 12 months in Hawaii	New sex partner: 19%
Tveit 1994 ¹⁰⁰	Cross-sectional	188 STI clinic patients in Norway. Age N/S. Relationship status during travel N/S.	Any in past 5 years; various destinations	New sex partner: 34% ^a
Davies 2011 ¹⁰¹	Cross-sectional	207 backpackers staying in Australian hostels. Ages 18-30 (median: 23). 87% European. ^b 17% traveling with regular partner.	Current, including to Australia (median: 4 months)	New sex partner: 62% • Unprotected sex: 61% Positive for chlamydia: 3%
de Graaf 1997 ¹⁰²	Cross-sectional	230 Dutch expatriates. Mean age=37. 35% single.	Recent long-term (>2 years) post to countries with high HIV prevalence	New sex partner: 17% Unprotected sex: 16-19% by partner type
Egan 2001 ¹⁰³	Cross-sectional	231 backpackers from 33 countries. Ages 15-34. ^b 58% in relationship with partner back home.	Current trip to Canada	New sex partner: 20% Last travel sex unprotected: 41%
Gagneux	RCT	541 travel clinic patients in Switzerland. Age<35.	Recent trip; 40% sub-	Casual sex partner: ^d 4%

Table 4. Summary of studies reporting prevalence of sexual and reproductive health outcomes among female international travelers

Citation	Design	Sample	Travel type	Results
1996 ¹⁰⁴		Relationship status during travel N/S.	Saharan Africa, 36% Asia*	• Unprotected sex: 54%
Hughes 2009 ¹⁰⁵	Cross-sectional	340 UK backpackers staying in hostels. Ages 18-35 (51% 21-24 years old). 21% traveling with long-term partner. ^b	Current travel in Australia (>2 weeks)	Unprotected sex: 46%
Kaehler 2013 ¹⁰⁶	Cross-sectional	148 backpackers from Western Europe, North America, and Australia. Ages 18-63 (mean: 27). ^b Unmarried.	Current travel in Thailand	New sex partner: 12% • Unprotected sex: 25%
Lewis 2016 ¹⁰⁷	Cross-sectional	684 backpackers (77% from Europe) departing on boats to Thai islands. Ages 17-44. All single.	Current travel in Thailand	New sex partner: 29% • Unprotected sex: 37%
Martin 2012 ¹⁰⁸	Cross-sectional	80 German volunteers who had completed international service project. Ages 18-30. ^b Relationship status during travel N/S.	Post for ≥ 6 months, 65% to Latin America*	Unintended pregnancy: 3% (n=2)
Maticka-Tyndale 1998 ¹⁰⁹	Cross-sectional	375 Canadian college students on Spring Break. Ages 18-30. ^b 35% in long-term relationship.	Current or recent 1-week trip to US	New sex partner: 13% Pre-travel intention of new sex partner: 11%
Matteelli 2013 ¹¹⁰	Cross-sectional	31,574 patients seen at 52 global surveillance clinics for STI evaluation. Relationship status during travel N/S.	Current or recent travel; various destinations	Test positive for STI: 0.4%
McNulty 2010; ¹¹¹ Wand 2011 ¹¹²	Cross-sectional	2,937 backpackers ^e attending Australian STI clinic. Mean age: 25. 5% married or cohabiting.	Current travel in Australia	Unprotected sex in past 3 months, if sexually active: 75% STI positivity: 5% chlamydia, 9% genital warts, 4% herpes

Table 4. Summary of studies reporting prevalence of sexual and reproductive health outcomes among female international travelers

Citation	Design	Sample	Travel type	Results
Moore 1995 ¹¹³	Cross-sectional	720 randomly sampled US Peace Corps volunteers in 28 countries. 75% under age 30. Not married or cohabitating.	Current long-term travel on Peace Corps mission	New sex partner: 60%
Ragsdale 2006 ¹¹⁴	Cross-sectional	128 tourists in Costa Rica. Ages 18+ (52% <23 years). Single and not traveling with men.	Current travel in Costa Rica for <3 months	New sex partner: 47% <ul style="list-style-type: none"> • If sex expected pre-travel: 62% • If sex not expected pre-travel: 32%
Senn 2011 ¹¹⁵	RCT	594 travel clinic patients in Switzerland. Ages 18-44. ^b Not traveling with regular partner.	Single trip; destination N/S	New sex partner: 14%
Sundbeck 2016 ¹¹⁶	Cross-sectional	Population-based sample of 464 Swedish residents reporting sex during recent travel. Ages 18-29.	Most recent trip in past 12 months	Casual sex partner: ^f 19% <ul style="list-style-type: none"> • Last sex unprotected: 59%
Tanton 2016 ¹¹⁷	Cross-sectional	Population-based sample of 6,399 UK residents sexually active in past 5 years. Ages 16-74. Relationship status during travel N/S.	Any in past 5 years	New sex partner: 11% (ages 16-34), 2% (ages 35-74) ^a
Whelan 2013 ¹¹⁸	Cohort	365 travel clinic patients in The Netherlands. Median age: 25. Relationship status during travel N/S.	Trip lasting 3-12 months; 31% Southeast Asia, 30% South America ^b	Casual sex partner: ^g 32%

^aDenominator includes non-travelers. ^bCharacteristic refers to combined sample of men and women. ^cLocal resident, other tourist, or sex worker. ^dSomeone other than a steady partner. ^eForeign born, lived outside of Australia for most of past 5 years, and been in Australia for <2 years or self-identifies as "traveler." ^fPrevious partner, friend, casual contact, commercial sex partner, or other non-regular partner. ^gAs defined by participant. CI=confidence interval, N/S=not specified, STI=sexually transmitted infection, UK=United Kingdom, US=United States.

Table 5. Summary of studies reporting correlates of new sexual partnership or unprotected sex among female international travelers

Citation ^a	Correlates: New sexual partnership	Correlates: Unprotected sex
Arvidson 1996, ⁸⁶ 1997; ⁸⁷ Mardh 1996 ⁸⁸	Current substance use, higher education, history of abortion/STI, current HPV infection, parity. Adjusted for age. ^b	
Bloor 1998 ⁹¹		Local sex partner, multiple travel sex partners, no pre-travel expectation of sex, did not carry condoms, received health advice from family vs. healthcare provider. Mutually adjusted in model.
de Graaf 1997 ¹⁰²	Younger age, pre-travel expectation to have sex, single at departure. (NS: Destination, duration, HIV prevalence at destination, and feeling lonely, challenged, homesick, bored, or freedom during trip). Adjustment variables not specified	Not carrying condoms. (NS: Age, urbanization, duration, pre-travel intention to have sex, relationship status at departure, destination, HIV prevalence at destination, number of casual travel partners, alcohol use prior to or during travel sex, subjective attitudes toward sex.) Adjustment variables not specified.
Maticka-Tyndale 1998 ¹⁰⁹	Proportion of peers who had sex, peer pact to have casual sex. Adjusted for prior sexual behavior and intentions.	
Mercer 2007 ⁹⁸	Age <25, unmarried, and SRH in past 5 years (greater number of partners, sex with women, STI diagnosis, HIV test). Adjusted for other sociodemographic characteristics. ^b	
Moore 1995 ¹¹³		Older age, higher number of sex partners, high perceived personal risk of HIV. Adjusted for trip duration, substance use, and perceived severity of HIV risk in host country.
Ragsdale 2006 ¹¹⁴	Pre-travel expectation to have sex, annual income <\$10,000. Adjusted for sexual impulsivity and travel companions (NS: Age, education, ethnicity, student status, condom attitudes, alcohol	

Table 5. Summary of studies reporting correlates of new sexual partnership or unprotected sex among female international travelers

Citation ^a	Correlates: New sexual partnership (use, previous sexual risk behavior.)	Correlates: Unprotected sex
Sundbeck 2016 ¹¹⁶	Age<25, trip duration ≥1 month, heavy drinking or drug use during trip. Adjusted for parental education and self-rated mental health. ^c	Age<25 and trip duration ≥1 month. Adjusted for parental education, self-rated mental health, and heavy drinking and drug use during trip. ^c
Tanton 2016 ¹¹⁷	Age <25, unmarried, and SRH in past 5 years (greater number of sex partners, partner concurrency, STI diagnosis, HIV test). Adjusted for other sociodemographic characteristics.	

^aRefer to Table 4 for full description of study characteristics. ^bReference group includes non-travelers. ^c“Casual” partner: Previous partner, friend, casual contact, commercial sex partner, or other non-regular partner. NS=not statistically significant, STI=sexually transmitted infection, UK=United Kingdom.

correlates for having a new travel sex partner: younger age;^{85,89,91,118,122,123} being single, traveling alone, or traveling without a steady partner;^{91-93,96,104,118,124} longer duration of travel;^{91,95,103,106,113,122-126} pre-travel expectations to have sex,^{91,93,103,115,122} take condoms,¹¹⁵ or use condoms;¹⁰³ bringing condoms on the trip;^{91,103} alcohol intake during travel;^{91,126,127} prior travel to the destination;^{104,106} pre-travel history of “casual sex”;^{91,93,103,104,115} number of lifetime casual sexual partners;¹⁰³ and number of partners in the 12 months before travel.¹²⁶ Two studies find higher prevalence of new sexual partners among men or women traveling for leisure versus other reasons,^{91,93} while others identify business travel as higher risk⁹² or find no significant differences by travel purpose.¹²⁸

Very few studies address whether new sex partnership is more likely during travel versus home. In the only study to look at women, Sundbeck et al. use a case-crossover design with a sample of Swedish women to partition women’s past 12 months into time spent abroad and time at home.¹²⁰ They observe a five-fold increased risk of casual sex associated with international travel (IRR 5.31, 95% CI 4.27—6.60). Two cross-sectional studies ask women to retrospectively report their pre-travel behaviors, which they then compare with travel behaviors.^{99,100} These studies are vulnerable to considerable recall bias and report inconsistent findings. A more rigorous cohort study by Vivancos et al. examines the sexual behavior of 427 male and female college students in the UK. Compared to students who are in the UK over summer break, those who travel abroad are 2.5 times more likely to have a new sexual partner (adjusted RR=2.06, 95%CI 1.10-6.06).¹²¹ However, the authors do not provide results stratified by sex.

Unexpected sex. Three studies examine unexpected sex for female travelers. Among travel clinic attendees in Belgium, 75% of women with new travel partners had not expected to have sex on their trip (a statistically significantly higher proportion compared to men).⁹³ In the second sample of single women visiting Costa Rica, new sex partners are more common among those who had anticipated having sex, but nearly one-third of women who had no expectations report a new travel sex partner.¹¹⁴ In the last study, Canadian university students traveling on Spring Break report new sexual partnerships at a similar level to their pre-travel expectations (13% vs. 11%, respectively).¹⁰⁹ In mixed-gender samples, between 33%¹⁰³ and 55%¹²⁹ of travelers with new partners had not expected to have one on their trip.

Unprotected sex. Most studies report prevalence of unprotected sex only for female travelers with new partners. In the Vivancos et al. meta-analysis, this (pooled) prevalence is 62.1% (95% CI 52.8-70.9%).⁷⁹ Individual study estimates range from 25% to 75%. Results for five studies not included in the meta-analysis show a similar spread: 25% (backpackers in Thailand) to 61% (backpackers in Australia).^{101,106} Five other studies calculate prevalence of unprotected sex for all female travelers, not just those with new sex partners. Estimates range from 16% (Dutch expatriates on long-term assignments) to 75% (backpackers in Australia).^{102,111}

Four studies evaluate multivariable correlates of women's unprotected sex during international travel. In a sample of UK residents reporting travel in the past two years without their partner, having unprotected travel sex is associated with having a local sex partner, having multiple travel sex partners, not expecting to have sex prior to departure, not carrying condoms, and receiving health advice from family members rather than a health care provider.⁹¹ De Graaf et al. support the findings for condoms but note lack of statistical significance for many other correlates, including pre-travel intentions to have sex.¹⁰² In a sample of Peace Corps volunteers, women reporting unprotected sex are older, have more sex partners, and, puzzlingly, have a high perceived personal risk of HIV infection.¹¹³ Lastly, in a sample of female Swedish travelers, young age (<25 years) and traveling for more than one month are correlates of unprotected travel sex. Studies using combined samples of men and women report inconsistent findings. Some find independent effects for number of travel sex partners,^{118,130} not carrying condoms.^{93,107} Non-significant correlates include age,^{90,93,103,118,126} travel purpose,^{93,97} destination,^{93,118} alcohol use during travel,^{90,126} and pre-travel expectations to have sex^{93,115} or take condoms.¹¹⁵ Findings are very mixed for relationship status, travel companions, travel duration, drug use during travel, and pre-travel sexual history.

There are no methodologically sound comparisons of women's condom behaviors while traveling versus at home. One study compares women's unprotected sex with casual sex partners—54% during travel vs. 36% prior to their departure—but pre-travel measures are retrospectively reported and the authors don't specify confidence limits or the reference period for home behaviors.¹⁰⁴

Use of contraception. There are no studies reporting on women's use of contraception (other than condoms) while traveling internationally.

Unintended pregnancy. One small study reports on unintended pregnancy among traveling women. In a survey of 80 German women, ages 18 to 30, who recently completed an international service project for at least six months, two (2.5%) participants report having unintended pregnancies during their post in Latin America.¹⁰⁸

STI acquisition. Five studies describe STI test results for women who are formerly or currently traveling abroad, and mostly recruited from clinical sites. Among 276 attendees of a Swedish STI clinic who report having a new sex partner during any international trip in their lifetime, 26% tested positive for at least one infection.⁸⁸ With such a long reference period, it is unlikely that all these infections were acquired during international travel. Bavastrelli et al. took a similar approach in their study of 88 women recruited from obstetrics/gynecology or infectious/tropical disease clinics in Rome.¹¹⁹ Among 57 women with any history of international travel, 26% tested positive for chlamydia. STI positivity is considerably lower (0.5%) in a sample of over 31,000 travelers seen at STI clinics in a global surveillance network.¹¹⁰ In another sample of 2,940 STI clinic attendees backpacking in Australia, prevalence ranges from 0% (syphilis) to 9% (genital warts).¹¹¹ In a smaller sample of 207 backpackers recruited from Australian youth hostels, 2.9% tested positive for chlamydia.¹⁰¹

The Australian STI clinic study is the only one to estimate multivariable correlates of STI acquisition for female travelers. For chlamydia, correlates include having three or more partners in the past three months, inconsistent condom use in the past three months, and presenting due to a known STI contact; age, marital status, alcohol use, and prior chlamydia diagnosis are not statistically significant.¹¹² Two other studies feature combined samples of male and female travelers, both recruited from STI clinics, with limited findings. In multivariable analysis, Matteelli et al. note positive associations between laboratory-confirmed STI and travel purpose (visiting friends or relatives vs. tourism), shorter trips (<30 days), and some travel regions.¹¹⁰ The other study finds no significant correlates of travel-associated infections in their unadjusted analyses.⁹⁶

Four studies of STI in women compare international travelers and non-travelers. In unadjusted analyses, the Australian STI clinic study finds significantly higher

positivity for chlamydia, but lower positivity for warts, among travelers.¹¹¹ Pooling crude data from three studies, Vivancos et al. report significantly higher odds of incident STI for women with history of a new travel partner (OR 2.45, 95% CI 1.95-3.09).⁷⁹ However, two of these studies report non-significant findings after adjustment⁸⁸ and the third relies on self-reported infections over a five-year recall period.⁹⁸

Other findings. While reviewing the literature for SRH outcomes, we identified some other pertinent findings that we briefly review here. First, four studies describe travelers' attitudes and concerns regarding SRH risks; none report findings restricted to women. In a sample of UK volunteers, a higher percentage report being concerned about STI/HIV upon arriving at their destination (23-25%) compared to pre-departure (5%).¹³¹ Another group of travelers attending a Swiss travel clinic report no such change in STI risk perception; however, their perceptions of STIs as a travel risk are significantly lower compared to an expert panel of physicians and travel health consultants.¹³² US study-abroad participants rank STIs 13th among 18 travel health threats in terms of likelihood as well as worry.¹³³ Finally, in a sample of German long-term (>6 months) travelers, 34% report being concerned about STIs or unintended pregnancy.¹⁰⁸

Substance use during travel has received considerable attention in studies examining leisure/holiday travel and, increasingly, US study-abroad participants. Two longitudinal studies observe significant increases in US college students' drinking behavior from the pre-travel to travel (study abroad) period.^{134,135} In another study, female students report their experience with alcohol-related sexual consequences during their semester abroad, including: "Has drinking gotten you into sexual situations you later regretted?" (23%) and "Because you had been drinking, have you neglected to use birth control or neglected to protect yourself from STIs?" (9%). In multivariable analysis, the number of alcohol-related sexual consequences was independently associated with: the number of drinks consumed per occasion, pre-departure expectations of drinking during travel, and experiencing culture-related social anxiety while abroad.¹³⁵

Summary and gaps in understanding. The existing literature on travelers' SRH is moderately sized but leaves many gaps. Women from the United States are the focus of only one study; findings from countries with different norms, policies, and approaches to SRH counseling may not be generalizable to US women. The abundance of clinic-based

samples leaves the experiences of many other travelers unrepresented. We cannot find any empirical evaluations of travelers' use of contraception, other than condoms, and only one very small study reports findings for unintended pregnancy. Indeed, most of the studies are motivated by infectious health threats and therefore emphasize STIs and their antecedent behaviors more than other facets of SRH. Methodological limitations include invalid reference groups, lengthy recall periods, not adjusting for confounders, and pooling data from men and women in multivariable analyses. The fundamental question of whether travel itself is a risk factor for adverse SRH, versus the selection into international travel by "high-risk" people, remains essentially unanswered.

Chapter 2

The International Travel and Reproductive Health Study

I. Study Design

A. Overview

The data for this dissertation come from a mixed methods study of our own design, which was conducted at the University of Minnesota from 2015 to 2017. The **quantitative** portion of the study is comprised of cross-sectional, online surveys administered to two samples of female students: (1) Women who completed an international trip in the past three months (“**Travelers**”) and (2) Women who anticipate international travel in the next three months (“**Pre-Travelers**”). In the **qualitative** component of the study, we conducted semi-structured, in-depth interviews with female students, again recruiting two samples: Travelers and Pre-Travelers. Below, we outline our rationale for this methodological approach and describe the setting for our study.

B. Rationale for mixed methods design

Epidemiologists are increasingly combining qualitative and quantitative research methods to answer questions about human health. This practice, termed mixed methods research, is applied to phenomena for which quantitative or qualitative methods are not sufficient on their own. Mixed methods research is implemented in myriad ways and there is no definitive text on its practice. However, the Office of Behavioral and Social Science Research (OBSSR) at the National Institutes of Health suggests some best practices for mixed methods research in the health sciences.¹³⁶

In their guidelines, the OBSSR makes the following contrast: “Quantitative (mainly deductive) methods are ideal for measuring pervasiveness of ‘known’ phenomena and central patterns of association, including inferences of causality. Qualitative (mainly inductive) methods allow for identification of previously unknown processes, explanations of why and how phenomena occur, and the range of their

effects.”¹³⁶ In our study, we used quantitative survey methods to examine known phenomena—new sexual partnerships and contraceptive use—in a novel setting: international travel. At the same time, we recognized the dearth of knowledge pertaining to the “why” and “how” of women’s SRH risks during travel. For example, how are risk (and protective) mechanisms activated during international travel? How do new cultural environments influence women’s SRH attitudes and behaviors? Why do some women anticipate having new sexual relationships while others do not? Qualitative methods allowed us to explore such questions in depth so that we could gain a holistic view of travelers’ SRH. Indeed, according to the OBSSR mixed methods research is often done to “develop a more complete understanding of a problem.”¹³⁶ We chose a convergent (concurrent) mixed methods design, implementing the qualitative and quantitative study activities alongside one another.

C. Rationale for cross-sectional design

Our interest in phenomena that span the pre-travel and travel periods led us to consider a longitudinal design—i.e., sampling participants before their departure and following them prospectively. Instead, we chose a cross-sectional study for methodological reasons. We were concerned that asking women about their travel expectations and preparations before their departure would prime them to modify their travel behaviors. As previously noted, existing literature suggests that female travelers may be prone to unexpected sexual encounters, with implications for their contraceptive use (or lack thereof). A cross-sectional design allowed us to examine women’s SRH during travel absent these intervention-like effects. Additionally, the Pre-Traveler samples offered the opportunity to measure women’s travel preparations and expectations in real time, before these constructs were affected by non-differential recall or recall bias.

In the survey, Pre-Travelers also served as a counterfactual substitute for Travelers. It is possible that “high-risk” women select into international travel and that their baseline risk profile, not the travel context, is what drives their SRH risk. Our inclusion of a Pre-Traveler reference group, whom we sampled to resemble Travelers in terms of baseline characteristics, allows us to evaluate whether international travel itself is associated with increased SRH risks among young women.

D. Setting

Our study took place at the University of Minnesota-Twin Cities (UMN-TC) campus, which is home to some 30,500 undergraduate students and 16,300 graduate and professional students.¹³⁷ Boynton Health Service (BHS), the on-campus clinic, conducts annual student surveys to monitor key indices of health, including sexual health. In the 2015 survey, 75% of female UMN-TC students reported being sexually active in their lifetime and 70% within the past 12 months.¹³⁸ Among students with lifetime sexual experience, the most commonly reported contraceptive methods used at last sex were: pills (44%), condoms (43%), and withdrawal (16%). (Students could report using multiple methods.) Other methods were reported by <10% of respondents. Nearly 1 in 6 (16%) sexually active women used EC in the past year, 42% of them more than once.

International travel is popular among UMN-TC students. Over 2,600 studied abroad for academic credit in the 2013-2014 academic year—the sixth highest number among institutions nationwide. For some students, such as undergraduate management majors, international experiences are a requirement of their academic program. UMN-TC students also travel for non-university purposes such as leisure and volunteerism. Data on these types of travel are hard to find because there is no system for monitoring them.

On-campus resources for student travelers include the BHS and the Learning Abroad Center (LAC). BHS' International Travel Clinic provides healthcare services for students and other travelers based on anticipated risks in their travel destination. From March 2014 to February 2015, the clinic served 465 female students plus additional students on the graduate insurance plan.¹³⁹ BHS has no protocol in place for SRH counseling during travel medicine visits. The LAC oversees 300 international programs that UMN-TC undergraduate students complete for academic study, service learning, research, work, intern, and volunteer experiences. The graduate and professional schools administer their own international programs, where such programs exist.

II. **Study Procedures**

A. Research approvals

Our study protocol was reviewed and approved by the UMN-TC’s Institutional Review Board (#1506P73421), the BHS’s Research Committee, and the LAC.

B. Recruitment

Eligibility criteria. Core inclusion criteria for the surveys and interviews were: female, 18-29 years old, UMN-TC student, has ever had sex with men, understands English, and considers the United States their home country (**Table 6**). Women with female sex partners were eligible if they also had male partners. We limited participation to students who call the United States “home” to avoid sampling international students traveling back to their native countries. While this phenomenon may carry its own significance for SRH, our study hypotheses implicate novel and unfamiliar travel settings.

Samples were further delineated by travel and clinic status. First, Travelers (both survey and interview participants) reported an international trip in the past three months and Pre-Travelers expected travel in the next three months. To reduce the influence of recent travel experiences, the latter sample was also restricted to women without travel in the past six months. Second, all interviewees had completed at least one visit to a travel medicine clinic for their recent or upcoming trip.

Table 6: Study eligibility criteria and recruitment strategies

Inclusion criteria	Exclusion criteria	Recruitment strategies
<ul style="list-style-type: none"> • Female • 18-29 years old • UMN-TC student • History of male sex partners • Understands English • Considers United States home • Interview: Completed travel medicine visit • Traveler: Completed international travel in past 3 months • Pre-Traveler: Intends international travel in next 3 months 	<ul style="list-style-type: none"> • Married • Engaged • Pregnant • Attempting pregnancy • Sterile • Pre-Traveler: International travel in past 6 months 	<ul style="list-style-type: none"> • Campus flyers • LAC e-mails to study abroad participants • Flyers in BHS travel medicine visits • Facebook • Interview: Snowball sampling

BHS=Boynton Health Service, LAC=Learning Abroad Center

To recruit a sample at risk of unintended pregnancy, we excluded from all samples women who were married, engaged, pregnant, attempting pregnancy, or sterile. As an exception, women who were pregnant at the time of screening, and who otherwise met Travel criteria, were eligible for the study so long as they were not pregnant when they began their trip. Becoming pregnant during international travel, especially unintentionally, is a salient (albeit rare) event that we wanted to capture.

Eligibility screening. Potential participants self-screened for eligibility on the study website (z.umn.edu/TravelStudy). Based on participants' responses, the website lists the activit(ies) for which they are eligible, if any, and asked them to check the ones in which they were interested. Participants could complete both the survey and interview if they were dually eligible, but only as a Traveler or Pre-Traveler. Also, participants could only complete each study activity once.

Recruitment strategies. We recruited study participants through multiple modes (**Table 6**). Key recruitment partners were the LAC and BHS. The LAC announced our study in e-mails to groups of students registered for upcoming or recent study-abroad programs. The first wave of emails occurred in March 2016 and were repeated through March 2017. BHS distributed study flyers to female students during their travel medicine visits. Together, these targeted approaches to students with known travel histories or intentions allowed us to reach a high proportion of eligible participants. We also posted hundreds of flyers throughout campus. Lastly, we used snowball sampling by asking interview participants to refer friends or fellow students who may be eligible.

C. Survey procedures

Technology infrastructure. Our survey was designed and administered using REDCap, a secure, web-based data collection system developed at Vanderbilt University (project-redcap.org). REDCap is now used by a consortium of over 1,700 institutions, including the UMN-TC. With support from the University's Clinical and Translational Science Institute, REDCap is offered to UMN-TC researchers free of charge and with dedicated technical support throughout the survey design and implementation phases. REDCap's design features include multiple question and response types (e.g., multiple choice, matrix, slider bar), branching logic to skip questions, piping, calculated fields,

data validation, longitudinal surveys, and automated survey invitations and reminders. The security features of REDCap are equally robust: investigators can designate different levels of access to each project staff; data are backed up nightly on secure servers; and users can designate identifying fields to be excluded from data downloads.

Definition of reference periods. Our goal to compare travelers' SRH outcomes to those of their non-traveling counterparts required us to consider how to best represent the counterfactual ideal in our survey design. One important component of the counterfactual was time: travelers' outcomes occur in a chronological window defined by their departure and return dates. The probability of SRH events likely accumulates with the amount of time travelers spend in their destination; thus, it was important that we addressed time when choosing the reference period for which Pre-Travelers reported their recent U.S. behaviors. To mimic the natural variation in reference period duration among Travelers (i.e., trip length), we asked Pre-Travelers identical questions, but for a single reference period in the U.S.: 7 days, 14 days, 60 days, 3 months, 6 months, or 12 months.

Survey development. We aimed to develop a survey instrument that offered breadth of content, methodological rigor, and ease of use. For content, we operationalized variables in **Tables 2 and 3** that could be measured with reliability and validity at the individual level. We also included measures to describe our study sample and control for confounding in analysis. We used existing measures from the literature, including previously validated instruments, whenever possible. We designed the survey to take no longer than 20 minutes to complete in order to limit the burden on survey respondents, thus optimizing data quality. The student PI and study research assistants (RAs) reviewed multiple survey drafts to make sure the questions were free typographical and grammatical errors, were organized in a logical order, and branched correctly based on responses to previous questions.

Pilot testing. The draft survey was pilot tested with 20 participants: 10 Travelers and 10 Pre-Travelers. Participants self-screened online for eligibility using the same criteria for the main study (**Table 6**). The study sessions were completed in person with study staff in private rooms on the UMN-TC campus. After providing their informed consent, participants were instructed to take the draft survey online in REDCap, taking note of any places where they were confused or the survey lacked flow. After they were

finished, staff led a 10-15 minute debrief session on the participants' survey experience using a structured question guide (**Appendix A**). Questions probed survey items that were particularly uncomfortable or embarrassing; in need of editing or revision; or worked well. We also asked participants about the breadth, length, and overall survey experience. They received a \$15 Amazon.com gift code in reimbursement of their effort.

Participants' feedback on the draft survey was generally positive. Almost all said the survey was comprehensive in content but not too long. The handful of participants who took the draft survey on a tablet did not think that platform was ideal. Based on the input we received, we made minor adjustments to some survey items and response sets; added some new questions; broke up the survey into shorter pages; and added a note indicating that the survey is best viewed on a laptop or desktop computer.

Survey measures. Measures were distributed across five domains (**Table 7**):

- 1) Baseline characteristics;
- 2) SRH history;
- 3) Pre-travel variables;
- 4) Trip characteristics and experiences; and
- 5) SRH during the reference period;

The survey was comprised mostly of objective, single-item measures and garnered high face validity with pilot study participants. However, we developed some of the measures expressly for this study and did not formally evaluate their psychometric properties. These include measures of language barriers and perceived accessibility of local SRH services (**Domain 4**). Other measures come from previously developed instruments. We measure the personality trait of sensation seeking (**Domain 1**) using the 8-item Brief Sensation Seeking Scale (BSSS).¹⁴⁰ The BSSS has exhibited adequate internal consistency ($\alpha=0.81$ to 0.82) in samples of US college students.^{141,142} One of the most consistent pieces of feedback in our pilot study pertained to the first item in the BSSS: "I would like to explore strange places." Many participants thought "strange" to be confusing or derisive; therefore, we altered this item to read, "...*exotic or* strange places." All other items were retained in their original format. Measures for religiosity (**Domain 1**) were adapted from the National Survey of Family Growth.¹⁴³

Table 7. Description of survey measures

Measure	Response set
Domain 1: Baseline characteristics	
Age	Years: Numeric (18 to 29)
Student status	Undergraduate or graduate/professional
Race/ethnicity	Check all: American Indian, Asian/Pacific Islander, Black/African American, Hispanic/Latina, White/Caucasian, other (specify)
Religious denomination	None, Catholic, Jewish, Protestant, other (specify)
Importance of religion in daily life ¹⁴³	Likert: Not important (1) to very important (3)
Sexual orientation	Heterosexual/straight, gay/lesbian, bisexual, other (specify)
Sensation-seeking; 8 items ¹⁴⁰	Likert: Strongly disagree (1) to strongly agree (5)
Chronic condition requiring medication	Yes, no
Number of prior international trips	0, 1, 2-5, 6-10, more than 10
Domain 2: SRH history	
Age at first sex	Years: >13, numeric (13 to 25), >25
Lifetime sex partners (male)	Numeric up to "10 or more"
Lifetime sex partners (female)	Numeric up to "10 or more"
Ever pregnant	Yes, No, Unsure
Pregnancies	Numeric up to "5 or more"
Abortions	Numeric up to "5 or more"
Births	Numeric up to "5 or more"
Has regular SRH care provider	Yes, no
STI diagnoses from healthcare provider	Check all: Chlamydia, gonorrhea, HIV, syphilis, HPV/warts, herpes, pelvic inflammatory disease, not sure, other (specify), none of the above
Ever-use of contraceptive methods	Check all: Condom, pill, patch, ring, injectable, implant, IUD, withdrawal, natural family planning, diaphragm/cap, spermicide, EC, other (specify)
Domain 3: Pre-travel variables	
Expectation to have sex	Likert: Definitely not (1) to definitely (5)
Expectation to meet a new sex partner	Likert: Definitely not (1) to definitely (5)
Received pre-travel health care	Yes, no
Clinic type	Check all: Travel, primary care, other (specify)
Clinic site	Boynton, other
Services received	Check all: Vaccinations, physical exam, prescription refill, anti-malarials, prophylactic

Table 7. Description of survey measures

Measure	Response set
antibiotics, birth control, pregnancy test, counseling, other (specify)	
Domain 4: Trip characteristics and experiences	
Destination countr(ies)	Open text
Trip duration	Departure and return dates
Purpose (primary)	Study abroad, other academic, conference, work, volunteer, leisure, other (specify)
Travel companions	Check all: Friend, family, romantic partner, students, guide/translator, supervisor, professor, study abroad staff, other (specify)
Type of residence	Check all: Hotel/resort, hostel, apartment/house, host family residence, friend/family residence, other (specify)
<i>Travelers only:</i>	
Carried travel health insurance	Yes, no, unsure
Language barriers: Perceived frequency	Likert: Never (1) to always (5)
Language barriers: Perceived impact	Likert: Not at all (1) to a great extent (4)
Alcoholic drinks per week (average)	Number
Binge drinking	Yes, no
Used any recreational drugs	Yes, no
Perceived accessibility of local SRH services	Likert: Very difficult (1) to very easy (5)
Domain 5: SRH during the reference period^a	
Relationship status	Single, casual/dating, serious relationship
Had sex	Yes, no
Gender of sex partner(s)	Check all: Male, female
Male sex partners	Number up to "5 or more"
Relationship with male partner(s)	Check all: Boyfriend/partner, friend, casual/stranger, local resident, ^b traveler from another country, ^b other (specify)
Had new partner(s)	Yes, no
Had unexpected sex	Yes, no
Contraceptive method(s) used	Check all: Condom, pill, patch, ring, injectable, implant, IUD, withdrawal, natural family planning, diaphragm/cap, spermicide, EC, abstinence, other (specify)
Satisfaction with contraception	Likert: Very unsatisfied (1) to very satisfied (4)
Contraceptive lapses (21 items) ^c	Yes, no
Started a new contraceptive method	Yes, no
Switched contraceptive methods	Yes, no

Table 7. Description of survey measures

Measure	Response set
Didn't have contraception on hand when needed	Yes, No
Had trouble finding contraception	Yes, no
Contraception lost or stolen	Yes, no
Got off schedule with contraception due to travel across time zones	Yes, no
Had sex without any contraception	Yes, no
Had trouble communicating with a sex partner about using contraception	Yes, no
Frequency of condom use during sex	Likert: None of the time (1) to all of the time (4)
<i>Travelers only:</i>	
Brought condoms	Yes, no
Brought contraception	Yes, no
Brought emergency contraception	Yes, no
Got pregnant	Yes, no
Got an STI	Yes, no

^aRefers to index trip (Travelers) or recent period in the U.S. (Pre-Travelers). ^bResponse options for Travelers only. ^cSee Table 8 for full description of contraceptive lapse measures. EC=emergency contraception, HPV=human papillomavirus, IUD=intrauterine device, SRH=sexual and reproductive health, STI=sexually transmitted infection.

Data collection. Participants who screened eligible and interested received an e-mail invitation from REDCap with a unique survey link. The IRB-approved consent form was integrated directly into the survey interface as the first question. Participants could stop the survey and return later with a unique access code. Only one survey question, travel destination (country or countries) was required because its value was piped into many subsequent questions. Participants received a \$10 Amazon.com gift code within 48 hours of their completing the survey.

Using the last digit of Pre-Travelers' system-generated study ID number, REDCap sorted them into a single survey reference period: 1 = 7 days; 2 or 3 = 14 days; 4 or 5 = 60 days, 6 or 7 = 3 months, 8 or 9 = 6 months, and 0 = 12 months. We assigned participants to the 7-day and 12-month modules at half the frequency of the others because we did not expect as many trips at these extreme durations. It was not feasible for us to implement a truly random allocation process in REDCap; however, we believe this process to be unbiased because it was simply determined by the order in which participants screened online for eligibility.

D. Qualitative interview procedures

Qualitative interview guides and measures. We used semi-structured interview guides, one for Pre-Travelers and one for Travelers. A semi-structured format afforded consistency across interview sessions, but also flexibility in how deeply each question was explored during a given session. As with the survey, our aim was to cover multiple facets of the travel/SRH phenomenon in an acceptable time frame (here, less than 60 minutes). The interview questions (**Appendices B and C**) assessed a variety of topics under the following categories: pre-travel expectations, concerns, and preparations; general trip information; SRH concerns and experiences during travel; experiences and attitudes related to their travel medicine visit; advice for other travelers; and lifetime SRH-related travel experiences. Only some of these measures were analyzed for this dissertation. More details about those measures and the development of the qualitative interview guides are provided in **Manuscript 3 (page 72)**.

Interviewer training. Interviews were conducted by the student principal investigator (PI) and two female RAs who were also MPH students in the University of

Minnesota School of Public Health. The student PI, who is experienced conducting qualitative interviews, trained the RAs for this study. Training activities included rehearsing the interview questions in role-play, direct observation of PI-led interviews, and conducting two interview sessions under supervision of the PI. After each RA independently completed her first interview, the PI reviewed the recording and gave feedback on successful techniques or areas for improvement.

Data collection. Participants who screened eligible and interested in the qualitative interview were contacted by e-mail to schedule their session. Interview sessions were completed in person, in a private space, and at the participants' preferred location (West Bank, East Bank, or St. Paul campus). We began the session with the informed consent process then distributed a brief self-administered baseline questionnaire assessing baseline characteristics, SRH history, and trip information. We then proceeded with the interview, which was digitally recorded. Upon completion of the interview, we reimbursed participants with a \$20 Amazon.com gift code.

Post-interview data management. After the interview, data from baseline questionnaires were entered into REDCap. Interview recordings were copied into a private folder on the Division of Epidemiology & Community Health server and deleted from the recording device. We transcribed interviews *verbatim* into Microsoft Word files as soon as possible after the study session. Recollection of non-verbal events helped us note, for example, whether participants expressed themselves with sarcasm or emphasized a statement hand gestures. The student PI reviewed all transcriptions for completeness and accuracy, at which point the recordings were permanently deleted from the server.

Chapter 3

Manuscript 1

Risk of contraceptive lapse and new sexual partnership among female university students traveling internationally

Introduction

International travel is increasingly popular among United States residents, including among youth. US citizens took over 72 million trips outside the country in 2016, an 8% increase over 2015.⁵⁴ Participation in study abroad programs is also on the rise. In the 2014-15 academic year, 314,515 US students traveled abroad for academic credit, 3% more than in the previous year and 52% more than a decade ago.⁵⁷

The sexual and reproductive health (SRH) risks of international travel have garnered increasing concern with the global spread of HIV, antibiotic-resistant sexually transmitted infections (STIs), and more recently, Zika virus.¹⁴⁴ Many aspects of international travel may influence SRH—e.g., perceived anonymity, disruption of routines, new sexual networks, cultural norms, local laws, and access to local health care services. Existing studies of travelers' SRH feature mostly clinic-based samples and are overwhelmingly focused on condom use, "casual" sex, and other STI risk behaviors.^{79,110} In contrast, research into travelers' contraceptive behaviors—the cornerstone of pregnancy prevention—is lacking. Literature comparing travelers with non-travelers is also sparse, making it unclear whether travel causes adverse SRH outcomes or if high-risk individuals disproportionately engage in international travel.

Emerging adulthood is both a common time for international travel and a risky period for SRH, especially for women. Nearly 7 in 10 US women ages 15-24 who use contraception rely on either the pill or condom, methods that are highly error-prone.^{47,48} Nationally, inconsistent contraception use accounts for 41% of unintended pregnancies and women ages 18-29 exhibit the highest unintended pregnancy rates.^{6,145} Early adulthood is also characterized by the formation of new sexual relationships, which

predict incident STIs in longitudinal studies of young women.^{38,39} Furthermore, youth typically favor condoms over more effective contraceptive methods within new and less committed sexual partnerships.¹⁴⁶ Thus, women's efforts to protect themselves from STIs in new relationships may leave them more vulnerable to unintended pregnancy.

In sum, young women face many SRH risks that may be exacerbated by the circumstances of foreign travel, yet few studies have examined this relationship. To address this knowledge gap, we conducted a cross-sectional study of women ages 18 to 29 in order to evaluate international travel as a risk factor for two SRH outcomes: contraceptive lapse and new sexual partnerships. Our goal was to inform the counseling practices of clinicians, administrators, and other practitioners who interact with young women as they prepare for international travel.

Methods

We conducted a cross-sectional survey of female university students who recently traveled internationally (Travelers) or planned to travel in the near future (Pre-Travelers). Both samples reported on their SRH during a recent reference period: for Travelers, their international trip, and for Pre-Travelers, a period of similar duration prior to their upcoming trip. The latter group—women with a known propensity for international travel—was selected to represent the counterfactual experience of Travelers, had they stayed in the United States. That is, Pre-Travelers were assumed to be similar to Travelers with regard to risk behavior and other potential confounding variables. We chose a cross-sectional, rather than prospective, design to avoid priming of travel behaviors by pre-departure measures. The study protocol was approved by the University of Minnesota Institutional Review Board.

Recruitment and Sample

Participants were recruited from the Twin Cities campus of the University of Minnesota via flyers, Facebook, the campus study abroad office, and the campus travel clinic. Potential participants self-screened on the study website based on the following inclusion criteria: female, aged 18-29 years, history of sex with male partner(s),

understands English, and considers the United States their home country. Inclusion criteria were further delineated by travel status: Traveler (completed international travel in past 3 months) or Pre-Traveler (no international travel in past 6 months, but intends international travel in the next 3 months). We excluded women who did not meet the travel requirements and women who were married, engaged, pregnant, attempting pregnancy, or sterile, to focus on a target population of those at risk of unintended pregnancy and new sexual partnerships. After completing the screening questions, women were shown the survey for which they were eligible (if any)—Traveler or Pre-Traveler—and asked to indicate their interest; participants could not screen eligible for both surveys. We recruited more Travelers than Pre-Travelers because of other study aims pertaining to outcomes among Travelers only.

Survey Procedures

Data were collected through an online survey designed and administered with REDCap electronic data capture tools hosted at the University of Minnesota.¹⁴⁷ The survey was drafted and pilot-tested with 20 participants, 10 Travelers and 10 Pre-Travelers, who met the eligibility criteria for the main study. After verbally consenting, participants completed the draft survey and provided feedback on its content (breadth, depth, sensitivity) and structure as well as the overall user experience. They were compensated with a \$15 gift card. Pilot testing confirmed that the survey duration fell in our target range of 15-20 minutes. Minor modifications were made before fielding the final survey. Data from pilot surveys were not included in this analysis.

Survey data were collected from February 2016 to March 2017. Participants who screened eligible and interested were e-mailed a unique link to the REDCap survey and one reminder if the survey remained incomplete after seven days. A consent form was integrated as the first survey question. Participants were e-mailed a \$10 electronic gift card upon completing the survey.

Nearly 1,400 women screened for the study (not including pilot study participants), of whom 584 were eligible (**Figure 1**). After excluding women who declined to participate (n=19) or did not submit a complete survey response (n=54), as

well as one Pre-Traveler who took the survey after her trip, we had 340 Travelers and 170 Pre-Travelers available for analysis.

Measures

Participants reported information for study outcomes and several other covariates relative to a reference period. This period varied in duration both between and within the two samples. For Travelers, it corresponded to their most recent international trip and therefore depended on each traveler's departure and return dates. Because we expected reference period duration to be associated with SRH outcomes, we induced variation in the Pre-Traveler sample with a REDCap algorithm that assigned each participant to a single reference period: 7 days, 14 days, 30 days, 60 days, 3 months, 6 months, or 12 months. Thus, all Pre-Travelers responded to the same questions, but relative to their assigned reference period.

All outcome measures pertained to sexual activity and contraceptive use in the reference period. Participants were asked whether they had sex and, if so, the gender of their sex partner(s) and whether any male partners were new ("someone you had not had sex with before"). Responses to the last question comprised our dichotomous outcome variable indicating a new sexual partnership. Participants selected from a checklist the contraceptive methods they used at any point during the reference period and, for each method, were branched to follow-up questions gauging method-specific errors and adherence. We used these data to derive a dichotomous outcome variable for contraceptive lapse, as described in **Table 8**.

For each participant, we first coded lapse at the method level and then aggregated across all her reported methods (except condoms and withdrawal) such that any lapse constituted a lapse for the outcome variable. Our approach for condoms and withdrawal recognized the frequency with which these methods are backed up by other forms of contraception in the same act of intercourse ("dual method use")^{148,149}. In our data, we could not determine whether the reporting of multiple methods represented dual method use because we did not assess women's contraceptive use at each coital event. However, we collected limited data on method type for participants' last intercourse and found that over 50% of women who used condoms or withdrawal did so in conjunction with other

methods. Therefore, to reduce the influence of dual method use on our outcome variable we only counted lapses on condoms or withdrawal among exclusive users—women who didn't use any other contraception during the reference period.

For non sex-dependent methods (**Table 8**), we coded lapse regardless of whether users were sexually active during the reference period. Sex does not carry risk of pregnancy on the day of a hormonal method lapse, but rather some days later when physiologic responses to lapse (i.e., follicular development, ovulation, and changes in cervical mucus) potentially manifest.¹⁵⁰ A lapse on hormonal contraception is therefore an inherently risky behavior, as it requires a commitment to future abstinence that may not be upheld.

We measured additional baseline variables to describe our study population and adjust for potential confounding. Demographic characteristics included age, student status (undergraduate or graduate), race/ethnicity, religious denomination, religiosity, and sexual orientation. We asked participants whether they had a regular SRH care provider or had a chronic health condition requiring ongoing prescription medication. Measures of SRH history consisted of age at sexual debut, number and gender of lifetime sexual partners, emergency contraception (EC) use, and history of pregnancy or STI diagnosis. Participants also reported their number of lifetime international trips. We incorporated the Brief Sensation Seeking Scale (BSSS),¹⁴⁰ an 8-item instrument that has exhibited internal consistency ($\alpha=0.81$ to 0.82) in samples of US college students.^{142,151} Sensation seeking, a personality trait denoting an attraction to novel sensations and experiences such as international travel, is associated with high-risk sexual behaviors.¹⁵² Respondents indicated their agreement with each BSSS item (e.g., “I get restless when I spend too much time at home.”) on a 5-point Likert scale. A summary score was calculated as the mean of the eight items, per instructions from the instrument's authors. Higher scores represented higher sensation seeking.

Analysis

We estimated relative risks of contraceptive lapse and new sexual partnership by travel status using multivariable modified Poisson regression models with robust standard errors.¹⁵³ Although our study was designed to minimize confounding by comparing

similar groups of women, we also assessed confounding empirically. We considered covariates that we specified *a priori* to be potentially associated with either contraceptive lapse or new sexual partnership, and that may also be related travel status: baseline variables (demographic characteristics, sensation seeking, having a regular SRH care provider, having a chronic health condition requiring ongoing medication, age at sexual debut, number of lifetime sex partners, history of female sex partners, sexual orientation, and history of pregnancy, STIs, EC use, or international travel), reference period duration, and type of contraceptive method(s) used during the reference period. We conducted bivariate analyses to empirically identify which variables were differentially distributed by travel status and each outcome variable using the chi-squared statistic or Fisher's exact test (for categorical variables) and t-test or Wilcoxon rank-sum test (for continuous variables). For each outcome, variables associated with both exposure and outcome at $p < .10$ were entered into a multivariable model along with travel status. Regression analyses were conducted on complete cases given the low percentage of observations with missing data (0.8% to 3.2% by model). We performed all analyses using StataSE version 14.2 (StataCorp; College Station, Texas).

During analysis, we discovered that a higher proportion of Travelers than Pre-Travelers was sexually active during the reference period. We considered sex to be a consequence of travel status and, accordingly, did not adjust for it in multivariable analysis. However, we ran a supplemental model for new sexual partnership that was restricted to participants who were sexually active during the reference period to compare groups with similar probabilities of sex.

We powered our study for new sexual partnership, one of the few SRH outcomes reported for female travelers in the extant literature.⁷⁹ We planned to enroll 375 Travelers and 125 Pre-Travelers, but adjusted our enrollment targets during data collection in order to recruit more quickly. Our revised sample sizes yielded 84% power to detect a new partnership prevalence of 20% (Travelers, $n=340$) vs. 10% (Pre-Travelers, $n=170$).

Results

Most participants were undergraduate students (86.8%), were white/non-Hispanic (83.9%), had a regular source of SRH care (80.1%), and had travelled internationally at some point before the reference period (88.8%) (**Table 9**). Prior pregnancy or STI were reported very infrequently (<6%) in both Travelers and Pre-Travelers. The two groups were generally comparable on baseline characteristics, but some differences were statistically significant at our threshold of $p < 0.10$. Compared with Pre-Travelers, Travelers were slightly older (mean=21.1 years vs. 20.4 years), less likely to be undergraduate students (84.6% vs. 91.1%), more sensation seeking (mean=3.46 vs. 3.32), less likely to identify as heterosexual (82.9% vs. 90.0%), and were more likely to have ever used EC (45.3% vs. 35.9%). Among Travelers (data not shown in table), the most common destinations were Europe (40.3%) and Central or South America (18.5%); 48.2% traveled for academic purposes, 42.4% for leisure, and 9.4% for work or volunteerism. Forty-two percent of Travelers saw a healthcare provider in preparation for their trip and 21.5% received care at a travel medicine clinic, specifically.

The crude prevalence of contraceptive lapse during the reference period (**Table 10**) was similar for Travelers (29.1%) and Pre-Travelers (31.8%), including among participants who were sexually active during the reference period (31.5% and 35.1%, respectively). New sexual partnerships with men were more common among Travelers (17.4% vs. 11.8%; $p=0.10$) even though Travelers were less likely to have sex (31.8% vs. 65.3%; $p < .0001$). Among participants who had sex, new male partners were reported three times more frequently by Travelers (54.6% vs. 18.0%, $p < .0001$).

The most commonly reported contraceptive method was the pill. Pill use was higher among Pre-Travelers than Travelers (62.9% vs. 50.0%; $p=.006$), but both groups were equally likely to report a pill lapse (49.5% vs. 50.0%, respectively; data not shown in table). Pre-Travelers were significantly more likely to report using condoms and withdrawal. Multiple contraceptive methods were reported by 28.2% ($n=144$), almost entirely involving use of condoms ($n=81$), withdrawal ($n=25$), or both methods ($n=34$). Only 0.8% ($n=4$) of the sample reported multiple methods that did not include condoms or withdrawal.

After adjusting for confounders (**Table 11**), we found no association between travel and contraceptive lapse (aRR=1.05; 95% CI, 0.83—1.32). However, risk of new

sexual partnership was 70% higher among Travelers than Pre-Travelers in the full sample (aRR=1.71; 95% CI, 1.07—2.74) and nearly three times higher when the sample was restricted to participants who had sex with men during the reference period (aRR=2.82; 95% CI, 1.89—4.21).

Discussion

We found evidence for increased risk of new sexual partnership, but not contraceptive lapse, during young women's international travel. To our knowledge, this study is the first to examine travel as an independent risk factor for these outcomes among women by comparing travelers with non-travelers. Without an appropriate comparison group, previous studies could not determine whether the SRH outcomes observed for travelers are attributable to travel itself or to selection into travel by sensation-seeking individuals predisposed to sexual risk-taking. Isolating the effect of travel is an important contribution, as it suggests distinct avenues for intervention.

Women frequently engage in international travel—approximately 36 million US women in 2016⁵⁶—yet the contraceptive behaviors of female travelers are virtually unexplored in the research literature. Certain aspects of international travel may make contraceptive lapse not only more likely, but also more consequential. In the aftermath of a lapse, travelers may need access to clinical services—e.g., EC, STI testing and abortion—that are inaccessible or unsafe in the local destination. For brief trips, the ramifications of contraceptive lapse may surface after women return home but are nonetheless significant.

Nearly one-third of the international travelers in our study experienced a contraceptive lapse, a proportion similar to what we observed in non-travelers. Our null findings may indicate a lack of travel-specific risk mechanisms, but may also mask heterogeneity in the effects of travel. For example, certain types of trips (e.g., academic, leisure, solo or accompanied) may affect women's contraceptive behaviors more than others; this warrants exploration in future research. Our focus on university students, half of whom were using the pill, could also have influenced our results. Student life and international travel both favor factors contributing to pill lapse—e.g., disrupted routines,

fatigue, and perceived stress related to school or work ^{154,155}—thereby reducing the relative impact of travel on women’s behavior.

We found a 70% increased likelihood of new male sexual partners associated with international travel. The significance of this finding is two-fold. First, women use less effective methods of contraception in both new and casual relationships, which increases their risk of unintended pregnancy.¹⁴⁶ Second, open communication between sexual partners facilitates many positive SRH outcomes ¹⁵⁶ and new relationships are characterized by non-verbal, indirect, and ambiguous communication.¹⁵⁷ Partnerships initiated during international travel may also be encumbered by linguistic and cultural differences, further increasing women’s susceptibility to pregnancy and STIs.

Some previous studies, while not directly comparable to ours, offer insight into our findings for new sexual partnerships. Sundbeck et al. used a case-crossover design to estimate risk of having a casual male sex partner (defined as previous partner, friend, casual contact, commercial sex partner, or another non-regular partner) during international travel, compared to at home, in a population-based sample of young Swedish women.¹²⁰ Their analysis only considered participants’ most recent sexual encounters in the past 12 months (at home and abroad, respectively) and did not precisely account for trip duration. They reported a five-fold increased risk of casual sex associated with international travel (incidence rate ratio [IRR] 5.31, 95%CI 4.27—6.60). Another prospective study of 427 university students in the U.K. more resembles our study population, but does not provide estimates specific to women. Male and female students who traveled abroad over their summer break were more likely to report new sexual partners (aRR 2.46, 95% CI 1.01–6.06) than those who stayed in the U.K.¹²¹ Whether women are more likely to establish new sexual partnerships when they travel internationally, as we found in our study, should be examined in more studies that make valid comparisons between travelers and non-travelers.

In addition to being one of the few comparative studies on SRH related to travel, our study provides novel estimates for the prevalence of new sexual partnerships among US women traveling abroad. Given the international variation in healthcare systems and our interest in providing guidance to US health care providers, this is a notable contribution. In prior studies, the frequency of new sexual partners among female

travelers has ranged widely from 2%⁹³ to 62%¹⁰¹ depending on sampling venue and participant characteristics. Our finding for US women, 17.4%, is similar to the 19.5% prevalence pooled from 13 studies in a 2010 meta-analysis.⁷⁹ Our study further contributes to this evidence base with a sample that is not exclusively clinic-based and is heterogeneous with respect to trip purpose, destination and duration. Most studies have recruited attendees of STI or travel clinics (e.g., ⁹²), residents of hostels (e.g., ¹⁰⁶), or women traveling to high-risk destinations (e.g., ⁸⁹), all of which are select populations and may differ substantially from the broader traveling population.

Our study has additional methodological strengths. We compared travelers with non-travelers while avoiding the pitfalls of priming and biased recall of pre-travel behaviors. This approach was taken to minimize confounding at the design stage; we further addressed potential confounding through the collection of a rich set of covariates known to be associated with SRH behaviors. Our survey also garnered a high 88% (511/584) response rate among eligibles and very low rates of missing data at the variable level.

There are also limitations to our study. First, recall of events that occurred as long as one year before the survey may have been inaccurate. Some literature indicates favorable test-retest reliability for SRH measures up to six months, although findings are very mixed by type of measure and study population.¹⁵⁸⁻¹⁶¹ Recall may have also been differential by exposure status if travelers had more salient experiences to aid their recollections, thus introducing bias. Second, we chose a dichotomous measure of contraceptive lapse that did not capture severity or frequency of lapse, variables that are more proximal to pregnancy risk. Third, for women who reported multiple contraceptive methods, we could not differentiate concurrent from discrete method use. Our outcome variable did not include condom and withdrawal lapses that occurred among these women; thus, we may have underestimated the true prevalence of contraceptive lapse. Fourth, our self-reported measures were susceptible to social desirability bias, although web-based surveys are the ideal mode for eliciting sensitive information.¹⁶² Lastly, our sample was comprised of women enrolled in a public university and their experiences may not be representative of the population of female travelers at large.

While our findings should be corroborated by additional research, they suggest a potential role for healthcare providers in the pre-travel period. About 80% of the women in our study had a regular SRH care provider and 42% of travelers sought care from a clinic in preparation for their trip. Clinicians of all specialties are in a unique position to counsel travelers on potential health risks. Counseling should address the possibility of new sexual partnerships during travel, travelers' plans for pregnancy prevention, and what to do in the case of a contraceptive lapse or unintended pregnancy.

Figure 1. Study flowchart

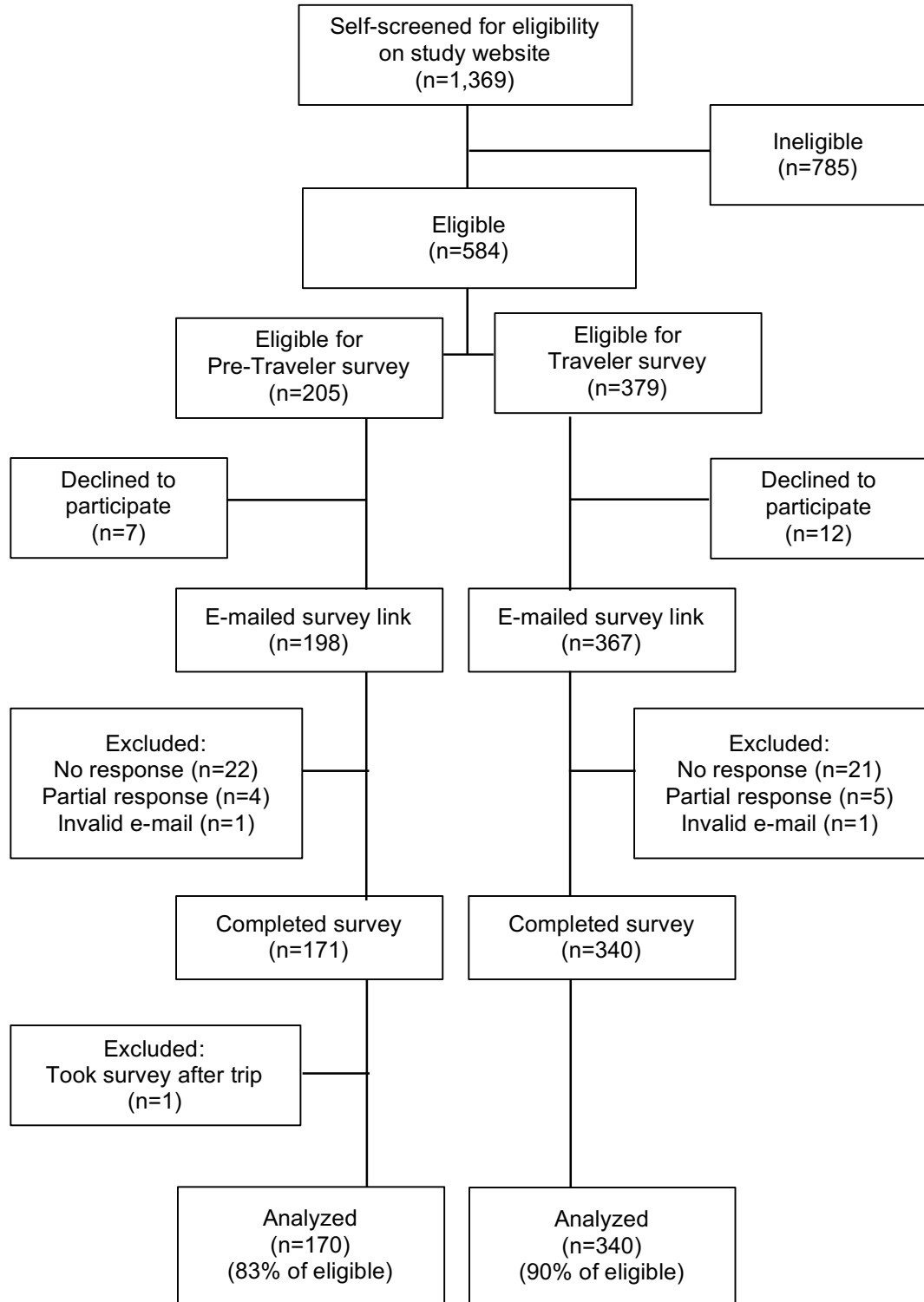


Table 8. Classification of contraceptive lapse by method type

Method ^a	Criteria for contraceptive lapse
<i>Not sex dependent</i>	
Implant	<ul style="list-style-type: none">• Not applicable^b
Intrauterine device	<ul style="list-style-type: none">• Not applicable^b
Injectable	<ul style="list-style-type: none">• Missed or was >7 days late for injection.
Pill	<ul style="list-style-type: none">• Missed (>24 hours late) one or more active pills.
Patch	<ul style="list-style-type: none">• Changed a patch >24 hours past schedule or• Applied a new patch >24 hours past schedule.
Ring	<ul style="list-style-type: none">• Removed a ring >24 hours past schedule;• Inserted a ring >24 hours past schedule; or• Left a ring out for >3 hours.
<i>Sex dependent</i>	
Condom ^c	Did not use any other method of contraception and: <ul style="list-style-type: none">• Had a condom break or slip off during sex;• Started having sex before using a condom;• Took off a condom before sex was over; or• Had sex more than once with the same condom.
Withdrawal ^c	Did not use any other method of contraception and: <ul style="list-style-type: none">• Had a partner who did not pull out in time.
Natural family planning	<ul style="list-style-type: none">• Had sex on fertile days without using another method; or• Was sexually active and could not identify her fertile days with confidence.
No method	<ul style="list-style-type: none">• Had sex with a male partner.

^aLapse was classified for all methods participants reported using for contraception, regardless of method effectiveness. ^bBehavioral lapse is not possible on this method. ^cLapse definition was restricted to exclusive users to rule out possibility of dual method use.

Table 9. Baseline participant characteristics by international travel status

	Status		p-value ^a
	Traveler n (%)	Pre-Traveler n (%)	
Total	340 (100.0)	170 (100.0)	--
Age at survey (years)			
18-19	69 (20.7)	47 (27.7)	.001
20-21	167 (50.2)	98 (57.7)	
22-29	97 (29.1)	25 (14.7)	
Undergraduate student	286 (84.6)	154 (91.1)	.04
Race/ethnicity			
Asian/Pacific Islander	25 (7.4)	11 (6.5)	.19
White, non-Hispanic	279 (82.1)	149 (87.7)	
Other	36 (10.5)	10 (5.9)	
Religion			
Catholic	77 (22.7)	31 (18.2)	.26
Protestant	69 (20.3)	47 (27.7)	
Other	32 (9.4)	14 (8.2)	
None	162 (47.7)	78 (45.9)	
Importance of religion in daily life			
Not important	219 (64.6)	100 (58.8)	.34
Somewhat important	87 (25.7)	54 (31.8)	
Very important	33 (9.7)	16 (9.4)	
Sensation-seeking score, ^b mean±SD	3.46±0.6	3.32±0.7	.02
Has a regular SRH care provider	277 (81.7)	129 (76.8)	.19
Has a chronic health condition requiring ongoing medication	70 (20.6)	34 (20.0)	.88
Younger than 17 years old at sexual debut	48 (14.2)	16 (9.6)	.12
Number of lifetime male sexual partners			
1 or 2	144 (42.4)	84 (49.4)	.14
3 to 5	91 (26.8)	50 (29.4)	
6 to 9	51 (15.0)	18 (10.6)	
10 or more	54 (15.9)	18 (10.6)	
Sexual orientation			
Heterosexual	282 (82.9)	153 (90.0)	.09
Bisexual	48 (14.1)	13 (7.7)	
Gay/lesbian/other	10 (2.9)	4 (2.4)	
History of female sex partners	38 (11.2)	12 (7.0)	.14
History of pregnancy	4 (1.2)	2 (1.2)	1.00
History of STI diagnosis	21 (6.2)	8 (4.7)	.50
History of emergency contraception use	154 (45.3)	61 (35.9)	.04
History of international travel ^c	306 (90.0)	147 (86.5)	.23

Table entries are n(column %) unless otherwise specified. ^aP-values correspond to χ^2 statistic for categorical variables and t-test for continuous variables. ^bScores are means from 8-item scale with items scored from 1 (low sensation-seeking) to 5 (high sensation-seeking). ^cDoes not include travel during the reference period. SD=standard deviation; STI=sexually transmitted infection.

Table 10. Bivariate comparisons of survey reference period variables by international travel status

	Status		p-value ^a
	Traveler n (%)	Pre-Traveler n (%)	
<u>Total</u>	340 (100.0)	170 (100.0)	--
<u>Outcome variables</u>			
Had a contraceptive lapse If sexually active ^b	99 (29.1)	54 (31.8)	.54
	34 (31.5)	39 (35.1)	.57
Had sex with a new male partner If sexually active ^b	59 (17.4)	20 (11.8)	.10
	59 (54.6)	20 (18.0)	<.0001
<u>Other variables</u>			
Had sex with male partner(s)	108 (31.8)	111 (65.3)	<.0001
Contraceptive method(s) used: ^c			
Implant	14 (4.1)	10 (5.9)	.38
Intrauterine device	39 (11.5)	22 (12.9)	.63
Injectable	4 (1.2)	1 (0.6)	.67
Pill	170 (50.0)	107 (62.9)	.006
Patch	3 (0.9)	1 (0.6)	1.00
Ring	12 (3.5)	4 (2.4)	.47
Condom	67 (19.7)	71 (41.8)	<.0001
Withdrawal	23 (6.8)	36 (21.2)	<.0001
Natural family planning	3 (0.9)	2 (1.2)	1.00
Emergency contraception	6 (1.8)	5 (2.9)	.39
Duration of reference period (days)			
Median	18	30	<.001
Range	2 to 361	7 to 365	

Table entries are n(column %) unless otherwise specified. ^aP-values correspond to the χ^2 statistic for categorical variables and Wilcoxon rank-sum test for continuous variables. ^bRefers to sex with male partner(s) during the reference period. ^cCategories are not mutually exclusive; participants could report using multiple methods during the reference period.

Table 11. Adjusted relative risk of contraceptive lapse or new sexual partnership associated with international travel

	aRR	95% CI
Model 1: Contraceptive lapse (All participants; n=506)		
Traveler	1.05 ^a	[0.83—1.32]
Pre-Traveler	1.0 (ref.)	
Model 2: New sexual partnership (All participants; n=499)		
Traveler	1.71 ^b	[1.07—2.74]
Pre-Traveler	1.0 (ref.)	
Model 3: New sexual partnership (Sexually active participants; ^c n=212)		
Traveler	2.82 ^b	[1.89—4.21]
Pre-Traveler	1.0 (ref.)	

^aAdjusted for sensation-seeking score, duration of the reference period, and use of the pill during the reference period. ^bAdjusted for age category, sensation-seeking score, and duration of the reference period. ^cRefers to sex with male partner(s) during the reference period.

Chapter 4

Manuscript 2

Pregnancy prevention on the fly: Prevalence and correlates of contraceptive lapse among young women traveling internationally

Introduction

Over the past 20 years, clinical guidelines for international travelers have increasingly emphasized the prevention of sexually transmitted infections (STIs) through safer sex counseling and vaccination.¹⁶³ Unintended pregnancy, in contrast, garnered little attention as a travel health concern until the rapid spread of Zika virus.¹⁶⁴ Similarly, the empirical literature concerning travelers' sexual and reproductive health (SRH) is predominantly focused on STIs and related behaviors (e.g., new sexual partnerships, condom use). Most existing studies examine European and clinic-based samples, and few studies evaluate SRH risk factors specifically for female travelers.⁷⁹ There is a conspicuous lack of research regarding women's use of contraceptive methods, other than condoms, during international travel.

The contraceptive practices of female travelers are significant given both the popularity of international travel and the stubbornly high rates of unintended pregnancy among young women in the United States.⁶ Women account for half of the overseas trips taken by US residents,⁵⁶ or roughly 36 million trips in 2016.⁵⁴ Nationwide, 41% of unintended pregnancies are attributable to mis-use of contraception¹⁴⁵ and young women favor error-prone methods like pills and condoms.^{47,48} Women's sexual behaviors, contraceptive behaviors, and pregnancy risk are shaped by a constellation of factors within physiological, psychosocial, structural, and cultural domains.^{34,49,165} We posit that these domains operate in unique ways during international travel (**Table 12**).

This study examines the prevalence and correlates of contraceptive lapse in a sample of female university students traveling internationally. Our aim was to identify potential opportunities for clinicians to mitigate the SRH risks of travel.

Materials and Methods

Recruitment and Sample

Our data come from the International Travel and Reproductive Health Study, a cross-sectional survey of female university students who either recently traveled outside the United States or planned to do so in the near future. This analysis is limited to the former group of recent travelers (n=340). We recruited participants from the University of Minnesota, Twin Cities campus through flyers, Facebook, the campus study abroad office, and the campus travel clinic. Recruitment materials directed potential participants to complete a brief screening survey on the study website. Inclusion criteria were: female, aged 18-29 years, history of sex with men, understands English, considers the United States their home country, and completed an international trip in the prior three months. Women were excluded if they were married, engaged, pregnant, attempting pregnancy, or sterile. If eligible, women were asked to indicate their interest in participating in a 15-20 minute online survey about their SRH during their recent trip.

Survey Procedures

The University of Minnesota Institutional Review Board approved the study protocol. The online survey was designed and administered using REDCap electronic data capture tools hosted at the University of Minnesota.¹⁴⁷ We pilot tested a draft survey from October 2015 to January 2016 with 10 participants using the same eligibility criteria as the main study. After providing verbal consent, pilot participants completed the draft survey in private on a laptop computer. They were asked to make note of questions that were confusing, embarrassing, or in need of additional response options. After finishing the survey, participants completed a de-brief session with study personnel to discuss their notes and overall user experience with the pilot survey interface. Participants received a \$15 gift card at the end of the session. Feedback was positive overall and prompted minor modifications to the survey instrument. Data from pilot surveys were excluded from this analysis.

The online survey for the large-scale study was conducted from February 2016 to March 2017. Women who screened eligible were e-mailed a unique survey link and

reminded one week later if they had not yet completed the survey. The first page of the survey covered all the elements of informed consent and asked participants to indicate their agreement before starting the survey. Participants received a \$10 gift card upon completing the survey.

Measures

We derived our outcome variable of contraceptive lapse using measures of contraceptive use and sexual activity during travel. Participants selected all the contraceptive methods they used at any point during their trip from a checklist and, for each method, were routed to follow-up questions evaluating their adherence or errors in use. With these data, we first classified each participant's lapse status at the method level (**Table 8, p.49**). Details to our approach are as follows: First, for hormonal methods, we classified lapse irrespective of travelers' sexual activity. Such lapses (e.g., missed pills) are inherently risky because they require women to be abstinent or use back-up contraception some days or weeks into the future, when lapse potentially manifests in the physiologic precursors to pregnancy (e.g., ovulation). Second, for condoms and withdrawal, we designated lapse only in exclusive users to rule out the possibility of dual method use. Data that we collected only for travelers' last sexual encounter indicated that most women who used condoms or withdrawal did so in conjunction with other contraceptive methods (55% and 94%, respectively). Third, women who did not report using any contraception were classified as lapsing if they had male sex partners while traveling. After coding at the method level, we aggregated lapse across all the participant's reported methods, resulting in a binary variable denoting lapse on any method. The reference group of non-lapsers therefore included contraceptive users without method-specific lapse as well as non-users who were not sexually active during travel; in a sensitivity analysis, we re-ran models restricted to those who were sexually active.

To evaluate potential correlates of contraceptive lapse, we selected variables from the substantial literature outlining the determinants of women's SRH in non-travel contexts and operationalized them for the travel setting. We also incorporated measures

from the small body of research among female international travelers on correlates of new sexual partnerships,^{102,109,114} condom use,^{91,102,113} or STI positivity¹¹².

Baseline and pre-travel variables. Baseline characteristics consisted of age, student status (undergraduate or graduate/professional), pregnancy history, STI history, past use of emergency contraception (EC), and having a regular SRH care provider. We also measured sensation seeking, a personality trait denoting a predisposition toward novel experiences and sensations, using the 8-item Brief Sensation Seeking Scale (BSSS; $\alpha=0.81-0.82$); summary scores were calculated for all participants missing no more than one item.¹⁴⁰ Participants reported their relationship status prior to departure and rated their agreement with the statement, “I expected to have sex on this trip” on a five-point scale ranging from “definitely not” to “definitely.” They also reported their number of lifetime international trips, whether and where they received pre-travel health services, and whether they carried travel health insurance.

Travel characteristics and experiences. Travelers listed their trip destination in an open text field, which we collapsed into five regions: Europe, Central/South America, Asia Pacific, Mexico/Caribbean, and Multiple/other. Travel purpose and residence were measured with pre-populated checklists and open text fields for “other.” Participants who selected more than one category for either question were further prompted to classify the primary purpose or type of residence. We calculated trip duration as the difference between participants’ departure and return dates. Participants described their traveling companions using a checklist of seven categories (e.g., friend, family member, romantic partner) plus an open text field; those who didn’t select any category were classified as traveling alone. We gauged language barriers in the travel destination in terms of how participants perceived their frequency (five-point scale ranging from “never” to “always”) and degree of impact (four-point scale anchored by “not at all” and “to a great extent”). Participants indicated how difficult they thought it would have been for them to access contraception, condoms, and abortion in their travel destination; they responded to each question with a five-point response scale: very easy, easy, not sure, difficult, or very difficult. Lastly, we asked participants to estimate the number of alcoholic drinks they consumed per week during their travel, whether they ever consumed four or more drinks

in one occasion (defined in analysis as binge drinking) and whether they used recreational drugs during travel.

SRH characteristics during travel. We asked participants whether they had sex during travel and the gender of their sex partner(s). Women who had sex with men reported number of male sex partners and described those partner(s) using a checklist of non-mutually exclusive categories: boyfriend/partner, friend/traveling companion, casual acquaintance/stranger, local resident, or traveler from another country. They also indicated whether any male sex partners were new (“men you had not had sex with before this trip”). Participants were asked whether they were expecting to have sex on their trip; those who reported “probably not” or “definitely not”, but reported male sex partners for their trip, were classified as having unexpected sex.

In addition to the contraceptive measures used to derive our outcome variable, the survey included several dichotomous measures of participants’ contraceptive-related behaviors and experiences while traveling: had trouble communicating with a male sex partner about contraception, brought condoms, brought EC, used EC, didn’t have contraception on hand when it was needed, started a new contraceptive method, switched methods, had trouble maintaining their contraception schedule due to changes in time zones, and had trouble finding a place to get contraception. Participants also reported their level of satisfaction with their contraceptive method(s) during travel, which we collapsed into a binary variable for analysis.

Analysis

We examined univariate distributions of all variables and crude bivariate associations of baseline characteristics, travel characteristics, and SRH variables (including contraceptive type) with lapse. We also calculated the prevalence of contraceptive lapse within each level of each correlate. The statistical significance of bivariate comparisons was evaluated using the chi-square statistic or Fisher’s exact test for categorical variables and student’s t-test or Wilcoxon rank-sum test for continuous variables.

In order to determine which correlates were independently associated with lapse, we computed adjusted relative risks (RRs) in a multivariable modified Poisson regression

model with robust standard errors.¹⁵³ We included all variables from bivariate analysis that were related to lapse at $p < 0.20$ and had at least five observations in each cell. The model was built cumulatively by variable domain: baseline and pre-travel variables, trip and travel destination variables, and then SRH-related travel variables. We evaluated different categorizations of variables to improve statistical efficiency and model fit. Within each domain, we entered all correlates simultaneously and dropped variables with $p \geq 0.20$ before moving to the next domain. After all domains were accounted for, we purged any variables remaining in the model with $p \geq 0.20$. Observations with missing data for model covariates ($n=7$, 2%) were excluded. We ran two supplemental models, one restricted to contraceptive pill users and the other to sexually active participants, to evaluate the robustness of our findings.

We did not perform a sample size calculation for this analysis due to its exploratory nature and the lack of prior studies describing the prevalence of women's contraceptive lapse during international travel. All analyses were done using StataSE 14.2 (StataCorp; College Station, Texas).

Results

During recruitment for the main study, 1,369 women self-screened on the study website and 785 were deemed ineligible. The most common reason for study exclusion was having no history of sex. Of the 584 women meeting criteria for the main study, 379 were considered for this analysis because they had completed an international trip in the three months prior to screening. Twelve (3.2%) opted out at the end of the screening questionnaire; thus, the remaining 367 (96.8%) were e-mailed a link to the survey. After excluding participants who did not respond to the link ($n=21$), provided an invalid e-mail address ($n=1$), or discontinued the survey before completing the questions about their SRH during travel ($n=5$), we were left with 340 observations for analysis (89.7% of eligible).

The sample was comprised of mostly undergraduate students ($n=286$, 84.6%), with a mean age of 21.1 years (**Table 13**). Twenty-one participants (6.2%) reported a prior STI diagnosis and only four (1.2%) had ever been pregnant (data not shown).

Almost half of the sample (n=154, 45.3%) reported using EC in the past. Most participants had a regular provider of SRH care (81.7%) and had travelled internationally before the index trip (90.0%).

Overall, 29% (99/340) of the participants had a contraceptive lapse during travel (**Table 13**, fourth column). In bivariate analysis, lapse was significantly more prevalent among participants who reported having a regular provider of SRH care (31.4%) compared to those who didn't (17.7%) and lapseders scored significantly higher on sensation seeking. Participants who attended a health clinic prior to their departure were more likely to lapse (34.5% vs. 25.3%; p=.06). The prevalence of lapse did not vary by many other baseline and pre-travel characteristics including age, relationship status, and history of international travel.

Several travel characteristics or experiences were associated with lapse in bivariate analysis (**Table 14**). Lapse prevalence varied by trip purpose: leisure (22%), academic (33.5%) or work/volunteer (37.5%). Women who lapsed took significantly longer trips than non-lapseders and the prevalence of lapse roughly increased with trip duration categories. Lapse was also more common among participants who traveled with friends (39.4%; p=.001) or a study-abroad program representative (46.9%; p=.02), compared to other travel companions. Lapse prevalence increased linearly with both the perceived frequency and perceived impact of language barriers while traveling. We also observed a linear pattern for perceived accessibility of abortion: the proportion of lapseders was lowest among participants perceiving it as easy to access (14.3%) and highest among those who thought it would be difficult (39.7%). Almost 57% of the travelers reported at least one episode of binge drinking and contraceptive lapse was more frequent among binge drinkers (33.2% vs. 23.3%, p=.05).

The contraceptive method most frequently used during travel was the pill (50.0%), while 23.2% of the travelers didn't use any method (**Table 15**). Condom use was also common (19.7%; data not shown), although only 5.0% of the sample relied on condoms as their sole method. The prevalence of lapse was highest among users of the pill or ring (both 50%) compared to other methods, although there were only 12 ring users. Among pill lapseders, one-third (29/85) missed one pill, another third (29/85) missed

two pills, and the remaining third (27/85) reported missing three or more pills (data not shown).

The prevalence of contraceptive lapse did not vary by number of sexual partners, partner type, having a new sexual partner, or having sex that was not expected (**Table 15**). Lapse prevalence was 50% or greater among women who had trouble communicating with a male sex partner about contraception (57.1%), didn't have contraception on hand when it was needed (50%), or had trouble maintaining their contraception schedule due to changes in time zones (52%). Only 10 women brought EC on their trip, but 70.0% of them had a contraceptive lapse ($p=.008$).

In multivariable analysis (**Table 16**), six correlates were independently related to contraceptive lapse. Compared to women traveling for one week or less, women on longer trips were at greater risk of lapse; we collapsed all categories beyond 30 days because risk estimates were similar (RR range 1.70—2.37, data not shown). The likelihood of lapse increased with the perceived impact of language barriers, though in a less linear fashion as we observed in bivariate analysis. Lapse risk was 70-80% higher among participants who: were the most affected by language barriers (vs. not at all), perceived abortion to be difficult to access in their travel destination (vs. easy or not sure), or had trouble communicating with a travel sex partner about contraception. Pill users were more likely to lapse than women who used other or no contraception (RR 4.51, 2.57—7.94). Even after accounting for pill use, participants who had trouble maintaining their contraception schedule because of time zone changes were at higher risk of lapse (RR 1.38, 95% CI 1.00—1.91). Our findings were mostly consistent in sensitivity analyses restricted to pill users and participants who had sex with men during their trip (**Appendix D**). In the latter model, the effect estimate for pill use was attenuated (RR 2.47, 95% CI 1.14—5.35).

Discussion

Based on our literature search, we believe this study is the first to quantify women's adherence to contraception, other than condoms, during international travel. While official US traveler statistics are not tabulated by age and SRH characteristics, the

sheer volume of trips suggests that millions of US women who do not desire pregnancy travel abroad each year.^{54,56} Thus, it is important to elucidate how travel affects women's contraceptive behaviors.

In this study, nearly one-third of international travelers had a contraceptive lapse. These findings are largely driven by high proportions of both pill use (50%) and pill lapse (50%). Lapse estimates for non-traveling pill users—38% in the past three months⁴⁹ and 47% in a single cycle¹⁶⁶—are lower than ours despite covering longer time frames. (In our sample, trips were 18 days on average.) Future studies should confirm whether travel exacerbates pill lapse relative to women's routine environments.

We identified correlates of contraceptive lapse that are travel-specific but relate to existing research of non-traveling populations. Women's challenges with daily pill-taking are well documented (e.g.,¹⁶⁷) and were evident in our study. We noted disruptions from changes in time zones, which is conceptually similar to reasons women have given for missed pills outside of international travel: exhaustion, irregular schedules, being temporarily away from home, and forgetfulness.¹⁶⁵ Our findings are also consistent with emerging research linking women's contraception-specific communication with sex partners to more consistent contraceptive use.¹⁶⁸ During travel, partner communication may be hindered by linguistic and cultural barriers.

Women's perceptions of language barriers and abortion services in their destination were independently associated with contraceptive lapse, but mechanisms are unclear. Negative perceptions may be markers of individual factors (e.g., stress, anxiety, poor acclimatization, personality traits) or destination characteristics that affected women's contraceptive behaviors. These factors warrant further exploration in other studies.

Our findings suggest a critical role for healthcare providers. Forty-two percent of our participants sought healthcare before their trip and 82% had a regular SRH provider. Clinical encounters offer opportunities for pre-travel intervention. For women of reproductive age, pre-departure counseling should address pregnancy prevention strategies, adequacy of contraceptive supplies, preparedness for unexpected sexual encounters, and adjusting contraceptive schedules to travel itineraries. Our findings suggest that guidance is particularly important for pill users, who were most vulnerable to

travel-associated lapse. Counseling and referrals for long-acting reversible contraception may also be prudent, especially for long-term travelers who anticipate contraceptive challenges.

We echo previous calls for the routine offering of EC to female travelers.⁶⁷ EC can provide a vital safety net for reproductive-aged women traveling in any unfamiliar setting, but particularly where SRH services are inaccessible. Our sample was experienced with EC, but few travelers brought their own supply. Lapse was more common among women who brought EC with them (n=10), which may reflect pre-travel anticipation of lapse, but we cannot draw firm conclusions from such small numbers.

Methodological strengths of this study include its high response rate and evaluation of potential correlates based on theory and prior evidence. We also note limitations. First, we cannot verify the temporal or causal relationships among our cross-sectional measures. Second, while standards for the measurement of contraceptive adherence are lacking,¹⁶⁹ our dichotomous outcome does not capture the severity or frequency of contraceptive lapse. Third, we have conservatively estimated lapse by excluding condom and withdrawal errors reported by women using other methods. Fourth, recall may have been less reliable for participants with longer trips or differential by lapse status. However, measures of sexual and contraceptive behaviors have shown good test-retest reliability up to six months' retrospection¹⁵⁸⁻¹⁶¹ and three-month retrospective measures of pill adherence perform similarly to prospective measures.¹⁷⁰ Fifth, social desirability bias may have affected our self-reported measures, although internet-based surveys such as ours are superior to other modes for eliciting sensitive data.¹⁶² Lastly, our study may not be generalizable beyond similar populations of female university students.

Ultimately, this study characterizes a unique population of women who are at risk of unintended pregnancy and suggests many opportunities for providers specializing in SRH, travel medicine, or primary care to meet their unique healthcare needs.

Table 12. Potential effects of international travel on women’s contraceptive use or pregnancy risk

Travel characteristic	Potential effects
Physiological	
Jet lag	<ul style="list-style-type: none"> • Alteration of menstrual cycle • Disruptions in contraceptive schedules
Gastrointestinal illness	<ul style="list-style-type: none"> • Decreased absorption of oral contraceptive pills
Psychosocial	
New social networks	<ul style="list-style-type: none"> • New sexual partners • Unanticipated sexual encounters
Increased autonomy & anonymity	<ul style="list-style-type: none"> • Increases in sexual risk-taking
Changes in daily routine	<ul style="list-style-type: none"> • Disruptions in contraceptive schedules
Language barriers	<ul style="list-style-type: none"> • Miscommunication with sexual partners • Difficulty navigating healthcare systems
Structural	
Poor transportation infrastructure; Restrictive SRH policies	<ul style="list-style-type: none"> • Diminished access to contraception, EC, or abortion • Diminished access to contraception, EC, or abortion
Liberal substance use policies	<ul style="list-style-type: none"> • Increased substance use and sexual risk-taking
Unregulated drugs & devices	<ul style="list-style-type: none"> • Decreased safety and effectiveness in local contraceptives
Cultural	
Permissive cultural norms	<ul style="list-style-type: none"> • Increased substance use and sexual risk-taking
Violence	<ul style="list-style-type: none"> • Sexual assault • Theft of baggage housing contraceptives

EC=Emergency contraception; SRH=Sexual and reproductive health.

Table 13. Baseline and pre-travel characteristics by contraceptive lapse status

	All participants	Contraceptive lapse during travel	No contraceptive lapse during travel	Prevalence of lapse (%)	p-value ^a
Total	340 (100.0)	99 (100.0)	241 (100.0)	29.1	N/A
Age at survey (years)					
Mean±SD	21.1±2.3	21.2±2.3	21.1±2.3	N/A	.83
18-19	69 (20.7)	19 (19.8)	50 (21.1)	27.5	.78
20-21	167 (50.2)	51 (53.1)	116 (49.0)	30.5	
22-29	97 (29.1)	26 (27.1)	71 (30.0)	26.8	
Student status					
Undergraduate	286 (84.6)	85 (85.9)	201 (84.1)	29.7	.68
Graduate/professional	52 (15.4)	14 (14.1)	38 (15.9)	26.9	
History of STI diagnosis					
Yes	21 (6.2)	4 (4.0)	17 (7.1)	19.1	.22
No	319 (93.8)	95 (96.0)	224 (93.0)	81.0	
History of emergency contraception use					
Yes	154 (45.3)	51 (51.5)	103 (42.7)	33.1	.14
No	186 (54.7)	48 (48.5)	138 (57.3)	25.8	
Has a regular SRH care provider					
Yes	277 (81.7)	87 (88.8)	190 (78.8)	31.4	.03
No	62 (18.3)	11 (11.2)	51 (21.2)	17.7	
Sensation-seeking score ^b					
Mean±SD	3.5±0.6	3.6±0.6	3.4±0.7	N/A	.02
Relationship status prior to trip					
Single	138 (40.6)	41 (41.4)	97 (40.3)	29.7	.22
In a casual or dating relationship	59 (17.4)	22 (22.2)	37 (15.4)	37.3	
In a serious relationship	143 (42.1)	36 (36.4)	107 (44.4)	25.2	
Expectations for sex during trip ^c					
Probably or definitely not	222 (65.7)	60 (61.9)	162 (67.2)	27.0	.24
Maybe	49 (14.5)	19 (19.6)	30 (12.5)	38.8	
Probably or definitely	67 (19.8)	18 (19.6)	49 (20.3)	26.9	
History of any international travel					
Yes	306 (90.0)	91 (91.9)	215 (89.2)	29.7	.45
No	34 (10.0)	8 (8.1)	26 (10.8)	23.5	

Attended any clinic in preparation for trip						
Yes	142 (41.8)	49 (49.5)	93 (38.6)	34.5	.06	
No	198 (58.2)	50 (50.5)	148 (61.4)	25.3		
Attended travel medicine clinic before trip						
Yes	73 (21.5)	26 (26.2)	47 (19.5)	35.6	.17	
No	267 (78.5)	73 (73.7)	194 (80.5)	27.3		
Obtained travel health insurance for trip						
Yes	202 (59.4)	66 (66.7)	136 (56.4)	32.7	.22	
No	117 (34.4)	28 (28.3)	89 (36.9)	23.9		
Not sure	21 (6.7)	5 (5.1)	16 (6.6)	23.8		

Table entries are n(%) unless otherwise specified. ^aP-values correspond to χ^2 statistic for categorical variables and t-test for continuous variables. ^bScores are means from 8-item scale with items scored from 1 (low sensation-seeking) to 5 (high sensation-seeking). ^cNo pre-travel expectation to have sex, but was sexually active on trip. N/A=Not applicable; SD=standard deviation; SRH=sexual and reproductive health; STI=sexually transmitted infection.

Table 14. Travel characteristics and experiences by contraceptive lapse status

	All participants	Contraceptive lapse during travel	No contraceptive lapse during travel	Prevalence of lapse (%)	p-value ^a
Total	340 (100.0)	99 (100.0)	241 (100.0)	29.1	N/A
Travel destination (region)					
Europe	137 (40.3)	44 (44.4)	93 (38.6)	32.2	.56
Central/South America	63 (18.5)	20 (20.2)	43 (17.8)	31.8	
Asia Pacific	45 (13.2)	12 (12.1)	33 (13.7)	26.7	
Mexico/Caribbean	42 (12.4)	8 (8.1)	34 (14.1)	19.1	
Multiple/Other	53 (15.6)	15 (15.2)	38 (15.8)	28.3	
Trip purpose					
Academic	164 (48.2)	55 (55.6)	109 (45.2)	33.5	.05
Leisure	144 (42.4)	32 (32.3)	112 (46.5)	22.2	
Work/volunteer	32 (9.4)	12 (12.1)	20 (8.3)	37.5	
Primary travel residence					
Hotel or resort	97 (28.5)	22 (22.2)	75 (31.1)	22.7	.34
Apartment or rental home	80 (23.5)	28 (28.3)	52 (21.6)	35.0	
Host family	64 (18.8)	21 (21.2)	43 (17.8)	32.8	
Local friend or family member	35 (10.3)	9 (9.1)	26 (10.8)	25.7	
Hostel	35 (10.3)	8 (8.1)	27 (11.2)	22.9	
Other	29 (8.5)	11 (11.1)	18 (7.5)	37.9	
Trip duration					
Median (range) in days	18 (2-361)	56.5 (2-361)	16 (3-339)	N/A	<.001
1 to 7 days	60 (17.8)	9 (9.2)	51 (21.3)	15.0	.001
8 to 14 days	81 (24.0)	20 (20.4)	61 (25.5)	24.7	
15 to 30 days	68 (20.2)	16 (16.3)	52 (21.8)	23.5	
31 to 120 days	56 (16.6)	26 (26.5)	30 (12.6)	46.4	
121-365 days	72 (21.4)	27 (27.6)	45 (18.8)	37.5	
Traveling companions ^b					
Other student(s)	159 (46.8)	52 (52.5)	107 (44.4)	32.7	.17
Friend(s)	127 (37.4)	50 (50.5)	77 (32.0)	39.4	.001
Family member(s)	95 (27.9)	26 (26.3)	69 (28.6)	27.4	.66
Professor	59 (17.4)	17 (17.2)	42 (17.4)	28.8	.96
Romantic partner	48 (14.1)	17 (17.2)	31 (12.9)	35.4	.30

Study abroad program representative	32 (9.4)	15 (15.2)	17 (7.1)	46.9	.02
Travel guide or translator	22 (6.5)	5 (5.1)	17 (7.1)	22.7	.50
Supervisor	14 (4.2)	4 (4.0)	10 (4.2)	28.6	1.00
None	33 (9.7)	11 (10.9)	22 (9.2)	33.3	.63
Language barriers: Perceived frequency					
Never or rarely	117 (34.4)	27 (27.3)	90 (37.3)	23.1	.04
Sometimes	118 (34.7)	32 (32.3)	86 (35.7)	27.1	
Very often or always	105 (30.9)	40 (40.4)	65 (27.0)	38.1	
Language barriers: Perceived degree of impact					
Not at all	107 (31.5)	21 (21.2)	86 (35.7)	19.6	.02
A little	138 (40.6)	12 (41.4)	97 (40.3)	29.7	
Somewhat	77 (22.7)	29 (29.3)	48 (19.9)	37.7	
To a great extent	18 (5.3)	8 (8.1)	10 (4.2)	44.4	
Perceived accessibility of contraception in destination					
Easy or very easy	56 (16.5)	18 (18.2)	38 (15.8)	32.1	.08
Not sure	172 (50.7)	41 (41.4)	131 (54.6)	23.8	
Difficult or very difficult	111 (32.7)	40 (40.4)	71 (29.6)	36.0	
Perceived accessibility of condoms in destination					
Easy or very easy	227 (67.2)	67 (68.4)	160 (66.7)	29.5	.20
Not sure	75 (22.2)	17 (17.4)	58 (24.2)	22.7	
Difficult or very difficult	36 (10.7)	14 (14.3)	22 (9.2)	38.9	
Perceived accessibility of abortion in destination					
Easy or very easy	14 (4.1)	2 (2.0)	12 (5.0)	14.3	<.001
Not sure	169 (49.9)	35 (35.4)	134 (55.8)	20.7	
Difficult or very difficult	156 (46.0)	62 (62.6)	94 (39.2)	39.7	
Number of alcoholic drinks consumed per week					
None	32 (9.4)	9 (9.1)	23 (9.6)	28.1	.65
1 to 7 drinks	206 (60.8)	62 (62.6)	144 (60.0)	30.1	
8 to 21 drinks	82 (24.2)	25 (25.3)	57 (23.8)	30.5	
22 drinks or more	19 (5.6)	3 (3.0)	16 (6.7)	15.8	
Had ≥ 1 episode of binge drinking ^c					
Yes	193 (56.9)	64 (65.3)	129 (53.5)	33.2	.05
No	146 (43.1)	34 (34.7)	112 (46.5)	23.3	
Used recreational drugs					
Yes	75 (22.1)	25 (25.3)	50 (20.8)	33.3	.36
No	265 (77.9)	74 (74.8)	191 (79.3)	27.9	

Table entries are n(%) unless otherwise specified. ^aP-values correspond to χ^2 statistic or Fisher's exact test for categorical variables and Wilcoxon rank-sum test for continuous variables. ^bCategories not mutually exclusive. N/A=Not applicable. ^c ≥ 4 drinks in one occasion. SD=standard deviation.

Table 15. Sexual and reproductive health characteristics during travel by contraceptive lapse status

	All participants	Contraceptive lapse during travel	No contraceptive lapse during travel	Prevalence of lapse (%)	p-value ^a
Total	340 (100.0)	99 (100.0)	241 (100.0)	29.1	N/A
Contraceptive method(s) used: ^b					
Implant	14 (4.1)	0 (0.0)	14 (5.8)	0.0	.01
Intrauterine device	39 (11.5)	1 (1.0)	38 (15.8)	2.6	<.001
Injectable	4 (1.2)	1 (1.0)	3 (1.2)	25.0	1.0
Pill	170 (50.0)	85 (85.9)	85 (35.3)	50.0	<.001
Patch	3 (0.9)	1 (1.0)	2 (0.8)	33.3	1.0
Ring	12 (3.5)	6 (6.1)	6 (2.5)	50.0	.11
Condom (exclusive users) ^c	17 (5.0)	3 (3.0)	14 (5.8)	17.7	.41
Withdrawal (exclusive users) ^c	2 (0.6)	1 (1.0)	1 (0.4)	50.0	.50
Natural family planning	3 (0.9)	0 (0.0)	3 (1.2)	0.0	.56
No method	79 (23.2)	2 (2.0)	77 (32.0)	2.5	<.001
Number of male sex partners					
None	232 (68.2)	65 (65.7)	167 (69.3)	28.0	.80
1 partner	82 (24.1)	26 (26.3)	56 (23.2)	31.7	
2 or more partners	26 (7.7)	8 (8.1)	18 (7.5)	30.8	
Type of male sex partner(s) ^d					
Boyfriend or partner	62 (18.2)	23 (23.2)	39 (16.2)	37.1	.13
Friend or traveling companion	26 (7.7)	5 (5.1)	21 (8.7)	19.2	.25
Casual acquaintance or stranger	24 (7.1)	9 (9.1)	15 (6.2)	37.5	.35
Local resident	24 (7.1)	6 (6.1)	18 (7.5)	25.0	.65
Traveler from another country	17 (5.0)	3 (3.0)	14 (5.8)	17.7	.41
Had sex with new male partner(s)					
Yes	59 (17.4)	16 (16.2)	42 (17.6)	27.1	.71
No	281 (82.7)	83 (83.8)	197 (82.4)	29.5	
Had unexpected sex ^e					
Yes	25 (7.4)	9 (9.1)	16 (6.6)	36.0	.43
No	315 (92.7)	90 (90.9)	225 (93.4)	28.6	
Had trouble communicating with male partner about contraception					
Yes	14 (4.2)	8 (8.3)	6 (2.5)	57.1	.02
No	323 (95.9)	89 (91.8)	234 (97.5)	27.6	

Brought condoms on trip					
Yes	63 (18.5)	17 (17.2)	46 (19.1)	27.0	.68
No	277 (81.5)	82 (82.8)	195 (80.9)	29.6	
Brought emergency contraception on trip					
Yes	10 (2.9)	7 (7.1)	3 (1.2)	70.0	.008
No	330 (97.1)	92 (92.9)	238 (98.8)	27.9	
Used emergency contraception					
Yes	6 (1.8)	2 (2.0)	4 (1.7)	33.3	1.0
No	334 (98.2)	97 (98.0)	237 (98.3)	29.0	
Didn't have contraception on hand when needed					
Yes	28 (8.3)	14 (14.3)	14 (5.8)	50.0	.01
No	311 (91.7)	84 (85.7)	227 (94.2)	27.0	
Initiated or switched contraceptive method(s)					
Yes	12 (3.5)	4 (4.0)	8 (3.3)	33.3	.74
No	328 (96.5)	95 (96.0)	233 (96.7)	29.0	
Had trouble maintaining contraception schedule due to travel across time zones					
Yes	102 (30.1)	53 (54.1)	49 (20.3)	52.0	<.001
No	237 (69.9)	45 (45.9)	192 (79.7)	19.0	
Had trouble finding a place to get contraception					
Yes	25 (7.4)	10 (10.2)	15 (6.2)	40.0	.20
No	314 (92.6)	88 (89.8)	226 (93.8)	28.0	
Dissatisfied with contraceptive method(s)					
Yes	37 (11.0)	11 (11.1)	26 (10.9)	29.7	.95
No	301 (89.1)	88 (88.9)	213 (89.1)	29.2	

Table entries are n(%) unless otherwise specified. ^aP-values correspond to χ^2 statistic or Fisher's exact test. ^bCategories are not mutually exclusive, although only 3 (0.9%) participants overlapped categories: implant + pill (n=1), intrauterine device + ring (n=1), and intrauterine device + natural family planning (n=1). ^cData are limited to users who did not report using any other contraceptive method. ^dCategories are not mutually exclusive. ^eNo pre-travel expectation to have sex, but was sexually active on trip.

Table 16. Relative risk of contraceptive lapse during international travel (n=333)

	Crude		Adjusted	
	RR	95% CI	RR ^a	95% CI
Duration of trip				
1 to 7 days	1.00 (ref.)		1.00 (ref.)	
8 to 30 days	1.59	0.82—3.10	1.39	0.76—2.54
More than 30 days	2.65	1.40—5.03	2.02	1.14—3.57
Language barriers: Perceived degree of impact				
Not at all	1.00 (ref.)		1.00 (ref.)	
A little	1.56	0.97—2.49	1.41	0.94—2.13
Somewhat	1.90	1.16—3.12	1.44	0.93—2.21
To a great extent	2.31	1.21—4.43	1.77	1.02—3.08
Perceived accessibility of abortion in destination				
Difficult to access	1.96	1.38—2.79	1.67	1.22—2.27
Easy to access / Not sure	1.00 (ref.)		1.00 (ref.)	
Contraceptive method				
Pill	5.89	3.48—9.96	4.51	2.57—7.94
Other/None	1.00 (ref.)		1.00 (ref.)	
Had trouble communicating with male sex partner about contraception				
Yes	2.07	1.27—3.37	1.79	1.16—2.75
No	1.00 (ref.)		1.00 (ref.)	
Had trouble maintaining contraception schedule due to travel across time zones				
Yes	2.75	1.99—3.82	1.38	1.00—1.91
No	1.00 (ref.)		1.00 (ref.)	

^aRelative risks are mutually adjusted for all covariates in the table. Covariates significant at $p < .20$ were retained in the final multivariable model.

Chapter 5

Manuscript 3

A qualitative exploration of young women's sexual and contraceptive behaviors during international travel

Introduction

Adolescence and young adulthood are pivotal life stages for relationship formation and accordingly, for maintaining one's sexual and reproductive health (SRH). Decades of research have aimed to elucidate the determinants of SRH, including sexual and contraceptive behaviors, among youth. One key insight from this body of work is that SRH behaviors are not only multifactorial, but also context specific. Finding greater variation in sexual risk behaviors *within* than *between* adolescents followed through early adulthood, Cooper described the behaviors as a “complex product of the person, the situation, and the relationship context.”¹⁷¹ Indeed, longitudinal studies show differences in use of contraception and condoms by relationship factors such as level of commitment,^{37,172} sexual communication with partners,^{173,174} and partner support for contraception.¹⁷⁴ Other studies of sexual risk-taking among youth have isolated the effect of event-level alcohol use from their global drinking behaviors.^{53,172} More knowledge of how youth's SRH risk behaviors operate within specific contexts could guide the creation of more potent interventions.

International travel is one experience that may trigger significant shifts in the context surrounding SRH behaviors. Given its increasing popularity, foreign travel warrants further research into its implications for SRH, especially for youth. In 2016 there were over 72 million trips from the United States to international destinations, an annual increase of 8%; 11% of travelers listed their occupation as “student.”^{54,55} Studying abroad, a type of travel specific to youth, entails longer and potentially more immersive experiences than other trips which may increase SRH risk. US students' participation in

formal study-abroad programs has grown 52% over the past decade, to over 300,000 U.S. students in the 2014-2015 academic year.⁵⁷

Most of the travel health literature is devoted to topics unrelated to SRH, but the spread of HIV and sexually transmitted infections (STIs) across international borders has directed attention toward travelers' sexual health. Studies have reported on the prevalence and correlates of STI acquisition and underlying risk behaviors—e.g., “casual” sex, new sexual partners, and unprotected sex—among international travelers.^{101,106,110,112,118,175,176} There are several gaps in the current literature. First, most of the samples are drawn from STI clinics, youth hostels, and other high-risk settings; behaviors in the general population of travelers are less defined. Second, studies that examine independent correlates of SRH outcomes report inconsistent findings. Third, it is unclear how risk mechanisms differ by gender because most analyses pool data from men and women. Lastly, and remarkably, empirical studies of travelers' contraceptive behaviors—other than condom use—are lacking. Not only would these data shed light on women's motivations for condom use with travel sex partners (i.e., to prevent pregnancy, STI, or both), they are also essential to understanding women's vulnerability to unintended pregnancy while traveling.

Research into the SRH of international travelers must consider the complexity of the travel setting. Entering a new country involves an abrupt shift in one's environment that may reverberate across many domains influencing SRH. For example, scholars have conceptualized the psychological state of travel one of anonymity, liminality, ephemerality, and freedom from routine roles and obligations—leading travelers to feel less inhibited and more prone to risky behaviors.^{78,80,81} International travelers also operate within discrete social networks that provide opportunities for new sexual partners. In qualitative studies, women report that their travel relationships, both platonic and romantic, were more intimate and progressed more quickly than at home.¹⁷⁷⁻¹⁷⁹ Travelers are also situated within the landscape of local policies and systems that govern the accessibility of SRH services. Access to emergency contraception (EC) and abortion is highly variable both between and within countries.^{69,70} Finally, local environments are imbued with cultural norms regarding sex, gender, and substance use

that may foster greater risk-taking by visitors. These examples illustrate two methodological challenges. First, many travel-related constructs are difficult to operationalize into quantitative measures. Second, international travel is comprised of several effects that operate simultaneously, across multiple domains, and in a condensed time frame.

In sum, the impact of international travel on SRH is not fully clear due to gaps in the existing literature and the complex nature of travel itself. Qualitative research methods are well suited for characterizing complex phenomena and generating hypotheses for potential mechanisms.¹³⁶ In this study, we use semi-structured qualitative interviews to explore the underpinnings of young women's sexual and contraceptive behaviors during international travel. We focus on young women because of the disproportionate burden of STIs and unintended pregnancy borne by this age group^{6,17} and the paucity of research on female travelers' contraceptive use. To capture the breadth of women's SRH experiences, including resilience to adverse outcomes, we consider various types of travel (i.e., purpose, duration, destination) and sample travelers from clinical and non-clinical settings. We address the following research questions:

- What expectations do women have regarding their sexual relationships and contraceptive use during international travel? What reasons do they give for these expectations? How do women's expectations align with their travel experiences?
- What are the circumstances that give rise to women's sexual encounters during international travel?
- How do female travelers negotiate STI and pregnancy prevention with their male sex partners?
- What are the factors that facilitate or hinder young women's contraceptive adherence while traveling?

Our goals are two-fold: (1) To strengthen the body of evidence regarding the effects of international travel on SRH, and (2) To highlight risks to travelers' SRH that

are potentially modifiable via pre-travel interventions by clinicians and other practitioners.

Methodology

Sample

Our data come from the International Travel and Reproductive Health Study, a cross-sectional, mixed-methods study conducted from October 2015 through March 2017. The study was comprised of female university students who had recently returned from an international trip (“Traveler”) or were preparing to travel internationally (“Pre-Traveler”). This analysis features the 25 Travelers and 19 Pre-Travelers who completed an in-depth qualitative interview. The University of Minnesota Institutional Review Board approved the study protocol.

We recruited participants from the University of Minnesota’s Twin Cities campus via flyers, Facebook, the campus study abroad office, and the campus travel clinic. Potential participants self-screened for eligibility on the study website. Inclusion criteria were: female, 18-29 years old, history of sex with male partner(s), understands English, and considers the United States their home country. Participants also had to have completed a travel medicine visit for their recent or upcoming trip because some aims of the main study pertained to the travel medicine encounter. We excluded women who were married, engaged, pregnant, attempting pregnancy, or sterile. Inclusion criteria were further defined by travel status: traveled internationally in the previous three months (Travelers); or plans to travel outside the United States in the next three months, with no international travel in the past six months (Pre-Travelers).

After enrolling 25 participants, we began using purposive sampling based on our preliminary observations of the data. For Pre-Travelers, we stopped recruiting women who were in relationships with men but would not be traveling with their partners. These participants had given highly consistent responses to questions about their expectations of travel sex, suggesting that additional interviews were unlikely to yield new information. We also instituted recruitment quota for Travelers so that at least half of the sample had experienced a new sexual partner, an unexpected sexual encounter, or a lapse in

contraceptive use while traveling. The preliminary Traveler sample skewed toward lower-risk SRH experiences and our goal was to explore experiences along the entire spectrum of risk.

Data collection

Participants completed interviews in private rooms. Interviewers used semi-structured guides that consisted mostly of standardized, open-ended questions. Some questions included optional probes that interviewers used at their discretion to encourage further elaboration from participants. This approach ensured consistency in the data collected across interviews, but also flexibility in how deeply interviewers explored each question with each participant. The interviews ranged in duration from 11 to 58 minutes with a median of 29 minutes. Participants received a \$20 gift card upon completion of the interview. The interviews were digitally recorded and later transcribed verbatim.

We took several precautions to create an environment in which participants felt comfortable discussing their personal attitudes and experiences related to travel and SRH. First, all interviews were conducted by female graduate students who were unacquainted with the participants. Second, interviewers assured participants that there were no correct answers and that they could skip any questions that made them feel uncomfortable. Third, the interview began with questions unrelated to SRH (e.g., “What was the best part about your trip?”) and gradually eased into more sensitive material. Finally, interviewer training emphasized the importance of withholding judgment and allowing participants to lead their own narratives.

Most interview measures focused on a single, round-trip international excursion originating in the United States (“index trip”). For participants with multiple trips in the three months before (if Traveler) or after (if Pre-Traveler) the interview, the index trip was defined as the one closest to the interview date. For this analysis, we selected measures pertaining to the pre-travel period that were assessed for both Travelers and Pre-Travelers: trip preparations (including for SRH), expectations to have sex on the trip, plans for contraceptive use, and SRH-related concerns for the trip. We included additional measures assessed only for Travelers: sexual partnerships during travel (description of partner(s), conversations about pregnancy/STI prevention, condom use);

contraceptive methods used; contraceptive use during travel; and reflections on how closely their pre-travel expectations matched their travel SRH experiences.

Before the interview, participants completed a brief baseline survey about their demographic characteristics (age, undergraduate or graduate student), SRH history (age at first sex, history of EC use), and trip characteristics (relationship status at departure, destination, primary purpose, duration, traveling companions).

Analysis

We summarized baseline characteristics using descriptive statistics. For the interview data, we followed qualitative analysis procedures described by Miles et al.¹⁸⁰ In the first stage, we began to condense the raw text from interview transcripts by coding them in ATLAS.ti Mac version 1.6.0 (ATLAS.ti Scientific Software Development GmbH; Berlin). We drafted a codebook that reflected the content of the interview guides and our initial review of the transcripts. During the coding process, we made multiple revisions to the codebook based on our observations of the data. We used an iterative, double-coding process whereby the coding of each transcript was performed by a primary coder, reviewed by a secondary coder, and updated as needed to conform to the final version of the codebook. Coders met frequently to resolve discrepancies and to refine the code set and definitions.

In the second stage of analysis, we exported the data from ATLAS.ti and organized them in matrices by topic (e.g., contraceptive use, sexual relationships). Within each matrix, we further synthesized the data to identify emergent themes. Some themes garnered endorsement from many participants, while others were less represented but nevertheless salient. We verified our conclusions through multiple reviews and re-groupings of the data. Participants could be represented under multiple themes because we classified them under every theme that was consistent with their responses.

Results

Participants were predominantly undergraduate students with a median age of 20-21 years (**Table 17**). Approximately 40% had used EC in the past and almost all (92-

95%) were experienced with international travel. A variety of geographic regions were represented in participants' travel destinations. Most participants (53-72%) were traveling on study abroad programs or to fulfill other academic requirements. Trip duration varied widely from a few days to one year. The most frequently reported contraceptive methods for travel were the pill (42-48%) and intrauterine device (IUD, 26-28%).

Below, we describe our qualitative findings within four categories: (1) Pre-travel expectations of sex, (2) Sexual partnerships during travel, (3) Facilitators of contraceptive use, and (4) Barriers to contraceptive use. We feature participant quotations to illustrate facets of each theme.

Pre-travel expectations of sex

Apart from those traveling with their partners, participants overwhelmingly thought that they would not have sex on their trip. Their rationales were varied but frequently centered on personal values, perceptions of limited opportunities for sex, and trip characteristics. We were unable to characterize travelers who were not in a relationship, but anticipating sexual activity on their trip, because only two participants fit that category. While most Travelers reported that their pre-departure expectations were borne out on their trip, some reported unexpected experiences.

Theme 1: Personal values support abstinence (n=23). Participants who were in relationships but traveling without their partners (n=13) voiced clear abstinence expectations stemming from their commitment to monogamy (e.g., “I have a pretty serious boyfriend...I don’t plan on doing anything to jeopardize that.”). Other travelers invoked personal values that were opposed to casual sex (“I’m not just going to go sleep with some random dude”) or relationships that become sexual too quickly (“I want to know them before making that connection”)—scenarios that they associated with having sex during travel. Some participants mentioned trip length in conjunction with value-based statements: “I only like to have sex in committed relationships and you can’t really form a committed relationship in two-and-a-half months.”

Theme 2: Not that kind of trip (n=12). Many participants expected to be abstinent due to the nature of their trip. Some perceived sex as selfish or incongruent with their trip’s purpose: “In my mind this isn’t really like a leisure trip” and “I am just trying

to stay a little more professional on this trip.” According to one participant, professors leading her trip discouraged students from being sexually active. Some women described being too busy to pursue sexual relationships while traveling, or that sex would be a distraction to their travel goals: “I’m not even thinking about [sex]. I’ll be just so busy and am excited about seeing the country.” For one Pre-Traveler who had just ended a relationship, abstinence was a fundamental component of her trip. As she explained, “I’m looking forward to taking care of myself and that includes being celibate.” Others predicted a lack of potential sex partners given the trip duration or travel companions: “The trip is going to be all girls, I’m staying with a girl, I’m straight (laughs).” One participant articulated several reasons in this category:

“If I were vacationing or living there, I would be sexually active. But when it’s two weeks and I don’t really know anyone....I’ll be busy doing what I’m there to do—being there with the kids and volunteering. It’s not, like, a relaxation trip.”

Theme 3: Abstinence for STI/HIV prevention (n=6). These participants planned to refrain from travel sex out of concern for STIs or HIV. While some concerns were unrelated to travel—“I have this guilt association with infectious diseases and so I just rarely have sex”—others were situated in the travel context (“I would be nervous about what you could potentially contract. Not just abroad, but in a country like that, too.”). A few participants cited the higher HIV rates in their destination, with one saying she would “think a whole lot harder” about having sex with a local partner than with someone in the United States.

Theme 4: Keeping things open (n=7). These participants held ambiguous expectations that favored abstinence, but still entertained the possibility of initiating a new sexual relationship while traveling. Many described their expectations in terms of their personality rather than of the circumstances of their index trip: “It wasn’t like I was going there to get laid. But I’m a pretty open person when it comes to relationships.” Others said they were “going there with a really open mind” and “[weren’t] planning or not planning” on being sexually active. Having flexible expectations was often expressed in terms of preparedness: “My plan was to not be involved with anybody emotionally or physically. But I guess I know myself pretty well, so I took birth control with me.” When stressing the importance of being prepared, some participants referenced their own

experiences with spontaneous sexual encounters. One participant drew from her past involvement in “hookup culture,” where sex “just happens.”

Theme 5: Unfulfilled abstinence expectations (n=4). Four Travelers, all on study-abroad trips, were sexually active despite pre-travel plans to be abstinent. Notably, three of them were traveling for at least six months and two remained in their destination longer than they originally planned. One participant, who described her travel sex encounter as “spur of the moment,” had anticipated dancing with men at clubs but “never really anything past that.” Another woman contrasted her travel “hook-ups” with her expectations: “I don’t think I ever would have done that if I were [in the United States]. I just didn’t expect to be with anybody, much less three partners.” The third Traveler was in a committed relationship when she left for her six-week trip and “obviously intended to remain monogamous,” but quickly began an intimate relationship with another student. The last participant went into her trip thinking, “It’s going to be a dry four months!” then had five sexual partners—the “polar opposite” of what she expected. Her advice to other women traveling: “Definitely consider your reproductive health and have plan A and then have a backup. Because when you travel, things will not go according to plan.”

Sexual partnerships during travel

Travelers perceived many aspects of their index trip as facilitating new sexual partnerships (themes 1-3 below). For these first three themes, participants are represented regardless of whether they had new sex partners while traveling, although the majority did. For sexually active participants, we characterize both successful (theme 4) and unsuccessful (theme 5) experiences with using condoms and contraception, including negotiation with sexual partners.

Theme 1: Center of attention (n=8). Many women received considerably more attention from men in their travel destination compared to the United States. While reports of street harassment (i.e., “cat-calling”) were frequent, this theme denotes more targeted pursuits of sexual relationships. Travelers spoke of feeling like “a novelty,” exoticized as Westerners, and stereotyped as sexually promiscuous: “They expect us to be more loose and uninhibited. And there was definitely an expectation that some of us would have sex with men at the bars.” Travelers to Latin American countries described

“gringa hunting”—local men’s pursuit of white female tourists for sex. One speculated that the phenomenon might be partly attributable to “a lot of women who come and want their flings...it’s definitely from both sides.” Attention from men wasn’t always unreciprocated or unwelcomed and at times led to sexual encounters. One Traveler said it was “a lot easier to get with people down there” for women wanting to have sex. Another woman who met a new partner at a club described a more “expressive culture” in which men “woo a girl” much more assertively.

Theme 2: Situational disinhibition (n=6). Participants pointed to psychosocial features of the travel environment that fostered behavioral disinhibition and, at times, risky sexual behaviors. Some viewed travel as an opportunity for exploration and experimentation. One participant knew she would be “kind of exploring out there” but “went a little crazy” with the number of sexual partners she had while traveling. Women also alluded to “partying” atmospheres typified by casual sex and substance use, using both positive (“all these twenty-somethings having fun”) and negative (“crazy ex-pat communities”) terms. Four participants attributed their sexual risk-taking to alcohol use. One focused on her academic responsibilities during the week, but “things would happen on the weekends. Insert beer, tequila. (laughs)...drinking definitely led me to make [sexual] decisions that I later regretted.” Another participant was unfaithful to her boyfriend—something she “had never done and will never do again”—while inebriated. While noteworthy, such accounts were the exception across the entire sample of Travelers; the majority perceived no change in their drinking habits, nor did they think their alcohol use influenced their sexual decision-making while traveling.

Theme 3: Compressed intimacy (n=4). “When you’re traveling, you get to know people so well, so quickly because you’re with them constantly. It’s such a deep and intense relationship, not like here [in the United States].” This statement from a Traveler who had three new sex partners during her trip depicts the particularly intense attachments that some women forged during travel. Other women witnessed “close-knit” and “intimately connected” groups of travelers. One participant who had a serious partner back home described her unexpected attraction to a fellow student: “I was drawn to him because he had been there, I felt safe around him, I felt like he already knew me.” Their

connection was accelerated by her dependence on his familiarity with the local environment and culture.

Theme 4: Trouble with condoms or communicating with partners (n=6). These Travelers, all of whom had new sex partners, used condoms inconsistently or had problems communicating with partners about condoms or contraception. Some of these episodes were due to cultural barriers. One participant was surprised to encounter resistance to condoms from her local partners, who favored withdrawal: “They’re like ‘Oh, I’ll just pull out.’ And I’m like, ‘I don’t even know you! And you don’t know me! What the heck!’ They were a little bit more belligerent.” One of her travel partners also removed a condom during sex without telling her. Other participants described local partners who avoided talking about pregnancy/STI prevention: “We didn’t have that conversation...the difficulties I had were cultural—not language at all.” One participant anticipated “pushback” from her partners on condom use if she told them she had an IUD, so she did not disclose her device. Another IUD user never used condoms with her new partner, even though they had only discussed risk of STIs, and not pregnancy, before their relationship became sexual. Condom troubles brought serious consequences for some Travelers. One participant reused a condom from the night before (with the same partner) and subsequently contracted herpes. Another had to use “crappy condoms from the grocery store” after running out of her preferred US brand and one of them broke during sex. With help from her partner, she found a local store that sold EC. A third participant neglected to use a condom because she thought she was outside her fertile window and subsequently became pregnant. She procured both a medication abortion and IUD while traveling.

Theme 5: Successful condom use and partner communication (n=7). Participants traveling with their regular partners “had things figured out” when it came to contraception, including condoms. For the other women who entered new sexual partnerships, communication was positive with at least some partners. While conversations were not always extensive, they were sufficient to establish that a condom would be used: “In general it was just like, ‘We’re going to use a condom.’ That was never questioned.” Two participants who were using both condoms and the pill decided to stop using condoms with their partners after discussing their STI status and testing

history. They described their partners as honest and truthful, and one appreciated that her partner initiated the conversation—“He was on top of things and wanted to make sure we were taking care of ourselves.” Another woman relied on mostly non-verbal cues to negotiate condom use with a partner she had met that same evening.

Facilitators of contraceptive use

Participants identified many supporting factors in both the pre-departure and travel periods that contributed to their successful contraceptive use. Themes were often delineated by method type and methods that required more regular behaviors, such as the pill, elicited more extensive comments.

Theme 1: Method is innately low maintenance (n=11). Nine IUD users were confident in their ability to prevent pregnancy while traveling due to their method’s high effectiveness and lack of maintenance. Their comments included, “It’s inside of me—all there and accounted for,” “It goes with me everywhere,” and “It just lasts all the time.” One participant specifically mentioned travel considerations: “It was really nice that I had an IUD...I didn’t have to worry about bringing enough pills into the country. Pills definitely were not available there.” Another traveler did not have to arrange for refrigeration of her vaginal ring because her trip fell within the three weeks that her ring was *in situ*. A patch user appreciated that she could just take her supplies with her without worrying about logistics like temperature control.

Theme 2: Digital tracking tools (n=10). Most pill users relied (or planned to rely) on daily alarms on their phones or watches for reminders. As one participant described: “I had a timer on my watch and then added the difference to the time I would have taken my pill here [in the U.S.]” One practitioner of fertility-based awareness used a smartphone app to track her menstrual cycle. For almost all participants, these tools were already integrated into their contraceptive routines in the U.S. Therefore, women were confident and matter-of-fact in transferring them to the travel setting.

Theme 3: Adequate pre-travel supplies (n=10). These participants, mostly pill users, did not have to make any special arrangements to obtain enough contraceptives for their trip because their normal supply was adequate, even abundant. Some of them mentioned receiving multiple pill cycles at a time and one had enough pills to last four

months. Trip duration was a contributing factor: contraceptive supplies were only sufficient because these pill users were gone for six weeks or less. One Traveler explained, “I already had the pills that I needed. I didn’t have to say anything like ‘I need this many more because I’m going to be gone.’ It was just a few weeks.” Another woman clarified that she did not need any “long term” supplies. The remaining participants had enough patches or latex condoms to last their entire trip.

Theme 4: Pre-travel anticipation of contraceptive challenges (n=9). For some participants, preparing for travel included thinking about its potential impact on their contraceptive use. A few pill users commented on their plans to accommodate the time difference between their home and travel destination in their pill-taking schedule. Some of them sought guidance from a healthcare provider: “That was super helpful—her making that point that you have to adjust the time.” One participant contemplated skipping her placebo pills while conducting fieldwork in a remote area because “it’s less things to pack and less things to worry about” in terms of menstrual products. Another woman was mindful of how her bleeding patterns change with her stress levels: “I was aware of how that might affect me—thinking the IUD was working, if my period was late or early.” Two ring users knew they wouldn’t have reliable access to refrigeration while traveling and carefully mapped out their schedules as to avoid changing their ring during their trip. There were also two women who did not anticipate problems with their contraception, but traveled with their own supply of EC “just in case.”

Theme 5: Learning from past travel experiences (n=4). A few pill users described how their previous travel experiences—for example, maintaining a daily schedule while crossing multiple time zones—informed their contraceptive use on their index trip. One Traveler was more prepared after facing contraceptive barriers on previous trips: “I know it’s hard to keep track of what time you are supposed to take your pill. I had just taken a trip where I didn’t get my pills in time. For that reason, I make sure I have an advance supply more than the day before I leave on a trip.” Another woman traveled with her own supply of EC, a habit she developed during prior trips: “I always felt better having [EC] in my back pocket. If a condom broke, it was still going to be a vulnerable situation, but I had one measure of protection still available. Especially in a place where abortion would probably not be accessible.”

Barriers to contraceptive use

Apart from the challenges some participants faced when negotiating condom use with their travel sex partners, all barriers to contraceptive use related to pills.

Theme 1: Insurance and healthcare provider blockades (n=8). Many pill users faced obstacles from health insurance companies or healthcare providers while trying to secure enough contraception for their upcoming trip. Some insurance plans restricted the number of pill cycles that could be dispensed at one time, which left participants without enough pills to cover their entire trip: “I had already picked up a prescription within the month, so I could pay out of pocket or wait until the end of the week...but I was leaving town before that.” One woman leaving for a year-long study abroad program could only get enough pills for six months, the duration of her student health insurance policy; she unsuccessfully petitioned to access the additional six cycles she needed for her trip. Some participants were able to circumvent insurance-related barriers with multiple phone calls and assistance from pharmacists, but others were only left with the option to pay out of pocket for the contraception they needed. Participants also cited provider-related barriers: two were prescribed the wrong pill formulation and one of them only discovered this mistake after arriving at her travel destination. She experienced “really bad side effects,” depression and weight gain, which led her to discontinue the pill in the midst of traveling. Another participant was “too lazy” to acquire a refill before leaving and discontinued the pill during her trip.

Theme 2: Disruptions from air travel (n=6). Traveling across multiple time zones and on lengthy and complicated flight itineraries led to disruptions in some participants’ pill-taking routines. One experienced traveler remarked, “I tried to manage it alright and kind of calculate it out, but it’s always a struggle. There was a little confusion.” Another woman had to “start fresh” with her pill schedule while traveling because her usual time was in the middle of the night at her destination; she described the process as “tough” and “confusing.” One Traveler was so daunted by the “complete opposite” hours between her home and travel destination that she decided to stop taking the pill before she departed; she didn’t have sex while traveling, but regretted the return of her menstrual cramps.

Some participants adhered well once they arrived, but became disoriented while traveling by plane: “You know, the days flying you forget. ‘Okay, we left on a Saturday, and by the time we got here it was still Saturday. Do I take one pill or two pills?’” Another succinctly remarked: “I was flying and I was like, ‘What time is it?!’” In addition to the pill users counted in this theme, there were others who did not consider the implications for their pill schedule: “I have no idea [about the time change]. I’m probably just going to take the risk and be like, ‘Whatever’s 24 hours later.’ We’re going to be traveling for an entire day.”

Theme 3: Pregnancy prevention not an immediate concern (n=5). Travelers who were not in sexual relationships during their trips expressed less diligence about their pill adherence. Four reported missing at least one pill during their trip. When discussing their pill lapses they used phrases such as “not a huge concern,” “not super careful,” “definitely intentional at times,” and “a little slack.” Two participants who traveled across multiple time zones admitted to giving no thought to the ramifications for their pill-taking schedule. Some women mentioned other motivations, besides pregnancy prevention, for staying on their pill regimen. One participant was primarily using the pill “for the skin and mental health—all those benefits.” Another continued using the pill to avoid the hormonal changes associated with discontinuing and restarting. Reflecting on her poor compliance, she described herself as only “kind of” using the pill.

Discussion

This study leverages the strengths of qualitative research methods to explore young women’s SRH behaviors in the multifaceted context of international travel. We consider pre-departure factors as part of this context, including women’s expectations of sex. In non-travel settings, not expecting or planning sex is among the reasons women give for having sex without using contraception.³⁴ Quantitative studies of female travelers find that unexpected sex is common—describing 32-75% of new sexual partnerships—but report mixed findings for its association with risky sexual behavior.^{91,93,109,114,179} We provide several novel insights into the relationship between sex expectations, pre-travel preparations, and SRH behaviors that may inform future research. First, women provide

myriad rationales for anticipating abstinence, even when they are single and taking longer trips, and they only associate sex with leisure trips. Second, ambiguous expectations accommodate a theoretical possibility of sex and coincide with prevention behaviors such as taking condoms “just in case.” These first two findings are echoed in a qualitative study of Swedish women backpacking in Vietnam.¹⁸¹ Third, unexpected sexual encounters are typified by some healthy behaviors (i.e., condom use, partner communication) but also by unprotected sex, substance use, condom errors, and unintended pregnancy. Fourth, travelers use their expectations of abstinence to rationalize non-adherence and discontinuation of their hormonal contraceptive methods.

Our study points to some aspects of international travel that may facilitate new sexual relationships and sexual risk-taking. Many prior studies attribute travelers’ increased engagement in risky sexual behaviors to their desire for exploration, higher substance use, and perceptions of anonymity and liminality—phenomena that are also evident in our sample.^{78,80,182,183} Like other authors, we also find that these factors are not universally present or influential across women’s travel experiences.^{181,184,185} For example, the university students in our sample mostly report similar drinking habits for home and abroad. Additionally, those with new partners often engage their habitual (pre-travel) STI and pregnancy prevention strategies and comfortably initiate sexual communication with their partners. Nonetheless, we observe significant SRH outcomes—EC use, STI acquisition, unintended pregnancy, and abortion—for women who exhibit more susceptibility to the disinhibiting effects of travel. Priorities for future research include the development and validation of quantitative measures that capture the psychosocial and cultural environment of international travel. It is important that measures be evaluated across different destinations, trip types, and traveler populations to establish the range of their effects. With valid measures of these constructs, researchers can better evaluate their associations with SRH outcomes. An example comes from Marcantonio and colleagues, who developed a 12-item measure for “situational conditions”; higher scores represented more participation in a sexualized study-abroad environment.¹⁸⁶ Scores helped to differentiate low-risk and high-risk pathways for students’ sexual behavior during travel.

We make a significant contribution to the research literature with our data on women's contraceptive attitudes, preparations, adherence, and experiences in the course of international travel. In this study, we observed an array of contraceptive considerations brought on by international travel—e.g., procuring extra supplies, adjusting schedules, and maintaining use during air travel—and obstacles that trigger contraceptive lapses and discontinuation. The logistical requirements of travel magnify differences in upkeep between methods; challenges are most acute for pill users, while travelers with IUDs appreciate their maintenance-free contraception. The literature will benefit from additional research into travel considerations for each contraceptive method type; women's strategies for overcoming contraceptive obstacles before and during travel; and interventions to support women's adherence to contraception while traveling.

Clinical and policy implications

Travelers may seek healthcare prior to their departure to receive services indicated for their destination (e.g., vaccines), obtain prescription refills, or manage their chronic medical conditions. The pre-travel clinic visit offers a timely opportunity for SRH counseling. We urge greater recognition of contraceptive lapse and unintended pregnancy as potential health risks for female travelers of reproductive age, just as clinical guidelines acknowledge the potential for travel-associated STI.⁶¹ At a minimum, providers should raise the possibility of unexpected sexual encounters and inquire of travelers' contraceptive plans, needs, and concerns. Hormonal method users should be encouraged to maintain strict adherence, even if they expect to be abstinent. We find that the days travelers spend in transit are particularly high-risk for pill lapse and that many women do not consider the implications of travel for their pill routines. Pill users need specific guidance customized to their itinerary, preferred time of day for pill taking, and time difference between their home and travel destination. The pre-travel visit is also an opportune time for clinicians to counsel women on EC use and offer them a dose to bring on their trip.⁶⁷ EC is a safe, simple, and critical intervention for the prevention of unintended pregnancy following contraceptive failure, unprotected sex, or sexual assault. There is precedent for travel medicine clinicians to prescribe medications for travelers to use only if necessary—most commonly, antibiotics for diarrhea.¹⁸⁷

Consistent with previous studies of non-traveling pill users, we find barriers associated with policies that restrict the number of cycles that women can receive at one time.^{188,189} The burden imposed on international travelers goes beyond frequent trips to the pharmacy. Women who anticipate being in another country when they are eligible for a refill must circumvent policy limits if they wish to have a sufficient contraceptive supply. Assistance from healthcare providers, pharmacists, and insurance companies is not guaranteed. Travel-associated barriers led some of our participants to discontinue the pill—a very significant event for women at risk of unintended pregnancy. We argue that the risks women potentially incur by traveling abroad without enough contraception far outweigh the costs of dispensing additional pill cycles.

Limitations

Our findings should be considered in light of study limitations. First, qualitative studies do not aim for generalizability, but for a rich description of a particular sample—in this case, female travelers attending a single U.S. university. Some of our insights may not apply to other populations of U.S. travelers, although a lack of comparable studies makes such an assessment difficult. Second, data collected from face-to-face interviews are subject to social desirability bias, particularly when related to sexual behavior.¹⁹⁰ While many of our participants report socially unsanctioned behaviors such as unprotected sex and multiple sex partners, we cannot be sure that all participants report these behaviors with honesty and accuracy. Third, qualitative analysis is an inherently subjective exercise where the investigator is the arbiter of “significance.” We cannot eliminate the possibility of investigator bias, even though we include safeguards such as double coding and verifying our conclusions through multiple checks of the data.

Conclusion

The health of international travelers and the SRH of young women are the subjects of sizeable, but largely discrete, bodies of research. The nexus of these literatures deserves greater attention as researchers strive to pinpoint the situational and contextual influences over young women’s SRH. International travel is increasingly common and also distinguished by its sudden and potentially sweeping impact on the environment

surrounding women's attitudes, decisions, behaviors, and health outcomes. Our study demonstrates that travel may amplify certain risk mechanisms for SRH, relative to what young women experience in their routine settings. While many research gaps remain, particularly for travelers' contraceptive use, our findings suggest potential targets for intervention. Clinicians, study-abroad program administrators, and other practitioners who connect with young women prior to their departure should help women integrate SRH into their travel preparations. Even for international trips perceived as low-risk for SRH, these pre-travel interactions are opportunities to reinforce young women's pregnancy/STI prevention strategies.

Table 17: Demographic, sexual and reproductive health-related, and travel-related characteristics of qualitative interview participants by travel status

	Travel status	
	Pre-Traveler (n=19)	Traveler (n=25)
Age (years)		
Median (range)	20 (18-26)	21 (19-28)
18-19	4 (21.1)	2 (8.0)
20-21	10 (52.6)	13 (52.0)
22-29	5 (26.3)	10 (40.0)
Undergraduate student	15 (79.0)	18 (72.0)
History of emergency contraception use	8 (42.1)	10 (40.0)
History of international travel ^a	18 (94.7)	23 (92.0)
Relationship status prior to departure		
Single	13 (68.4)	10 (40.0)
In a relationship	6 (31.6)	15 (60.0)
Traveling with romantic partner	1 (5.3)	5 (20.0)
Traveling alone	4 (21.1)	3 (12.0)
Trip destination (region)		
Asia Pacific	7 (36.8)	6 (24.0)
Central/South America	3 (15.8)	9 (36.0)
Europe	2 (10.5)	1 (4.0)
Mexico/Caribbean	1 (5.3)	1 (4.0)
Other	4 (21.1)	3 (12.0)
Multiple	2 (10.5)	5 (20.0)
Trip purpose		
Academic	10 (52.6)	18 (72.0)
Leisure	5 (26.3)	6 (24.0)
Work/volunteer	4 (21.1)	1 (4.0)
Trip duration		
Median (range) in days	21 (5-210)	90 (14-365)
1 to 14 days	3 (15.8)	1 (4.0)
15 to 30 days	8 (42.1)	8 (32.0)
31 to 120 days	7 (36.8)	8 (32.0)
121-365 days	1 (5.3)	9 (36.0)
Contraceptive method(s) used on trip ^b		
Implant	1 (5.3)	0 (0.0)
Intrauterine device	5 (26.3)	7 (28.0)
Pill	8 (42.1)	12 (48.0)
Patch	1 (5.3)	0 (0.0)
Ring	2 (10.5)	0 (0.0)
Condom	2 (10.5)	9 (36.0)
Natural family planning	0 (0.0)	1 (4.0)

^aNot including the index trip. ^bCategories are not mutually exclusive. For Pre-Travelers, data represent anticipated travel methods.

Chapter 6

Discussion

I. Strengths

A. Public health significance

Viewed through the lens of epidemiology, international travel is a high-frequency exposure in the US population. In 2016 alone, roughly 36 million women were “exposed” to traveling outside the United States.^{54,56} This dissertation evaluates the association between this common exposure and SRH outcomes of considerable consequence for adolescent and young adult women. Contraceptive lapse and new sexual partnerships with men contribute to the disproportionately high incidence of STI and unintended pregnancy for young women in the United States. Identifying, and then mitigating, travel-associated SRH risks could improve health for the millions of annual US travelers and contribute to reductions in population SRH morbidity.

International travel also carries significance for women’s SRH, specifically, because of the worldwide variation in the accessibility and quality of SRH services—i.e., contraception, condoms, EC, abortion, and STI testing and STI treatment. Some travelers do not need these services, bring their own SRH supplies, or only seek SRH services upon their return to the United States. However, some proportion of travelers will inevitably need to access critical SRH services during their trip and for them, international travel could be a highly vulnerable experience.

B. Innovation

This dissertation addresses research questions with little precedent in the epidemiological literature. Our review of the existing research on SRH and travel identified gaps for women traveling from the United States, travelers’ contraceptive behaviors, adjusted correlates of SRH outcomes during travel, and valid comparisons of travelers with non-travelers. We conceptualized an original research study that could

bridge each of those gaps. Furthermore, to maximize our contributions to the literature, we formulated study aims that were both hypothesis-testing and hypothesis-generating. Reflecting those aims, we took an innovative methodological approach that combined the strengths of quantitative and qualitative research methods.

C. Methodology

Manuscript 1. In our first manuscript, we isolate the effects of international travel on women’s risk of new sexual partnership and contraceptive lapse. Central to our approach is the use of Pre-Travelers as a counterfactual substitute for what Travelers would have experienced, had they remained in the United States. Several methodological strengths stem from our comparison of cross-sectional samples of Pre-Travelers and Travelers. First, we minimize confounding at the design stage by selecting a comparison group with a known propensity for travel. Second, we avoid both biased recall of pre-travel behaviors (i.e., from a cross-sectional study of Travelers only) and priming of travel behaviors by pre-departure measures (i.e., from a prospective study following the same women from pre-travel to travel). Third, we integrate reference period duration—an important component of the counterfactual—into our survey design.

Manuscript 2. Our second paper evaluates a wide range of factors that may influence young women’s risk of contraceptive lapse during their international travel. The key strength of this analysis is our selection of potential correlates based on behavioral theory, a robust literature on adolescents’ SRH, and emerging research describing travelers’ sexual behavior. We consider the contributions of women’s background characteristics, their pre-departure expectations, and multiple trip-related factors. We also include comprehensive measures for contraceptive lapse and its situational antecedents (e.g., getting off schedule with taking contraception, trouble communicating with male sex partners). Lastly, we confirm the consistency of our main findings in sensitivity analyses restricted to pill users and sexually active travelers.

Manuscript 3. This paper adds critical context to the findings presented in our first two manuscripts. Using data from qualitative interviews, we describe phenomena that we could not have fully rendered with a purely quantitative approach. We consider many manifestations of SRH—e.g., expectations, concerns, behaviors, and experiences—

for both the pre-travel and travel periods, and for multiple types of travel. Furthermore, we capture international trips characterized by high risk, low risk, and even protection from risk, relative to the United States. As a result, we generate hypotheses for an array of potential risk mechanisms affecting women's SRH during travel.

II. Limitations

A. Study design

Temporality. There are limitations to our study that are inherent to cross-sectional designs. We cannot establish temporality among our survey measures for the reference period. For **Manuscript 2** especially, we are limited in our ability to make inferences regarding causes of contraceptive lapse. We can confidently assume that background and pre-travel correlates temporally precede contraceptive lapses reported for the travel period. However, we cannot say the same for correlates assessed for the same trip.

Generalizability. We analyze data from a study comprised of female students from a single institution of higher education in Minnesota. Our findings may not be generalizable to students from other US institutions, although we have no evidence that this is the case. Generalizability is likely more limited for the broader population of young women (beyond college students) who engage in international travel.

B. Measures

Misclassification (general). Most our survey measures are self-reported and retrospective. There are limited data on the reliability of retrospective SRH measures, especially for recall periods longer than six months. Recall may be suboptimal across our entire survey sample, leading to non-differential misclassification with respect to travel status. It is also possible that Travelers report more accurately because they have memorable travel experiences to anchor their recollections (*recall bias*).

Misclassification (contraceptive lapse). Findings for two of our three manuscripts are predicated on accurate measures of contraceptive lapse, which we derive from multiple survey items related to women's contraceptive use and sexual behavior. From the standpoint of data validity, it is best to measure contraceptive use in a diary or

calendar format that captures women's contraceptive use at each coital event as well as overlap in her use of multiple methods. Such measurements were not feasible for our 15-20-minute online survey. Thus, we take a conservative approach when classifying lapse for condom and withdrawal users, invariably misclassifying some true lapsed into the referent (non-lapse) group. In **Manuscript 1**, misclassification of lapse is likely non-differential because Pre-Travelers and Travelers are both affected. However, misclassification preferentially affects sex-dependent methods and Pre-Travelers were more likely to have sex during the reference period. Thus, differential misclassification is also plausible. We assume the same for **Manuscript 2** correlates; non-differential misclassification is likely, but we cannot rule out differential misclassification for variables associated with sex.

Social desirability. Data gathered through in-person interviews are typically more reliable than self-report, but are nevertheless susceptible to social desirability bias. Participants in our study may have been reluctant to share information that they perceived to be embarrassing or socially unacceptable. We attempted to mitigate this threat by instructing interviewers to avoid leading questions or reacting in a way that connotes approval or disapproval. We also emphasized with participants that there were no “right” or “wrong” answers. Social desirability bias is also possible for the survey sample, but to a lesser degree. The anonymity provided by an online survey should reduce the likelihood of participants' perceiving judgment of their responses. In all cases, we have no reason to suspect differential bias by travel status.

C. Analysis

Statistical power. The existing literature on female travelers' SRH only includes estimates for prevalence of new sexual partnerships, which we used as the basis for our power calculation. With no prior studies reporting on contraceptive lapse, we were unable to design our study in a way that would ensure adequate power for analyses treating lapse as an outcome. However, we hope that the novel estimates from our study will contribute to the design of future studies.

III. Implications

A. Implications for research

This dissertation makes substantial contributions to the burgeoning literature on SRH during international travel. To our knowledge, it is the first study to compare female travelers and non-travelers with respect to risk of new sexual partnership and contraceptive lapse. These comparisons are fraught with methodological challenges, which we address in our design and analytic approach. Hopefully we can inform the design of additional comparative studies. Second, our descriptive analyses for the prevalence of travel-associated contraceptive lapse are also seemingly unprecedented. To date, studies have only considered condom use, leaving travelers' pregnancy prevention behaviors shrouded in mystery. There are many ways to measure contraceptive use and adherence; there are both advantages and disadvantages to each approach. We hope that other investigators adopt and refine our schema to improve measures of travelers' contraceptive use. Lastly, the exploratory analyses featured in this dissertation suggest many potential avenues for future research. As one example, prospective studies that clarify temporal relationships among travel measures could help determine whether the *correlates* we identify for contraceptive lapse are also *risk factors*. Our qualitative analyses spur numerous hypotheses for factors that may influence women's SRH—positively or negatively—during international travel.

B. Implications for healthcare providers

We designed this study with healthcare providers in mind. In our sample, high proportions of travelers either visited a clinic for travel health services or had a routine provider for the SRH care. As detailed in our manuscripts, these clinical encounters are important windows for SRH counseling specific to international travel. In clinical practice guidelines for travel medicine, STIs and condom use receive much more emphasis than contraceptive use and unintended pregnancy. Our findings suggest that pregnancy prevention should be prioritized alongside STI prevention in the counseling of young women preparing for international travel.

The clinical implications of our study extend to other settings in which travelers receive education and counseling. For example, student travelers often receive educational materials, pre-travel orientation, and on-site orientation that address health topics. These platforms, along with interpersonal exchanges between student travelers and travel program staff, should look for opportunities to address travelers' SRH.

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Appendices

Appendix A. Pilot survey session guide

Appendix B. Qualitative interview guide: Travelers

Appendix C. Qualitative interview guide: Pre-Travelers

Appendix D. Sensitivity analyses for Manuscript 2

Appendix A

Pilot survey session guide

Instructions to participants: Please take this online survey. We guess it will take about 15-20 minutes. Take note of where you get stuck, are confused, or don't know how to answer the question; write down the question number on this piece of paper.

1. Survey type: ___ Pre-Traveler ___ Traveler
2. Survey start time:
3. Survey end time:
4. Let's start with the notes you made about where you got stuck. (PROBE: Tell me about why this was confusing. How could we rephrase the [question/response set] to make it less confusing?)
5. What questions made you feel uncomfortable? Can you think of a way to ask them differently that would make you feel less uncomfortable?
6. What do you think about the length of the survey? (Too long? Short? Just right?)
7. This study is focused on the sexual and reproductive health of international travelers. Was there anything missing – that is, something we should have asked, but didn't?
8. What questions would you delete, if any?
9. What did you like about this survey?
10. What other changes would you make to improve the experience of people like you taking this survey?

Appendix B

Qualitative interview guide: Traveler

Interviewer: Thank you for taking the time to talk to me. Before we start, I want to emphasize again that all questions are voluntary and you do not have to answer anything that makes you feel uncomfortable. If that happens, please let me know and we will move on to the next question. Also let me know if something's unclear and I will explain it better. There are no right or wrong answers—you are the expert here!

As I mentioned, the interview will be recorded. I'll start that now. [Start recorder.]

General

1. First I'd like to hear about where you traveled. What was the best part of your trip? (PROBE: urban vs. rural areas, traveling companions, prior travel to destination)
2. Tell me a little bit about the local culture. What are 2 or 3 things characterize [destination]? (PROBE: attitudes about sex, birth control, alcohol/drugs). How well do you speak the language?

Travel concerns

3. What were your top concerns during this trip when it comes to your health? (PROBE: illness, jet lag, accidents, etc).
4. How concerned were you about sexually transmitted infections like chlamydia or HIV? What about pregnancy? Were these things you were concerned about before you traveled?

Sexual relationships and pregnancy/STI prevention

5. Now I'd like to talk about your romantic relationships during this trip. Did you have a sexual partner on this trip? (PROBE: New partner? Local?) Tell me about how you met. What conversations did you have about preventing pregnancy? STIs?
6. What birth control method(s) did you use during your trip? Did you experience any problems using that method? Was there anything specific that helped you keep up with your birth control during this trip? (PROBE: supplies, refills, change in method due to travel considerations)
7. Did you drink alcohol or use drugs on this trip? (If so: Do you think that using alcohol or drugs affected the decisions you made about having sex? How?)

Health services

8. Did you seek out condoms in [travel destination]? *If yes*: Walk me through what you did. (PROBE: Where, with whom, how easy/difficult, quality.) *If no*: What do you think you would have done if you needed them? (PROBE: Where, with whom, how easy/difficult.) [Repeat for birth control other than condoms, EC, pregnancy testing, abortion].

Conclusion

9. Think back to the time just before you left for this trip and what you imagined it would be like. Now think specifically about your sexual and reproductive health – romantic relationships, birth control, pregnancy, and sexually transmitted infections. In what ways was this trip different than what you expected when it comes to your sexual and reproductive health? Does anything come to mind that we haven't already discussed?
10. What advice would you give to other female students who are preparing to travel abroad when it comes to their sexual and reproductive health? You can think back to your experiences on previous international trips as well, if that helps.
11. Lastly, I have some questions about long-acting reversible contraception. Have you heard of the IUD or contraceptive implant that goes in your arm? *If yes*: Thinking about your international travel experience, do you think these methods would be suitable for travelers? Why or why not?

Appendix C

Qualitative interview guide: Pre-Traveler

Interviewer: Thank you for taking the time to talk to me. Before we start, I want to emphasize again that all questions are voluntary and you do not have to answer anything that makes you feel uncomfortable. If that happens, please let me know and we will move on to the next question. Also let me know if something's unclear and I will explain it better. There are no right or wrong answers—you are the expert here!

As I mentioned, the interview will be recorded. I'll start that now. [Start recorder.]

Travel preparation & information

1. First I'd like to hear about your trip. Can tell me about it? (PROBE: Destination, traveling companions, duration, urban vs. rural areas)
2. How familiar are you with the country and its culture? Tell me a little bit about what you know. (PROBE: attitudes about sex, birth control, alcohol/drugs). How well do you speak the language?
3. What sources of information (like books or websites) have you consulted while preparing for this trip? (PROBE: for health information specifically?)
4. Walk me through what happened at your travel medicine visit. What was helpful? What remaining concerns do you have? Did you discuss anything related to sexual health such as birth control, sexually transmitted infections, or pregnancy? *If yes:* What topics? Who initiated the conversation? How did you feel during the conversation? *If no:* What would you have thought if your provider brought up sexual health concerns for this trip?

Travel concerns

5. What are your concerns for this trip when it comes to your health? (PROBE: illness, jet lag, accidents, etc.)
6. How concerned are you about sexually transmitted infections like chlamydia or HIV? What about pregnancy?

Sexual relationships and pregnancy/STI prevention

7. Do you think you'll have sex during this trip? With whom? (PROBE: travel partner, new partner) (PROBE: If not, why not?)

8. What are you planning to use for birth control during this trip? (PROBE: supplies, refills, change in method due to travel considerations). What concerns do you have about your ability to use this method while traveling?
9. Now I'd like to talk about local supplies and services in [destination]. Say you want to find condoms in [travel destination]. Walk me through what you would do. (PROBE: Where? With whom? How easy/difficult?)
[Repeat for birth control other than condoms, EC, pregnancy testing, abortion].

Conclusion

10. Now, think back to all the trips you have taken outside the U.S. What are some memorable experiences you've had related to your sexual and reproductive health? These could be good, bad, or neutral experiences.

Appendix D

Sensitivity analyses for Manuscript 2

Table D1. Multivariable models estimating relative risk of contraceptive lapse for all participants, only pill users, and only participants who were sexually active with men during travel—*Variables formatted to match main model.*

Table D2. Multivariable models estimating relative risk of contraceptive lapse for all participants, only pill users, and only participants who were sexually active with men during travel—*Variables re-formatted to address low sample size for subgroups.*

Table D1. Multivariable models estimating relative risk of contraceptive lapse for all participants, only pill users, and only participants who were sexually active with men during travel—**Variables formatted to match main model.**^a

	All (n=333)		Pill users (n=166)		Sexually active (n=103)	
	aRR	95% CI	aRR	95% CI	aRR	95% CI
Duration of trip						
1 to 7 days	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
8 to 30 days	1.39	0.76—2.54	1.47	0.76—2.82	1.19	0.30—4.78
More than 30 days	2.02	1.14—3.57	2.04	1.11—3.76	1.71	0.50—5.86
Affected by language barriers						
Not at all	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
A little	1.41	0.94—2.13	1.35	0.88—2.07	1.58	0.82—3.05
Somewhat	1.44	0.93—2.21	1.47	0.95—2.29	0.85	0.35—2.08
To a great extent	1.77	1.02—3.08	1.89	1.10—3.25	1.27	0.18—9.11
Perceived accessibility of abortion in destination						
Difficult to access	1.67	1.22—2.27	1.53	1.12—2.08	1.38	0.76—2.51
Easy to access / Not sure / Neutral	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Contraceptive method						
Pill	4.51	2.57—7.94	N/A	--	2.25	1.07—4.74
Other/None	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Had trouble communicating with male sex partner about contraception						
Yes	1.79	1.16—2.75	1.60	1.13—2.26	2.17	1.20—3.93
No	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Had trouble maintaining contraception schedule due to travel across time zones						
Yes	1.38	1.00—1.91	1.26	0.93—1.71	1.52	0.82—2.79
No	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	

^aModels include the same variables as the main model (Table 16), formatted in the same manner, to enhance comparability across models. However, small cell sizes in subgroup analyses (n<5, denoted in GRAY text) produce unstable estimates.

Table D2. Multivariable models estimating relative risk of contraceptive lapse for all participants, only pill users, and only participants who were sexually active with men during travel—*Variables re-formatted to address low sample size for subgroups.*^a

	All (n=333)		Pill users (n=166)		Sexually active (n=103)	
	aRR	95% CI	aRR	95% CI	aRR	95% CI
Duration of trip (days)	1.00	1.00—1.00	1.00	1.00—1.00	1.00	1.00—1.00
Affected by language barriers						
No (Not at all)	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Yes (All other categories)	1.59	1.08—2.33	1.58	1.07—2.35	1.41	0.74—2.69
Perceived accessibility of abortion in destination						
Difficult to access	1.60	1.17—2.20	1.47	1.08—2.02	1.34	0.75—2.39
Easy to access / Not sure / Neutral	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Contraceptive method						
Pill	4.60	2.62—8.07	N/A	--	2.47	1.14—5.35
Other/None	1.00 (ref.)		--	--	1.00 (ref.)	
Had trouble communicating with male sex partner about contraception						
Yes	1.76	1.17—2.66	1.57	1.15—2.14	2.04	1.16—3.60
No	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	
Had trouble maintaining contraception schedule due to travel across time zones						
Yes	1.40	1.02—1.93	1.30	0.96—1.76	1.42	0.78—2.57
No	1.00 (ref.)		1.00 (ref.)		1.00 (ref.)	

^aModels include the same variables as the main model (Table 16), but variables are re-formatted to address small cell size in sub-groups (n<5, denoted in GRAY text).