THE EFFECTS OF INTERNET USE ON ADOLESCENTS' FIRST ROMANTIC AND SEXUAL RELATIONSHIPS IN TAIWAN *

Simon Cheng
University of Connecticut

Stacy A. Missari
University of Connecticut

Kuo-hsun Josef Ma
University of Connecticut

Chin-Chun Yi
Academia Sinica

November 11, 2011

Running Head:

Internet Use and Adolescents' Intimate Relationships

Word Count:

9,611 words (with footnotes and abstract, 10,464 words)
2 figures, 4 tables, and 2 appendices

* Direct all correspondence Simon Cheng, Department of Sociology, University of Connecticut, Unit 2068, 344 Mansfield Rd., Storrs, CT 06269-2068. Email: simon.cheng@uconn.edu. Email for Stacy A. Missari: stacy.missari@uconn.edu. Email for Kuo-hsun Josef Ma: kuo-hsun.ma@uconn.edu. Email for Chin-Chun Yi: chinyi@gate.sinica.edu.tw.

THE EFFECTS OF INTERNET USE ON ADOLESCENTS' FIRST ROMANTIC AND SEXUAL RELATIONSHIPS IN TAIWAN

ABSTRACT

The determinants of adolescent romantic relationships and sexual behavior have always been a central topic in social science research. However, due to the pervasiveness of internet use among youth and its central importance to their social behaviors, analyses that examine only traditional determinants, such as family and academic characteristics, are no longer satisfactory. In this study, we present a quantitative analysis of the influences of internet use and internet café visits on the timing of adolescents' first romantic relationship and first sexual intercourse using longitudinal data from Taiwan that followed more than 5,000 adolescents from junior high school to their early twenties from 2000 to 2009. Survival analyses clearly indicate that, in any given age in adolescence, internet use and internet café visits both increase the hazard of first romantic relationship and first sexual intercourse, net of family bonds, parental supervision, and other commonly-controlled sociodemographic and educational variables. In particular, adolescent girls who visit internet cafés are more vulnerable than their female counterparts who do not visit internet cafés and than boys in general. Multinomial logit analyses further show that internet use and internet café visits increase the likelihood of having sexual intercourse before first romantic relationship. These results add to the growing literature on the influence of new media on adolescent development, and specifically, romantic and sexual behavior.

The media's effects on children's development have been a central concern of social science research and policymaking. In past research, the effects of television were the primary focus. However, attention has shifted to whether "new media," and the internet in particular, have a positive or negative impact on outcomes such as learning, violent behavior, and health (Bavelier, Green and Dye 2010; Brown and Bobkowski 2011; Ko et al. 2009; O'Keeffe and Clarke-Pearson 2011; Strasburger, Jordan, and Donnerstein 2010; Subrahmanyam et al. 2001). Most recently, parents and educators have focused on whether internet use puts children at an increased risk of exposure to sexual predators, pornography, and inappropriate sexual activity such as the sharing of nude pictures (e.g., "sexting") (Ferguson 2011; Dowdell, Burgess, and Flores 2011; Ryan 2010). Whereas much of the work on internet use and adolescent sexuality has focused on sexual behaviors in the virtual realm (Valkenberg and Peter 2011; Baumgartner, Valkenburg and Peter 2010a, 2010b), fewer studies have examined how internet use at home or elsewhere may impact adolescents' *actual* romantic and sexual behaviors.

We suspect that little research has been done on this topic in part due to the lack of timely large survey datasets that include information on internet use *and* adolescents' romantic and sexual activities. Consequently, empirical studies on this topic have been mostly limited to qualitative analyses exploring the dynamics of social interactions in the virtual world (Ito et al. 2009; Pascoe 2011) and social inequalities in computer and internet access (i.e. the "digital divide") (DiMaggio et al. 2001, 2004; Hargittai 2010; Hargittai and Hinnant 2008; Hargittai and Walejko 2008; Robinson, DiMaggio, and Hargittai 2003; Zhao and Elesh 2007). In this study, we take advantage of the recently available Taiwan Youth Project (TYP), which followed more than 5,000 adolescents from junior high school into their early twenties from 2000 to 2009. Using these data, we present a quantitative analysis that examines the influences of Taiwanese

adolescents' internet use in general and in internet cafés on their first romantic relationship and first sexual intercourse. Specifically, we ask: Do internet use and internet café visits in Taiwan affect the timing of first romantic relationship and first sexual intercourse in adolescence, net of sociodemographic and achievement factors? If so, are these effects a function of self-selection related to the extent to which adolescents are detached from or attached to their families? And, finally, are there sex differences in the effects of internet use and internet café visits on adolescents' first intimate experiences?

Below, we briefly introduce adolescents' internet use in Taiwan. We then discuss the recent theoretical development regarding the effects of internet use on adolescents' intimate behaviors, identify factors that may make these effects spurious, and explore the potential sex differences in the effects of internet use and internet café visits on adolescents. After presenting results from survival analyses and multinomial logit regression, we discuss the theoretical and policy implications of our empirical findings.

ADOLESCENT INTERNET USE IN TAIWAN

In the contemporary global society, Taiwan is known in large part for its unique political position in relation to mainland China and rapid economic development since the 1960s. As one of the "Four Little Tigers" in Asia between the 1960s and 1990s, Taiwan experienced decades of rapid industrialization and, by the twenty-first century, has developed into an advanced and high-income economy. Following this economic development were a marked increase in labor costs, continued relocation of labor-intensive industries to cheap-labor economies such as China and Vietnam, and consequently, a transformation of the economy to high-tech industries such as computer peripherals and telecommunications. From 2000 to 2010, the percentage of the

population that has access to the internet increased from 28.15% to 70.1% (ITU 2010). As a result, internet use and digital networking have also become an integral component of the young generation in Taiwan. Most adolescents now routinely use the internet for educational purposes and to obtain new information in their daily lives. Many also play online multiplayer games, visit chat rooms, and maintain relationships with their friends via social networking programs.

Access to computers and the internet among adolescents is not equal (Hargittai 2010; Notten, et al. 2009; Hargittai and Hinnant 2008). Internet cafes (or "wangbas" in Taiwan) provide an affordable place to access the internet for adolescents who do not have it at home (Liu 2009). As in the case of mainland China, South Korea, and Hong Kong, internet cafés in Taiwan are also a social space where adolescents can escape parental supervision, hang out with peers, and feel a sense of freedom in addition to internet access.[1] Most internet cafés are set up near schools. However, they are primarily a social, rather than academic space, as characterized by the lack of printers, photocopiers, or word processing programs on the café computers (Wu and Cheng 2007; Liu 2009). A large proportion of the patrons are high-school-aged boys from nearby schools. Many of the patrons are also dropouts or unemployed young people who are prone to blackmail, intimidation, and rioting (Wu and Cheng 2007). Liu (2009) found that, despite their similar family and socioeconomic backgrounds, many internet café visitors in Taiwan distinguished themselves from "good students" who focus on academic success and pleasing their parents and teachers.

[1] Internet cafés are also popular in Brazil, Greece, Switzerland, and other Asian countries such as Indonesia, Malaysia, and the Philippines. In the United States, the first internet café opened in San Francisco, CA, in 1994, and were visible in some neighborhoods in New York City in the 1990s. However, in part because of the affordability of personal computers and laptops along with the expansion of fast and oftentimes free Wi-Fi offered by businesses and restaurants, internet cafés never played an important role in American teenagers' lives as in other countries (Hargrave 2004).

INTERNET USE AND ADOLESCENT ROMANTIC AND SEXUAL RELATIONSHIP

The importance of romantic and sexual experiences within adolescence makes it an ideal case to examine the influences of internet use on youths' social behaviors. While most scholars agree that adolescent sex increases the risk for various negative outcomes, romantic and sexual experiences are now commonly seen as a normative aspect of adolescent development (SIECUS 2004; Diamond 2006; Russell 2005). Researchers suggest, for example, that healthy romantic relationships offer adolescents the opportunity for self-disclosure and consensual validation of self-worth with a non-familial significant other as they begin to develop a public life outside of parental supervision (Shulman and Scharf 2000). Romantic partners not only serve as companions and friends for adolescents to seek support, comfort, and care, but also provide experiences of cooperation and reciprocal interactions with members of the other gender. These experiences lay a foundation for adolescents' future significant romantic relationships. On the other hand, although teenage sex has become increasingly prevalent, both sociological and public health literature has extensively documented the potential risks associated with adolescent sex. In particular, having sexual intercourse in early adolescence can lead to teen pregnancy, sexually transmitted infections, and other long-term consequences in adulthood (Guttmacher Institute 2010; Centers for Disease Control and Prevention 2009, 2010; Meier 2007).

Adolescents have always found ways to avoid parental supervision in order to build romantic and sexual relationships, which in the past primarily took place outside of the family home, in school, or other social spaces. An enormous body of research has explored traditional determinants of adolescent romantic relationships and sexual behavior, including family characteristics, academic performance, and peer interactions. The question is, then, whether increased access to the internet at home or elsewhere significantly increase or decreases the

probability of first romantic and sexual encounter in adolescence. Although several scholars have explored the dynamics of intimate interactions through the cybernet (Valkenberg and Peter 2011; Baumgartner, Valkenburg, and Peter 2010a, 2010b), theoretical development in this area is still in its infancy, especially regarding the impact of internet use on adolescents' *actual* intimate activities outside of the virtual realm.

The Effects of Internet Use

Internet use is important for adolescent development and maintenance of intimate relationships for several obvious reasons. First, widespread internet access enables adolescents to interact with potential romantic partners and explore non-romantic sexual encounters 24 hours a day, outside *and within* the home, beyond the social occasions that are traditionally defined by physical, face-to-face interactions. Second, the internet provides a "private space" in which to manage self-presentation and maintain social networks (Pascoe 2011; Osgerby 2004). This feature of the internet is especially relevant for adolescents, because they are at a life-stage characterized by feelings of awkwardness and vulnerability about their changing bodies and burgeoning social identities (Valkenburg and Peter 2009). Thirdly, the internet also allows teens to circumvent parental control over their dating and sexual relationships. Subrahmanyam and Greenfield (2008), for example, report that almost 25% of teens surveyed have interacted with a romantic partner between the hours of midnight and 5am.

In the past, researchers typically relied on the *reduction hypothesis* to explain the impact of the internet on social interactions in daily life, which argued that time spent on the internet detracts from the maintenance of real life social bonds (Valkenburg and Peter 2009). With the rise in social networking sites such as MySpace, Facebook, and Google+ over the last five years, however, the ways in which adolescents use the internet have shifted from chatting with

strangers whom they had never met in real life to primarily an extension of existing social groups (Kraut et al. 2002; Valkenburg and Peter 2007). This significant change led some scholars to suggest that the internet may enhance social connectedness (Kraut et al. 2002; Valkenburg and Peter 2007). According to the *internet-enhanced self-disclosure hypothesis*, the new forms of social and networking media may foster social connectedness by providing users with the opportunity to self-disclose vulnerabilities and intimate thoughts and feelings that they would be less likely to disclose in face-to-face interaction (Valkenburg and Peter 2009).

Exactly which adolescents are affected by internet use may depend on the personality type of adolescents themselves. Some scholars suggest that adolescents who are shy and socially reserved may benefit most from supplementing already established social relationships via the internet. Others argue that those who are already socially savvy and popular in real life tend to further enhance their social standing online (Kraut et al. 2002; Valkenburg and Peter 2007). For the purpose of our study, the research literature on adolescents' internet use in general and the internet-enhanced self-disclosure hypothesis in particular suggest that internet use outside of home for non-educational purposes (in the context of Taiwan, internet cafes, or "wangbas") tends to increase the probability of romantic relationships and first sexual intercourse in adolescence. Even if adolescents use the internet only at home, the probability that they have romantic relationships and sexual intercourse in adolescence still increases, though likely in a smaller magnitude. The fact is that at the same time the internet provides educational benefits for the young generation, it has also become an integrated part of adolescents' social life. Yet, most parents lag behind their children in the knowledge of the latest technology, making it difficult to supervise or get involved in their children's peer interactions through the digital world.

Spurious and Self-selection Effects

As noted earlier, adolescents who do not have a personal computer or internet access at home may be more likely to use the internet in their friends' house or go to internet cafés. This unequal access to computers and the internet suggests that internet café use may be a proxy for structural disadvantage resulting from adolescents' sociodemographic backgrounds (Zillien and Hargittai 2009). For example, families with higher parental education and family income are more likely to have a computer or other electronic devices connected to the internet for their children to use. To ensure that the effects of internet use and internet café visits reported in our study are not spurious, we include a number of statistical controls in empirical analyses, including parental education, family structure, and adolescents' academic achievements.

Spurious effects may also arise from two sources of self-selection. First, as discussed earlier, intimate relationships with a romantic or sexual partner may provide adolescents with support and self-validation from a non-familial member. At the same time, because the internet and internet cafés allow adolescents to escape parental supervision, adolescents who are more detached from families also may be more likely to immerse themselves in the digital world. This implies that any connection between internet use or internet café visits and adolescents' romantic and sexual activities could potentially be a function of family attachment or detachment rather than of the internet itself. Secondly, internet café visits may be the causes and the effects of delinquent behaviors at the same time. To the extent that teenage sex is closely associated with delinquent activities, one may argue that adolescents with a greater risk of having early sexual intercourse are also likely self-selected visitors of internet cafés.

In this study, we are more interested in the first type of self-selection, because it is difficult to determine the causal effects between adolescents' sexual activities and delinquent

behaviors. To see whether the effects of internet use and internet café visits are caused by some adolescents' detachment from families, we include proxy measures of family attachment in multivariate analyses. We readily acknowledge that the potential associations between delinquent activities and teenage sex and its compounding effect with internet café visits are not examined in our study.

Gender Effects

Internet use may facilitate adolescents' romantic interactions because it allows teenagers to self-disclose intimate thoughts and feelings that they would otherwise feel intimidated to share. This may imply gender differences in the effects of internet use. Research shows that in general, adolescent girls can more easily share personal feelings with their friends and family (Gilligan 1993). In contrast, gender socialization of masculinity often emphasizes strength, de-personalization, and self-confidence (Connell 1995; Pascoe 2007). This may lead adolescent boys to find it difficult to disclose their personal feelings in face-to-face interactions. By this reasoning, we may hypothesize that internet use has greater effects on romantic relationships and sexual intercourse experiences for adolescent boys than for adolescent girls. Consistent with this hypothesis, Schouten, Valkenburg, and Peter (2007) report that adolescent boys seem to benefit more from online communication with existing friends than girls do.

Gender difference in the effects of internet use may operate in the opposite direction. Despite the animosity the internet provides, the digital world is not completely safe. Quite the contrary, it is full of people who seek out sexual activities through the exploitation of young people. Because adolescent girls are more likely targets of online sexual predators than are adolescent boys, we may hypothesize that internet use has greater effects on first romantic

relationship and first sexual intercourse for adolescent girls than for adolescent boys, especially when they use the internet outside of home for non-educational purposes.

SUMMARY

Recent empirical studies on adolescents' internet use and social behaviors tend to use qualitative, interview data to explore how adolescents use new technology to manage their social relationships. These studies lay an important foundation regarding new and more accurate ways of understanding the role of social media in adolescents' lives. However, they are unable to make general conclusions about the effects of the internet on romantic and sexual behaviors due to small sample sizes taken at one point in time. In this research we are able to test the impact of internet use and internet café visits by following adolescents to their late teens when romantic and sexual activities become more prominent in their lives.

DATA, MEASURES, AND METHODS

We analyze data from the Taiwan Youth Project from 2000 to 2009 (TYP 2000-09). TYP 2000-09 is a longitudinal study conducted by the Institute of Sociology at Academia Sinica to investigate Taiwanese youths' development from adolescence to young adulthood. In addition to its rich information on adolescents' backgrounds, family characteristics, educational experiences, and social behaviors, TYP's longitudinal design allows us to follow respondents' trajectories of romantic and sexual experiences. Equally important, the TYP data were collected after the year 2000. This timing coincides with the time period when internet development and usage increased tremendously. Together, these features make it an ideal dataset to examine the effects of internet use and internet café visits on adolescents' romantic and sexual experiences.

In 2000, TYP used a multi-stratified random sampling procedure in the base-year survey to select 2,690 students in seventh grade ("the J1 sample") and 2,851 students in ninth grade ("the J3 sample") from forty representative junior high schools across Taipei City, Taipei County, and Yi-Lan County. These three areas include various levels of urbanization and economic structure. Taipei City is the largest metropolitan area in Taiwan; Yi-Lan is primarily agriculture-based; and Taipei County is moderately urbanized compared to Taipei City and Yi-Lan County. Our analyses use all nine waves of the TYP data from 2000 to 2009. The family background and sociodemographic variables were derived from the base-year survey. Internet use and internet café visits are measured when adolescents were in senior high school and measures of first romantic relationship and sexual intercourse are based on students' reports of romantic and sexual experiences throughout the entire TYP surveys. We follow the standard procedure of multiple imputations for missing values in the control variables used in our analyses. To obtain reliable and valid inference from this procedure, we used 20 imputations throughout (Royston, Carlin, and White 2009). After eliminating missing cases in dependent variables and key independent variables, our final samples consist of 3,894, 4,250, and 4,149 cases respectively in the analyses of first romantic relationship, first sexual intercourse, and whether adolescents have a romantic relationship before first sexual intercourse or sex before first romance.

Measures

Dependent variables. We include three sets of dependent variables measuring adolescents' intimate experiences. The first is whether or not a young adult had their first romantic relationship in adolescence and, if yes, how old the adolescent was *in years and months* when the relationship began. The second is whether or not a young adult had their first sexual intercourse

in adolescence and, if yes, how old the adolescent *in years* was when this occurred.[2] If an adolescent reported first romantic relationship or first sexual intercourse in any wave of the TYP surveys, we know exactly the age the event occurred. If no information on an adolescent's intimate activities is available, perhaps because data collection ended before an event occurred or because a young adult did not experience a romantic relationship or sexual intercourse in adolescence, the time of the event is undefined or unknown. All cases in which the age of first romantic relationship or first sexual intercourse is undefined or unknown are coded as *censored*. Appendix A reports the coding of these two variables in detail.

Thirdly, we also examine whether adolescents had sexual intercourse before having their first romantic relationship, had a romantic relationship first before any sexual intercourse, or had neither first romantic experience nor first sexual intercourse before data collection ended. Approximately 2.5% of adolescents had their first romantic relationship and first sexual intercourse at the same time. They are coded as having a romantic relationship first before sexual intercourse. Analyses excluding these cases do not show different findings.

Internet use and internet café visits. The key independent variables in our analyses are adolescents' internet use and internet café visits. Internet use is measured in the first year of senior high school using the question, "How often do you use the Internet?" Responses are then coded as number of days adolescents use the internet per week, ranging from 0 (never use the internet) to 7 (use the internet everyday). Similarly, internet café visits are measured by the number of days adolescents visited internet cafés while they were in high school. For the J1

[2] Our analyses use the J1 cohort data until Wave 9 and the J3 cohort data until Wave 8, when the vast majority of the subjects were 22 to 23 years old. Because our study focuses on adolescents, we coded subjects with their first romantic relationship and first sexual intercourse after age 20 as censored. Analyses that follow young adults' romantic and sexual experiences after age 20 do not change the conclusions. Results from these analyses are available upon request.

sample, this is the average of adolescents' responses for three years.[3] For the J3 sample, this is the average of adolescents' responses for two years, because TYP did not include a question inquiring adolescents' internet café visits in the Wave 2 survey for high school freshman.

Family attachment factors. The effects of internet use and internet café visit may be spurious if adolescents who are more detached from their families are also more likely to use the internet and visit internet cafés to explore possibilities of intimate relationships. To address the issue of self-selection, we include two variables measuring adolescents' family bonds and parental supervision in multivariate analyses. Family bonds are measured by six TYP items when adolescents were in 9th grade: 1) When making decisions, I discuss with my family members, 2) my family enjoys free time together, 3) all family members would participate in family activities, 4) my family accepts each other's friends, 5) whenever frustrated, I can always find comfort from my family, and 6) I depend on my family for advises and suggestions whenever I need one.[4] Responses from these items (1 = strongly disagree, 4 = strongly agree) are then averaged to form a composite variable, with a reliability score of .836 and a range of 1 (weak family bonds) to 4 (strong family bonds). Parental supervision is measured by the average of two questions in 9th grade: 1) Does dad always know where you are?, and 2) does mom always know where you are? Responses to these question range from 1 to 5, with a higher value indicating

[3] We do not use multiple imputations for the missing values in internet use and internet café visits because these are the key independent variables in our analyses. Using multiple imputations for these two variables increases the sample size for the analyses of first romantic relationship to 4,892 and for the analyses of first sexual intercourse to 5,571, but do not change the empirical patterns we reported in the paper. Analyses using imputed data for internet use and internet café visits are available upon request.

[4] Factor analysis shows that the six items have a common single factor. Factor loadings of the six items on the factor range from .63 to .80.

closer parental supervision.[5]

Other control variables. To examine the net effects of internet use and internet café visits on timing of first romantic relationship and first sexual intercourse, we also include adolescents' sociodemographic characteristics and academic achievement in our analyses. Appendix B reports the detailed matrices and descriptions of all independent variables. Academic achievements are measured by class rank in 9th grade (higher value = lower class ranking) and a dummy variable indicating whether adolescents attended an academic senior high school. Highest parental education is measured in years of schooling. Monthly family income is measured in thousands of Taiwanese dollars. Family structure is measured by the number of dependents in the household and a dummy variable indicating whether adolescents live in two-parent families.[6] Given the potential differences in the prevalence of internet use and internet cafés, we include two dummy variables indicating whether adolescents attend schools in Taipei county or Yilan county, with Taipei City, the capital and the most urbanized city in Taiwan, as the reference category. Finally, we also include the adolescent's gender (female = 1) and age in 9th grade.

Statistical Methods and Analytical Strategies

We use Cox regression to analyze first romantic relationship because adolescents' age in this event is measured in years and months. Cox regression is the most popular method for analyzing continuous-time survival data (Allison 1984:35). In the Cox regression model, the dependent variable, *h(t)*, or the hazard of an event at time *t*, is listed in two parts: a variable

[5] Other indicators in the TYP data may also potentially measure parental supervision, but these indicators are not available for both the J1 and J3 cohorts in the same year of surveys. The measure we use here is a reasonable proxy given the data limitation. As we will see shortly, analyses using this measure confirm the hypothesized effects of parental supervision on adolescents' first romantic relationship and sexual intercourse.

[6] Approximately 10.31% of families are headed by a divorced or separated parent; and 3.53% of families are headed by a widowed parent. These two categories are combined as the reference group because of the small percentage of adolescents who live with a widowed parent.

containing the time of the event or censoring, and a variable indicating whether or not that time was a censoring time of an event time. Specifically, the Cox regression equation is,

$$h(t) = h_0(t)\exp(\beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k).$$

By taking the natural logarithm, the equation can be rewritten as,

$$\log h(t) = h_0'(t) + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k,$$

where $h_0'(t) = \log h_0(t)$. $h_0(t)$ is the baseline hazard and equals the exponential of the intercept, which drops out of the estimation process and thus not reported in the output. A specific strength of Cox regression over other continuous-time regression models is that h_0'(t) can be any function of time. This releases researchers' burden to decide how the hazard rate depends on time, particularly when little information on which to base such a choice is available.

Discrete-time logit method is used to analyze adolescents' first sexual intercourse because we only measure the time of this event in years.[7] The discrete- time hazard function, denoted by P_t, is the conditional probability that adolescents' first sexual intercourse occurs in age t, given that it has not occurred prior to t. The dependence of P_t on the explanatory variables is assumed to follow a logit model,

$$\log\left[\frac{P_t}{1-P_t}\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k.$$

Further considerations are necessary to specify the time structure of the events in discrete-time logit methods. In the context of our analysis, this means the change in the expected probabilities of first sexual intercourse over time in adolescence. Preliminary analyses show that

[7] When the empirical patterns of interest are robust, the discrete-time method tend to give results that are very similar to the Cox regression model (Allison 1984:22). In our case, analyses using Cox regression for first sexual intercourse show consistent findings. Because of the general concern with potential biases that may be caused by tied events in discrete-time measures, however, we report the results from discrete-time logit analyses. Results from Cox regression analyses are available upon request.

the probability of first sexual intercourse increases from ages 11 to 18, reaching the first peak when adolescents complete high school and enter colleges, decreasing slightly after that, and increasing again after age 20. To model this time structure, we specify α as a third-order polynomial in time, or $\alpha_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \alpha_3 t^3$. To facilitate the interpretation of results, we report the hazard ratio coefficients, or $\exp(\beta)'s$, for both Cox regression and discrete-time logit analyses. This gives a ratio change in the *hazard* of an event for each one-unit increase in a particular explanatory variable, holding all other variables constant (Kleinbaum 1996).

Finally, we use multinomial logit to examine whether romance or sexual intercourse occurred first as opposed to no romance and no sexual intercourse in adolescence, because the dependent variable is measured by three nominal outcome categories. The multinomial logit model used in our analyses can be written as,

$$\Pr(y = m \mid X) = \frac{\exp(\alpha_m + \beta_{1m} x_1 + \beta_{2m} x_2 + ... + \beta_{km} x_k)}{1 + \sum_{j=2}^{3} \exp(\alpha_m + \beta_{1m} x_1 + \beta_{2m} x_2 + ... + \beta_{km} x_k)},$$

where $m = 1$ is the reference category, no romance and no sexual intercourse in adolescence, and $\exp(\mathbf{x}\boldsymbol{\beta}_m) = 1$ when $m = 1$. Because we are interested in how internet use and internet café visits affect both the dynamics among the three outcome categories and the expected probabilities of each outcome related to the two key independent variables, we present both the logit coefficients and the predicted probabilities based on the multinomial logit estimates.

Our analyses proceed as follows. After examining the bivariate differences in first romantic relationship and first sexual intercourse by adolescents' internet use and internet café visits, we present multivariate analyses for the three sets of dependent variables. For each set of analyses, we first examine the effects of internet use and internet café visits on the outcome controlling for adolescents' sociodemographic characteristics and academic achievements.

Family bonds and parental supervision are then added to the model to see whether the effects are spurious due to self-selection. Finally, we compare the effects of internet use and internet café use on outcomes for male and female adolescents to highlight gender differences.

RESULTS

Table 1 presents the simple, nonparametric life tables for adolescents' ages of first romantic relationship and first sexual intercourse. In Panel A, we see that only .37 percent of adolescents have their first romantic relationship before the age 14 (i.e., .04% for the age group 11 to 13; .33% for age 13 to 14). The rates begin to increase more substantially from ages 14 to 15 (approximately 6.67%) and reach the first peak in age 15 to 16, when most adolescents move from middle school to high school. The percentages of adolescents who experience their first romantic relationship decrease slightly in the next two years (from 16 to 18 years old). This may reflect the fact that many sophomore and junior students in high schools are under the pressure of university entrance exams. Once students pass this stage and enter colleges or begin a career, the percentages of having first girl/boy friends increase substantially (16.14% and 21.11% respectively for ages 18 to 19 and 19 to 20). By age 20, only 43.02% of our sample have not yet had their first romantic experience.

[Table 1 About Here]

As to be expected, Panel B shows that on average, the ages of adolescents' first sexual intercourse are higher than those of their first romantic experience. Similar to the age of first romantic experience, however, we observe that the highest rates of first sexual intercourse occur after most adolescents complete high school (11.53% for age 18 to 19; 7.93% for age 19 to 20). That a smaller percentage of young adults have first sexual intercourse between ages 19 and 20

than between 18 and 19 may suggest the importance of finishing high school or entering college as a transition from adolescence to young adulthood. By age 20, one out of every 3.5 young adults have had their first sexual intercourse experience, while approximately 71.44% "survive" through their adolescent years and remain virgins.

Effects of internet use and internet café visits

The differences in the ages of first romantic relationship and first sexual intercourse by internet use and visit internet café can be summarized using the survival functions plotted in Figure 1. Since virtually all adolescents have some experiences of using the internet, we divide internet users and non-users by whether or not adolescents use the internet more than one day a week.[8] In contrast, approximately forty percent of adolescents do not visit internet café; this difference is used in the plot in Figure 1.

[Figure 1 About Here]

In the top-left panel, we observe that internet users have slightly higher survival rates than non-internet users for first romantic relationship through adolescence. While this finding contradicts our expectation that internet use may increase the probability of having first romantic relationship in a given age, adolescents who regularly use the internet differ from their counterparts in several sociodemographic characteristics. They are more likely to be male, attend an academic high school, have higher parental education and smaller household size, and live in Taipei City,(results available upon request). These characteristics may affect the age of first romantic relationship and first sexual intercourse. Bearing these sociodemographic differences in mind, we see in the bottom-left panel that at any given age, the survival rates of having first sexual intercourse are lower among adolescent internet users than among non-users. The size of

[8] Approximately 57 percent of our sample used the Internet more than one day a week. Of these, 56.9% are male; 43.1% are female.

this difference accumulates as adolescents grow older. Overall, however, the two left panels suggest that the influences of internet use on adolescents' romantic and sexual behaviors are small.

In contrast to the small effects of internet use, the survival functions plotted in the two right panels clearly suggest that visiting an internet café has greater impact on the hazard rates of having first romantic relationship and first sexual intercourse during adolescent years. At age of 18, approximately seventy-seven percent of internet café visitors have not yet had first romantic experiences, compared to eighty-seven percent of those who do not visit internet cafés. These survival rates drop to fifty and sixty-seven percent, respectively, for internet café visitors and non-visitors at age 20. The size of the internet café effect is even larger for young adults' first sexual intercourse. At age 18, seventy-seven percent of internet café visitors have not yet had first sexual intercourse, compared to ninety-four percent of young adults who do not visit internet cafés. When these young adults reach the age of 20, only sixty-three percent of internet café visitors have not yet had sex, approximately twenty-two percent lower than those who do not visit internet cafés.

To determine the net effects of internet use and internet café visits, we control for adolescents' sociodemographic characteristics and educational achievements in Cox regression for first romantic relationship and in discrete-time logit analysis for first sexual intercourse. The baseline models are presented in Table 2. To facilitate the interpretation of results, we report the hazard ratio coefficients, or exp(β)'s. This gives a ratio change in the *hazard* of an event for each one-unit increase in a particular explanatory variable, holding all other variables constant. Regarding first romantic relationship, for example, we find that being one year older in 9th grade *decreases* the hazard ratio of having a first romantic relationship by a factor of .791 in any given

age (p<.01). Similarly, attending an academic high school and living in a two-parent household also significantly decrease the hazard of having a first romantic experience (both p's<.05), whereas being ranked more poorly in 9th grade increases the hazard ratio of having first boy/girl friend. Regarding teenage sex, we find that at any given age, being female decreases the odds of having first sexual intercourse by a factor of .606, or 39.4 percent (i.e., 100%×[1-.606], p<.01). Similarly, holding all other variables constant, being older in 9th grade, attending an academic high school, having higher parental education, and living in a two-parent household all decrease the odds of having first sexual intercourse, whereas the odds of having teenage sex are significantly higher for adolescents who have a higher family income and were ranked more poorly in 9th grade. Note that, with the exception of age in 9th grade, all explanatory variables' effects on first sexual intercourse are greater than those on first romantic relationship.[9] This may suggest that, statistically, the variations in ages of first romantic relationship are smaller than those of first sexual intercourse. Substantively, however, these results also may imply that romantic behaviors are now more accepted as a normative aspect of adolescent development and thus less distinguishable by sociodemographic and achievement indicators.

[Table 2 About Here]

The top panel of Table 3 presents the hazard ratio coefficients of internet use and internet café visits for adolescents' first romantic relationship using the variables in Table 2 as baseline controls. Model 1 indicates that for every additional day of internet use, the hazard ratio of first romantic relationship increases by a factor of 1.044 (p<.01, two-tailed), net of sociodemographic and educational achievement factors. Model 2 shows that for every additional day of internet

[9] In supplementary analyses, we also used Cox regression for first sexual intercourse. This allows $h_0'(t)$ to be any function of time. The conclusions from these analyses are generally consistent with those we report in the paper.

café visits, the hazard ratio increases by a factor of 1.164 (p<.01, two-tailed). The sizes of these effects decrease slightly when both variables are included in Model 3, but remain statistically significant at the .01 level. Further analyses suggest that these two variables do not interact with each other. As noted, it is possible that adolescents who are more isolated from their family or less supervised by parents also may use the internet and visit internet cafés more frequently. The same self-selection process may lead adolescents to seek out intimate interactions with a romantic partner and thus render the relationship in Model 3 spurious. Model 4 confirms that closer parental supervision reduces the hazard ratio of first romantic relationship, but the inclusion of family bonds and parental supervision in the model does not change the effects of internet use and internet café visits.

[Table 3 About Here]

The bottom panel of Table 3 shows similar patterns for the effects of internet use and internet café visits on the odds of teenagers' first sexual intercourse. At any given age, every additional day of intent use increases the odds of first sexual intercourse by 6.7%, holding all other variables constant (p<.01, two-tailed). For each additional day of internet café visits per week, adolescents' odds of first sexual intercourse increase by 22.7%, an effect that is substantially larger than that of internet use. When these two variables are included in the same model, the sizes of the effects do not change much and remain statistically significant at the .01 level. Model 4 indicates that stronger family bonds and closer parental supervision both reduce the odds of having first sexual intercourse in a given age, but the inclusion of these two variables does not alter the effects of internet use and internet café visits on the odds of first sexual intercourse in any given age.

Taken together, these analyses suggest three tentative conclusions. First, both internet use

and internet café visits significantly increase the hazard ratios of adolescents' first romantic relationship and first sexual intercourse. These effects are net of adolescents' sociodemographic backgrounds and academic performance in school. Secondly, the effects of internet café visits on adolescents' first romantic relationship and first sexual intercourse are more sizeable than those of internet use. Finally, the effects of internet use and internet café visits on teenagers' romantic and sexual behaviors are not due to adolescents' isolation from family or lack of parental supervision.

Sex differences

Models 1 to 4 suggest that in any given age, being female increases the hazard ratio of first romantic relationship, but decreases the odds of first sexual intercourse, holding all other variables in the equations constant.[10] These findings are interesting in their own right, and are consistent with the general impression that girls tend to focus on the psychological dimensions of romance and give less importance to physical aspects of a sexual relationship than boys do (Thompson 1995). For the purposes of our study, however, we are more interested in whether and how internet use and internet café visits may have differential effects on adolescent males and females. In the top panel of Model 5, we see that for every additional day of internet use, the hazard ratios of having first romantic relationship increase in similar magnitudes for teenage boys and girls (both p's<.01; p-value for sex difference = .425). Significant sex differences emerge for the effects of internet café visits, however (p<.01, two-tailed). For every additional day of internet café visits, the hazard ratios increase by 10.2% for boys and by 35.4% for girls, holding all other variables constant. When family bonds and parental supervision are added, this

[10] The negative effect of being female on first sexual intercourse does not necessarily imply that boys are having sex with older girls. It is possible, for example, that a proportion of boys may have first sexual partners who have had prior sexual experiences.

sex difference (or no-difference in the case of internet use) remains unchanged. Model 6 also shows that the effects of family bonds on first romantic relationship are not significant for both male and female adolescents. Although close parental supervision decreases the hazard ratio of first romantic relationship only for teenage girls, but the difference in the size of the two coefficients is not statistically significant (p = .531).

As in the case of first romantic relationship, Model 5 of the bottom panel indicates that internet use and internet café visits increase the odds of first sexual intercourse for both teenage boys and girls. Again, no sex difference was found in the effects of internet use, but the effect of internet café visits is significantly and substantially greater for adolescent girls than boys. These patterns do not change when family bonds and parental supervision are added into the analysis in Model 6. For boys, closer parental supervision (but not family bonds) decreases the odds of first sexual intercourse. For girls, both closer parental supervision and stronger family bonds have significantly negative effects on the odds of first sexual intercourse. Neither effects associated with family bonds or parental supervision, however, show significant sex differences. Overall, these results suggest that the effects of internet use are similar for boys and girls, but internet café visits have particularly sizable effects on the hazard ratios of girls' first romantic relationship and sexual intercourse in teenage years.

Romance before sex or sex before romance?

That internet use and internet cafe visits increase the hazard rates of both first romantic relationship and first sexual intercourse naturally leads to the question of whether they also increase the likelihood of having sex before the occurrence of first romance in adolescence. To answer this question, we divide adolescents into three categories—sexual intercourse before first romance, romance before any sexual intercourse, and no romance or sexual intercourse before

age 20 (used as the reference category)—and examine the dynamics among these dependent outcomes using multinomial logit analysis.[11] The results are reported in Table 4. Model 1 shows that for every additional day of internet use, the odds of having romance before any sexual intercourse increase by 6.1% (i.e., $[e^{.059}-1]\times100\%$), the odds of having sexual intercourse before first romance increase by 10.1% (i.e., $[e^{.096}-1]\times100\%$), and the odds of having sexual intercourse before first romance as opposed to romance before any sexual intercourse increase by 3.8% (i.e., $[e^{.096-.059}-1]\times100\%$; all p's<.05), holding adolescents' sociodemographic backgrounds and school performance constant. At the same time, every additional day of internet cafe visits increases the odds of having romance before any sexual intercourse by 21.8% (i.e., $[e^{.197}-1]\times100\%$, $p<.01$), increases the odds of having sexual intercourse before first romance by 24.4% (i.e., $[e^{.218}-1]\times100\%$, $p<.01$), but does not significantly change the odds of having sexual intercourse before first romance as opposed to having romance before sexual intercourse ($p>.10$). Three control variables (i.e., gender, age in 9th grade, and parental education) significantly decrease the odds of having sexual intercourse before first romance versus having sex before first romance. With the exception of gender, however, no sociodemographic or educational factors change the odds of having romance before sex or having sex before first romance versus the reference category, no romance or sexual intercourse before age 20.

[Table 4 About Here]

The above relationships do not change when family bonds and parental supervision are added in Model 2. Interestingly, stronger family bonds increase the odds of having a romantic relationship before sex versus no romance and no sexual intercourse before age 20, but do not

[11] Because the ages of first romantic relationship and first sexual intercourse are censored in Wave 9 for the J1 cohort and in Wave 8 for the J3 cohort, measuring the exact years between first sexual intercourse and first romantic relationship would lead to a biased analytical sample excluding a large number of subjects who did not experience either event during teenage years.

significantly change the odds of having sexual intercourse before romance. This finding may confirm that romantic experiences with no sex during teenage years are accepted as a normative aspect of adolescent development and to some extent even encouraged in some families. In families with closer parental supervision, however, the odds of either having romance before sex or having sex before first romance versus no romance and no sex both decrease, but the odds of having romance before sex versus having sexual intercourse before first romance are not affected. This suggests that stronger family bonds and closer parental supervision do not always affect adolescents in the same way.

Model 3 examines sex-differential effects by allowing the slopes of adolescents' internet behaviors and the two family attachment variables to vary across gender. Notice that, after adding these interaction terms, the main effect of gender in Models 1 and 2 disappears, but the coefficients for all other control variables remain almost identical. We observe some sex differences in the effects of family bonds and parental supervision, but none of these differences reach statistical significance at the .05 level. For the purpose of our study, the most important finding in Model 3 is the significant sex difference in the effects of internet cafe visits. Clearly, by visiting internet cafes, teenage girls more substantially increase their odds of first romantic relationship and first sexual intercourse than do teenage boys. Aside from this, the overall patterns we observed in Models 1 and 2 regarding the effects of internet use and internet cafe visits apply in general (though the odds ratio change for sex before first romance versus romance before sex is not statistically significant for females).

Sex differences in the effects of internet use and internet cafe visits on the timing of first romantic relationship and first sexual intercourse can be summarized using the multinomial logit estimates from Table 4 to compute the expected probability for the three dependent outcome

categories. These probabilities are plotted in Figure 2. Three general patterns are observed. First, although increases in internet use and internet café visits consistently decrease the probabilities of no romantic relationship and no sexual intercourse before age 20, increase the probabilities of romantic experiences before any sexual intercourse, and increase the probabilities of sexual intercourse before first romantic relationship, the effects of internet use are relatively small. In the top-left panel, for example, we see that compared to adolescent boys who do not use the internet at all, the predicted probabilities of no romantic relationship and no sexual intercourse, romance before sex, and sex before first romance for those who use the internet almost everyday change only by .104, .021, and .083, respectively, holding all other variables in Table 4 at their means.

[Figure 2 About Here]

Secondly, for adolescent boys, internet café visits may potentially increase their opportunities of intimate experiences, reducing the probabilities of no romantic relationship and no sexual intercourse from .376 for those who do not visit internet café to .195 for those who visit internet café almost everyday. Most of these changes, however, are due to the increase in romantic interactions before they experience any sexual intercourse. This finding certainly does not rule out the possibility that some adolescent boys may further develop a sexual relationship with their romantic partners. At least for those adolescent boys who are interested only in sex, however, internet café visits seem to have very limited effects.

Finally, and most importantly, the bottom-left panel shows that internet café visits greatly decrease the probabilities that adolescents girl experience no romantic interactions and no sexual intercourse before age 20. The effect is most substantial between girls who do not visit internet cafés at all and those who visit internet cafés once a week, decreases in magnitude for girls who

visit internet café two or three days a week, and eventually becomes negligible for those who go to internet cafés four or more days per week. The nonlinear effect is also apparent for the probabilities of romantic relationship before any sexual intercourse, changing from .381 for no internet café visits to .597 for internet café visits three days a week and beginning to decrease after that. Past empirical studies have extensively documented the potential risks associated with early sexual intercourse for female adolescents (Frisco 2007; Meier 2007; McCarthy and Casey 2008). Figure 2 shows that from no internet café visits to one day per week, adolescent girls' probabilities of having sexual intercourse before first romantic experience increase by .075. Compared to adolescent girls who do not visit internet café, the probabilities of sexual intercourse before first romantic relationship for those who visit internet café everyday are .303 larger.

DISCUSSION AND CONCLUSION

The determinants of adolescent romantic relationships and sexual behavior have always been a central topic in social science research. However, due to the pervasiveness of internet use among youth and its central importance to their social behaviors, analyses that examine only traditional determinants, such as family and academic characteristics, are no longer satisfactory. Using data from TYP 2000-09 that follow Taiwanese respondents from adolescence to young adulthood, our study examines whether and how adolescents' intimate experiences may be affected by their internet use and internet café visits during a time period when internet development and usage increased tremendously and at a life stage when romantic and sexual activities become increasingly prominent.

Our study offers evidence that both internet use and internet café visits significantly increase the hazard ratio of adolescents' first romantic relationship and first sexual intercourse, net of sociodemographic background and academic performance in school,. These findings expand the growing literature on the influence of new media on adolescent development to *actual* romantic and sexual behaviors, and are consistent with the recent argument that the new forms of networking media may facilitate adolescents' maintenance and development of social bonds and interactions with peers (Valkenburg and Peter 2009). In light of the prevalence of new social networking tools such as the internet and text messaging, some may be also inclined to conclude that communication through internet programs and digital devices has replaced traditional face-to-face social interaction, thus becoming the main form of social interactions for our new generation. We caution, however, that this conclusion remains tentative until scholars further prove that the rise of new telecommunication technologies has qualitatively changed adolescents' social activities over the past ten years.

Past research has shown that inequalities in computer and internet access may result in differences in adolescents' educational and behavioral outcomes (Zhao 2009; Jackson et al. 2007). Our study suggests that the effect of these inequalities may be further compounded by *where* adolescents use the internet. At least in terms of first romantic relationship and first sexual intercourse, we found that internet café visits have more sizeable effects than internet use in general. We readily acknowledge that this pattern may arise potentially because adolescents who are more likely to engage in delinquent behaviors and early adolescent sex are also more likely to visit an internet café, but note that surprisingly, the difference in the sizes of these effects remains largely the same even after taking into account adolescents' degree of parental supervision and strength of family bonds. A possible explanation for these different effects is

that adolescents may use the internet at an internet café exclusively for gaming and social networking, whereas internet use at home or in school tends to serve both educational and non-educational purposes. Recent large-scale data collection efforts in the US (e.g., ECLS) and in other countries (e.g., PISA) have routinely investigated whether and *how* children use computers and the internet. The availability of these representative datasets opens up possibilities for rigorous statistical analyses to further identify how the contents of computer and internet use at home and elsewhere may affect children's outcomes.

In light of the significant effects of internet use and internet café visits on adolescents' first romantic relationship and first sexual intercourse, one may naturally ask whether new media may increase the probability that adolescents experience non-romantic sexual encounters. Our analyses show that internet use and internet café visits both increase the odds of having sexual intercourse before first romantic relationship as opposed to having no romance and no sex in adolescence, but only internet use (but not internet café visits) increases the odds of having sex before first romance versus romance before any sexual intercourse. That these effects are not contingent upon levels of parental supervision and family bonds may imply that adolescents tend to adopt new technologies more easily than their parents. As a result, parental and family interventions of adolescents' social activities directly or indirectly through in the internet are difficult and often ineffective.

Finally, our analyses show that while the effects of internet use discussed above generally apply to male and female adolescents equally, sex differences exist in the effects of internet café visits. The size of these differences is particularly large for adolescents' rates of first sexual intercourse and non-romantic sexual encounters. These findings are inconsistent with the general impression that teenage boys have more difficulties to share emotions and personal feelings in

face-to-face interactions and thus may benefit more from online communication than their female counterparts. Rather, by exposing themselves in a social environment that is outside of their home and mostly dominated by males who use the internet for non-educational purposes, teenage girls are likely to become easy targets of online sexual predators. The lack of gender difference in the effect of internet use may also reflect the little variations in the access to and use of the internet across gender groups. A direct extension of this inference is that over time, internet use may become an equalizer of the gender gap in information access and related outcomes, such as sexuality health and intimate behaviors.

To what extent can our findings be generalized to adolescents from the U.S. and other countries? A definitive answer is not possible. While many of our results are consistent with the current discussion regarding the influence of internet use on adolescents' social behaviors, most existing datasets in the U.S. and other countries either do not capture the recent development in adolescents' internet use or lack adequate information on teenagers' intimate experiences and sexual activities. Additionally, while our analyses suggest that internet café visits have substantial influences on the rates of Taiwanese youth's first romantic relationship and sexual intercourse, internet cafés are more commonly seen in Asia than in American and European societies. Despite these limitations, our study provides some insight into how new media may affect adolescent development and thus sheds light on a topic that not only has important policy implications but also is understudied in sociological research.

REFERENCES

Allison, Paul D. 1984. *Event History Analysis*. Thousand Oak, CA: Sage.

Baumgartner, Susanne E, Patti M. Valkenburg and Jochen Peter. 2010a. "Assessing Causality in the Relationship Between Adolescents' Risky Sexual Online Behavior and Their Perceptions of this Behavior." *Journal of Youth and Adolescence* 39:1226–1239.

--------- 2010b. "Unwanted online sexual solicitation and risky sexual online behavior across the lifespan." *Journal of Applied Developmental Psychology* 31:439–447.

Bavelier, Daphne, Shawn Green and Matthew W.G. Dye. 2010. "Children, Wired: For Better and for Worse." *Neuron* 5(9): 692–701.

Brown, Jane D., and Piotr Bobkowski. 2011. "Older and Newer Media: Patterns of Use and Effects on Adolescents' Health and Well-Being." *Journal of Research on Adolescence* 21: 95–113.

Centers for Disease Control and Prevention. 2009. *CDC Report Finds Adolescent Girls Continue To Bear A Major Burden of Common Sexually Transmitted Diseases.* U.S. Department of Health and Human Services: Atlanta, GA.

Centers for Disease Control and Prevention. 2010. *Sexually Transmitted Disease Surveillance, 2009*. U.S. Department of Health and Human Services: Atlanta, GA.

Connell, RaewynW. 1995. *Masculinities.* Berkeley: University of California Press.

Diamond, Lisa M. 2006. "Introduction: In Search of Good Sexual-Developmental Pathways for Adolescent Girls." *New Directions for Child and Adolescent Development*: 112: 1–7.

DiMaggio, Paul, Eszter Hargittai, Coral Celeste, and Steven Shafer. 2004. "From Unequal Access to Differential Use: A Literature Review and Agenda for Research on Digital Inequality." Pp. 355–400 in *Social Inequality*, edited by Kathryn Neckerman. New York: Sage.

DiMaggio, Paul, Eszter Hargittai, W. Russell Neuman, and John P. Robinson. 2004. "The Social Implications of the Internet." *Annual Review of Sociology* 27:307-336.

Dowdell, Elizabeth B., Ann W. Burgess and Robert J. Flores. 2011. "Online Social Networking Patterns among Adolescents, Young Adults, and Sexual Offenders." *American Journal of Nursing* 111(7): 28–36.

Ferguson, Christopher J. 2011."Sexting Behaviors among Young Hispanic Women: Incidence and Association." *Psychiatric Quarterly* 82(3): 239–243.

Frisco, Michelle. 2008. "Adolescents' Sexual Behavior and Academic Attainment." *Sociology of*

Education 81: 284–311.

Gilligan, Carol. 1993. *In a Different Voice: Psychological Theory and Women's Development.* Cambridge: Harvard University Press.

Guttmacher Institute. 2010. *U.S. Teenage Pregnancies, Births and Abortions: National and State Trends and Trends by Race and Ethnicity*. Washington: DC.

Hargittai, Eszter. 2010. "Digital Na(t)ives? "Variation in Internet Skills and Uses among Members of the Net Generation." *Sociological Inquiry*: 80(1): 92–113.

Hargittai, Eszter, and Hinnant Amanda. 2008. "Digital Inequality: Differences in Young Adults' Use of the Internet." *Communication Research*. 35(5): 602–621.

Hargittai, Eszter, and Gina Walejko. 2008. "The Participation Divide: Content Creation and Sharing in the Digital Age." *Information, Communication and Society* 11(2): 239–256.

Hargrave, Sean. 2004. "Terminal Decline? They Were among the Visible Symbols of the Dotcom Boom, but Are Cyber Cafes Now in Danger of Dying Out?" *The Guardian* Online. http://www.guardian.co.uk/media/2004/mar/08/mondaymediasection

Ito, Mizuko et al. 2009. *Hanging Out, Messing Around, and Geeking out: Kids Living and Learning with New Media*. Cambridge: MIT Press.

ITU. 2010. *Internet Usage Stats and Marketing Report*. http://www.internetworldstats.com/asia/tw.htm.

Jackson, Linda A., Ricky Samona, Jeff Moomaw, Lauren Ramsay, Christopher Murray, Amy Smith, and Lindsay Murray. 2007. "What Children Do on The Internet: Domains Visited and Their Relationship to Socio-Demographic Characteristics and Academic Performance." *CyberPsychology and Behavior* 10:182–190.

Kleinbaum, David G. 1996. *Survival Analysis: A Self-Learning Text*. New York: Springer-Verlag.

Ko, Chih-Hung, Ju-Yu Yen, Shu-Chun Liu, Chi-Fen Huang, and Cheng-Fang Yen. 2009. "The Associations between Aggressive Behaviors and Internet Addiction and Online Activities in Adolescents." *Journal of Adolescent Health* 44: 98–605.

Kraut, Robert E., Sara Kiesler, Bonka Boneva, Jonathon N. Cummings, Vicki Helgeson, and Anne Crawford. 2002. "Internet Paradox Revisited." *Journal of Social Issues* 58(1): 49–74.

Liu, Fengshu. 2009. "It is Not Merely about Life on the Screen: Urban Chinese Youth and the Internet Café." *Journal of Youth Studies* 12(2): 167–184.

McCarthy, Bill and Teresa Casey. 2008. "Love, Sex, and Crime: Adolescent Romantic

Relationships and Offending." *American Sociological Review* 73: 944–69.

Meier, Ann M. 2007. "Adolescent First Sex and Subsequent Mental Health." *American Journal of Sociology* 112: 1811–1847.

Notten, Natascha, Peter, Jochen, Kraaykamp, Gerbert and Patti M. Valkenburg. 2009. "Research Note: Digital Divide across Borders—A Cross-National Study of Adolescents' Use of Digital Technologies." *European Sociological Review* 25: 551–560.

O'Keeffe, Gwenn Schurgin, and Kathleen Clarke-Pearson. 2011. "Clinical Report-The Impact of Social Media on Children, Adolescents, and Families." *Pediatrics* 127(4): 800–804.

Osgerby, Bill. 2004. *Youth Media*. New York: Routledge.

Pascoe, C.J. 2007. *'Dude, You're a Fag': Masculinity and Sexuality in High School*. Berkeley: University of California Press.

Pascoe, C.J. 2011. "Resource and Risk: Youth Sexuality and New Media Use." *Sexuality Research and Social Policy* 8: 5-–7.

Robinson, John, Paul DiMaggio, and Eszter Hargittai. 2003. "New Social Survey Perspectives on the Digital Divide." *IT & Society* 1(5):1–22.

Royston, Patrick, John B. Carlin, and Ian R. White. 2009. "Multiple Imputation of Missing Values: New features for mim." *Stata Journal* 9: 252–264.

Russell, Stephen T. 2005. "Introduction to Positive Perspectives on Adolescent Sexuality." *Sexuality Research and Social Policy* 2(4): 1–3.

Ryan, Elizabeth M. 2010. "Sexting: How the State Can Prevent a Moment of Indiscretion from Leading to a Lifetime of Unintended Consequences for Minors and Young Adults." *Iowa Law Review* 96(1): 357–383.

Schouten, Alexander P., Patti M. Valkenburg, and Peter Jochen. 2007. "Precursors and Underlying Processes of Adolescents' Online Self-Disclosure: Developing and Testing an 'Internet-attribute-perception' model." *Media Psychology* 10: 292–315.

SIECUS (Sexuality Information and Education Council of the United States). 2004. *National Guidelines Task Force: Guidelines for Comprehensive Sexuality Education 3rd Ed*. Washington, DC.

Shulman, Shmuel, and Miri Scharf. 2000. "Adolescent Romantic Behaviors and Perceptions: Age- and Gender-Related Differences, and Links with Family and Peer Relationships." *Journal of Research on Adolescence* 10: 99–118.

Strasburger, Victor C., Amy B. Jordan, and Ed Donnerstein. 2010. "Health Effects of Media on

Children and Adolescents." *Pediatrics* 125(4): 756–767.

Subrahmanyam, Kaveri, Patrticia Greenfield, Robert Kraut, and Elisheva Gross. 2001. "The Impact of Computer Use on Children's and Adolescents' Development." *Applied Developmental Psychology* 22: 7–30.

Subrahmanyam, Kaveri, and Patricia Greenfield. 2008. "Virtual Worlds in Development: Implications of Social Networking Sites." *Journal of Applied Developmental Psychology* 26: 407–417.

Thompson, Sharon. 1995. *Going all the Way: Teenage Girls' Tales of Sex, Romance, and Pregnancy*. New York: Hill and Wang.

Valkenburg, Patti M., and Jochen Peter. 2007. "Preadolescents' and Adolescents' Online Communication and Their Closeness to Friends." *Developmental Psychology* 43: 267–277.

Valkenburg, Patti M., and Jochen Peter. 2009. "Social Consequences of the Internet for Adolescents: A Decade of Research." *Current Directions in Psychological Science* 19: 1–5.

Valkenburg, Patti M., and Jochen Peter. 2011. "Adolescents' Online Communication: An Integrative Model of Its Attraction, Opportunities, and Risks." *Journal of Adolescent Health* 48: 121–127.

Wu, Chin-Shan and Fei-Fei Cheng. 2007. "Internet Café Addiction of Taiwanese Adolescents." *Cyberpsychology & Behavior* 10(2): 220–227.

Zhao, Shanyang. 2009. "Parental Education and Children's Online Health Information Seeking: Beyond the Digital Divide Debate." *Social Science & Medicine* 69: 1501–1505.

Zhao, Shanyang and David Elesh. 2007. "The Second Digital Divide: Unequal Access to Social Capital in the Online World." *International Review of Modern Sociology* 33: 171–192.

Zillien, Nicole, and Eszter Hargittai. 2009. "Digital Distinction: Status-Specific Internet Uses." *Social Science Quarterly* 90(2): 274–291.

Table 1. Life Table for Age of First Romance/Sex

Panel A. First Romantic Relationship

Interval (Lower	Upper)	Effective sample size	Number had first romance	Number censored	Conditional probability of failure	Survival
11	13	4,892	2	0	.0004	.9996
13	14	4,890	16	0	.0033	.9963
14	15	4,874	325	33	.0667	.9297
15	16	4,516	581	198	.1287	.8074
16	17	3,737	394	268	.1054	.7191
17	18	3,075	262	75	.0852	.6571
18	19	2,738	442	164	.1614	.5477
19	20	2,132	450	69	.2111	.4302

Panel B. First Sexual Intercourse

Interval (Lower	Upper)	Effective sample size	Number had first sex	Number censored	Conditional probability of failure	Survival
11	13	5,571	1	0	.0002	.9998
13	14	5,570	16	446	.0029	.9968
14	15	5,108	28	191	.0055	.9913
15	16	4,889	79	378	.0162	.9746
16	17	4,432	161	220	.0363	.9383
17	18	4,051	254	7	.0627	.8794
18	19	3,790	437	24	.1153	.7777
19	20	3,329	264	174	.0793	.7144

Data source . Taiwan Youth Project, 2000-09.

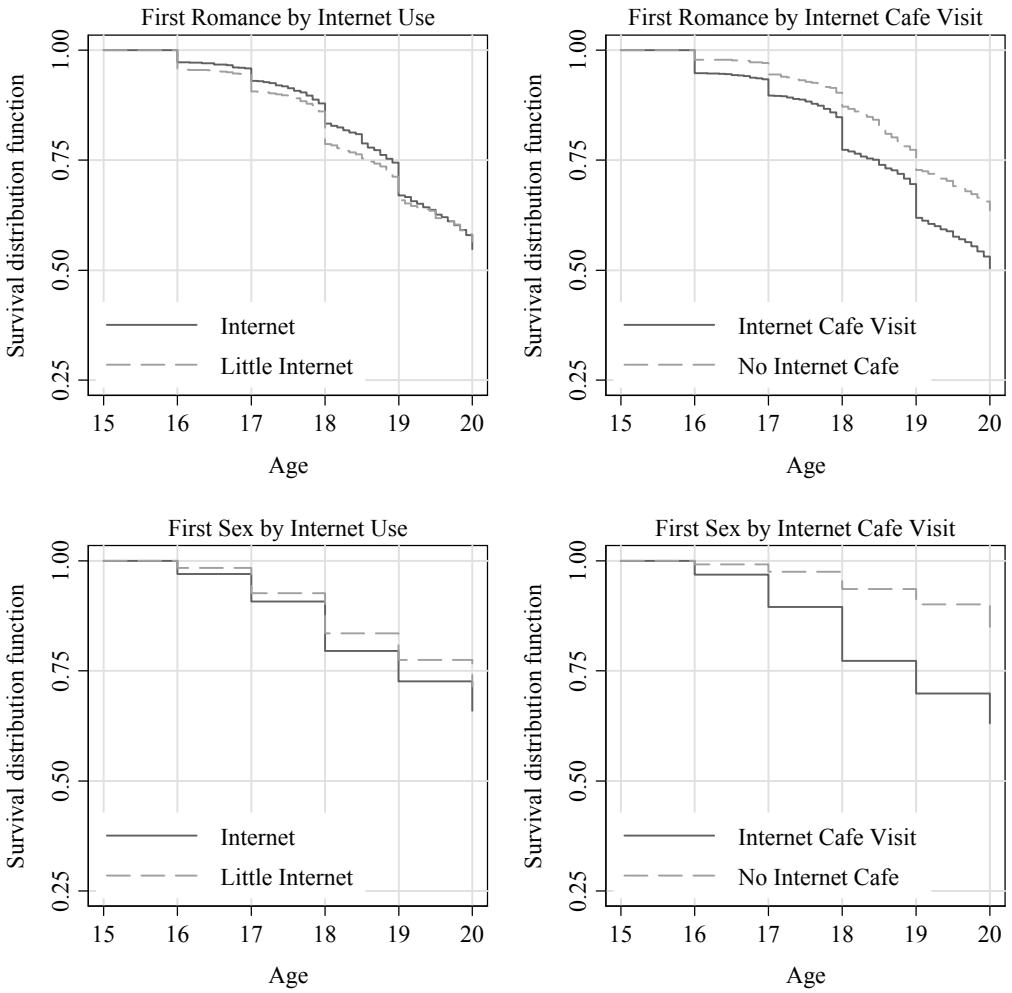

Figure 1. Estimated Survival Functions for First Romance and First Sex, by Internet Use and Internet Cafe Visit

Table 2. Survival Analysis for Adolescents' First Romantic Relationship and First Sexual Intercourse: Baseline Models

	First romantic relationship		*First sexual intercourse*	
	Hazard Ratio	S.E.	Hazard Ratio	S.E.
Female	1.035	(.044)	.606	(.063)**
Age in 9th grade	.791	(.037)**	.863	(.065)*
Academic high school	.871	(.052)*	.809	(.077)**
Class ranking in 9th grade [a]	1.152	(.035)**	1.259	(.035)**
Highest parental education	1.006	(.008)	.977	(.011)*
# dependents in the household	1.015	(.026)	1.051	(.028)
Family income	1.000	(.001)	1.004	(.001)**
Two-parent families	.861	(.054)*	.641	(.094)**
School location: Taipei County	.997	(.075)	.981	(.074)
School location: Yilan County	1.017	(.071)	.981	(.084)
Constant			.000	(7.124)
Age			.346	(1.390)
Age^2			1.270	(.091)**
Age^3			.992	(.002)**
N	3,894		4,250	
F-value	12.56		55.02	

Data source. Taiwan Youth Project, 2000-09. * $p < .05$, ** $p < .01$ (2-*tailed*)

Notes. Robust standard errors are in parentheses. All coefficients are adjusted by cohort effects and multiple imputations for missing cases in the control variables ($m = 20$). [a] In 10 units.

Table 3. Hazard Ratio Coefficients of Internet Use and Internet Café Visit on Adolescents' Romantic Behaviors

					Model 5		Model 6	
	Model 1	Model 2	Model 3	Model 4	Male	Female	Male	Female
First Romantic Relationship								
# days using internet per week	1.044 ** (.010)		1.037 ** (.010)	1.036 ** (.010)	1.041 ** (.013)	1.036 ** (.014)	1.039 ** (.013)	1.036 ** (.014)
# days visiting internet café per week		1.164 ** (.027)	1.150 ** (.027)	1.145 ** (.028)	1.102 **[a] (.031)	1.354 **[a] (.055)	1.103 **[a] (.031)	1.338 **[a] (.052)
Family bonds				1.027 (.037)			1.051 (.065)	1.026 (.060)
Parental supervision				.927 ** (.023)			.949 (.035)	.903 ** (.028)
Female	1.074 (.049)	1.149 ** (.051)	1.177 ** (.055)	1.199 ** (.057)	1.076 (.077)		1.406 (.374)	
F-value	13.49	19.41	17.12	14.68	17.20		15.11	
First Sexual Intercourse								
# days using internet per week	1.067 ** (.012)		1.056 ** (.013)	1.052 ** (.013)	1.052 ** (.015)	1.070 ** (.021)	1.048 ** (.015)	1.066 ** (.021)
# days visiting internet café per week		1.227 ** (.030)	1.208 ** (.031)	1.191 ** (.032)	1.155 **[a] (.032)	1.759 **[a] (.063)	1.144 **[a] (.033)	1.691 **[a] (.063)
Family bonds				.862 ** (.051)			.910 (.063)	.813 * (.088)
Parental supervision				.885 ** (.028)			.896 ** (.035)	.871 ** (.047)
Female	.640 ** (.064)	.700 ** (.067)	.726 ** (.068)	.743 ** (.069)	.568** (.108)		.894 (.326)	
F-value	53.42	54.31	51.58	48.16	48.28		41.53	

Data source. Taiwan Youth Project, 2000-09. * $p < .05$, ** $p < .01$ (2-*tailed*)

Notes. Robust standard errors are in parentheses. All analyses include control variables used in Table 2. Coefficients are adjusted by cohort effects and multiple imputations for missing cases in the control variables ($m = 20$). [a] Significant gender difference at the .05 level.

Table 4. Multinomial Logit Coefficients for Timing of First Romantic Relationship and First Sexual Intercourse

	Model 1		Model 2		Model 3			
	Romance before sex	*Sex before romanc*	*Romance before sex*	*Sex before romanc*	*Romance before sex*		*Sex before romance*	
					Male	Female	Male	Female
# days using internet per week	.059 ** †	.096 **	.059 ** †	.095 **	.051 *†	.066 **	.097 **†	.091 **
# days visiting internet café per week	.197 **	.218 **	.201 **	.213 **	.130 **[b]	.848 **[b]	.130 *[b]	.950 **[b]
Family bonds			.219 **	.099	.160	.290 **	.100	.117
Parental supervision			-.101 **	-.141 **	-.106 *	-.079	-.127 *	-.143 *
Female	.206 **††	-.102	.232 ** †	-.073	-.517		-.332	
Age in 9th grade	.131 ††	-.158	.133 ††	-.158	.134	††	-.157	
Academic high school	-.011	-.149	-.005	-.135	.003		-.123	
Class ranking in 9th grade [a]	.009	.069	-.008	.044	-.008		.042	
Highest parental education	.026 ††	-.015	.025 ††	-.014	.027	††	-.013	
# dependents in household	.068	.097	.064	.092	.067		.096	
Family income	-.001	.000	-.002	.000	-.002		.000	
Two-parent families	-.111	-.198	-.110	-.174	-.084		-.149	
School location: Taipei County	.065	.107	.071	.114	.061		.103	
School location: Yilan County	.154	.277	.146	.264	.128		.243	
Constant	-2.358 †	1.126	-2.620 ††	1.357	-2.414 **	††	1.310	
N	4,149		4,149		4,149			
F-value	37.51		49.74		75.46			

Data source. Taiwan Youth Project, 2000-09. † $p < .05$, †† $p < .01$ (2-*tailed*) * $p < .05$, ** $p < .01$ (2-*tailed*)

Notes. Reference category = No romance or sex. Daggers indicate significance levels of differences across equations. Robust standard errors in parentheses. All coefficients are adjusted by cohort effects and multiple imputations for missing cases in the control variables ($m = 20$). [a] In 10 units. [b]Significant gender difference at the .05 level.

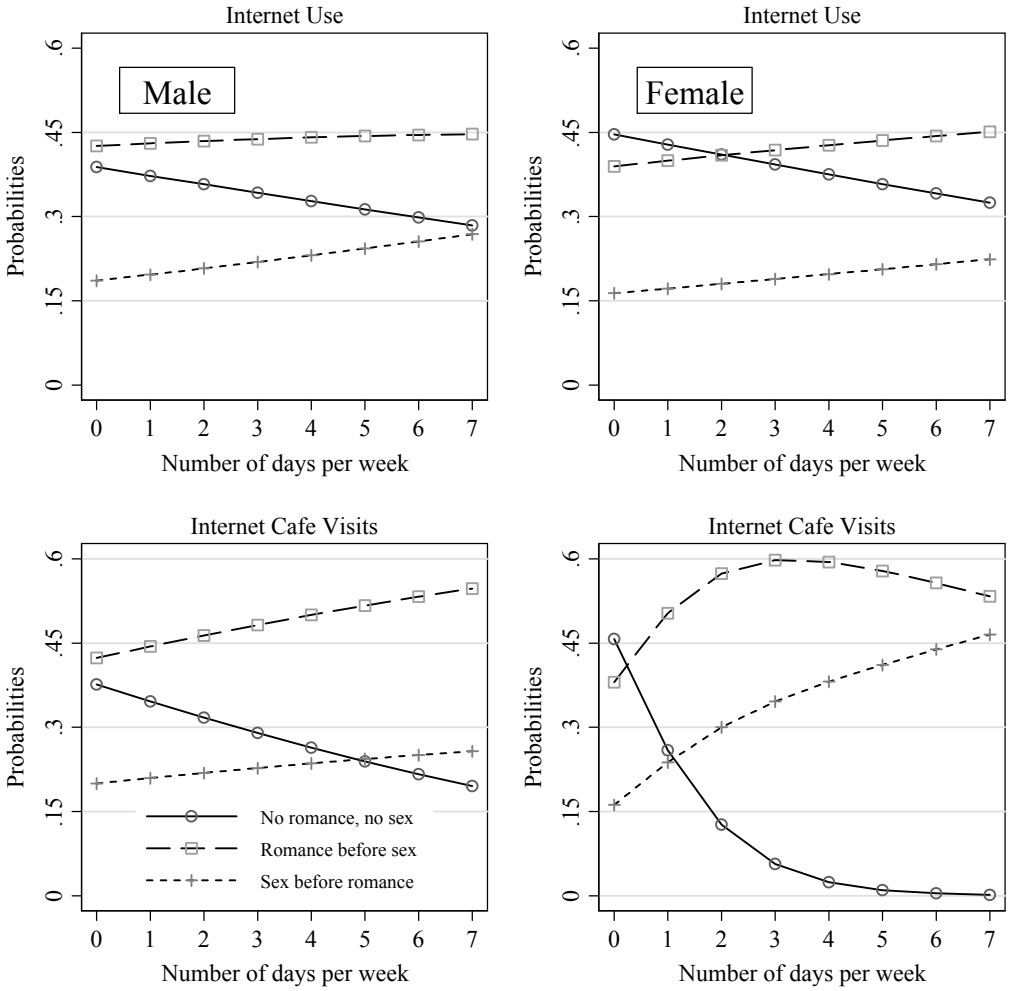

Figure 2. Timing of First Romance and First Sexual Intercourse by Internet Use and Internet Cafe Visit

Notes. Analyses are based on Model 3 of Table 4, holding all control variables at their means.

Appendix A.
Coding for Adolescents' First Romantic Relationship and First Sexual Intercourse

Table A1. Survey Items Used to Code Adolescents' First Romantic Relationship and First Sexual Intercourse, TYP 2000-09

		First romantic relationship			First sexual intercourse	
	School grade/Life stage	Do you have a boyfriend/ girlfriend now?	How long have you been dating this person?	Did you ever had a boyfriend/ girlfriend?	Have you ever had any sexual intercourse?	When did you have first sexual intercourse?
Wave for J1 cohort						
2	8th grade	√				
3	9th grade	√				
4	One year after 9th grade	√	Years/months			
5	Two years after 9th grade	√	Years/months			
6	Three years after 9th grade	√	Years/months			
8	Five years after 9th grade	√	Years/months	√	√	Age in years
9	Seven years after 9th grade	√	Years/months	√	√	Age in years
Wave for J3 cohort						
2	One year after 9th grade	√				
3	Two years after 9th grade	√				
4	Three years after 9th grade	√				
6	Five years after 9th grade	√	Years/months	√	√	Age in years
7	Seven years after 9th grade	√	Years/months	√	√	Age in years
8	Nine years after 9th grade	√	Years/months	√		

Table A1 lists the items from the Taiwan Youth Project 2000-09 (TYP 2000-09) used to code adolescents' first romantic relationship and first sexual intercourse. Adolescents' first romantic relationship is measured by whether or not a young adult had their first romantic relationship in adolescence and, if yes, how old the adolescent was *in years and months* when the relationship began. The coding is based primarily on adolescents' responses to two questions from Waves 2 to 9: (1) Do you have a boyfriend or girlfriend now? And (2) How long have you been dating this person? Results of this coding are then cross-tabulated with adolescent's responses to the question "Did you ever had a boyfriend or a girlfriend?" in Waves 6 to 9 for further verification. Since questions about adolescents' romantic relationships were asked in almost in every wave, we are able to identify the age of their first romantic relationship. If no information on an adolescent's romantic experiences is available due to data attrition, the age of first romantic relationship is coded as censored. Adolescents who missed most waves of the TYP surveys are excluded from analyses because little information is available to judge whether they had a girlfriend or boyfriend. 675 adolescents reported that they had a boyfriend or girlfriend before the survey was administered five years after respondents graduated from junior high school. However, no information on the age of their romantic relationship is available; therefore these respondents are coded as missing if they missed any of the previous surveys. If a respondent completed all surveys in previous waves, the time of his/her first romantic relationship is coded as the age in Wave 7 if the

respondent is from the J1 cohort, and as the age in Wave 5 if the respondent is from the J3 cohort.

Adolescents' first sexual intercourse is measured by whether or not a young adult had their first sexual intercourse in adolescence and, if yes, how old the adolescent was *in years* when this occurred. As shown in Table A1, TYP directly asked adolescents the age of their first sexual intercourse in multiple waves. If respondents provided inconsistent information in different waves, we use their earlier response as the measure of this variable. For adolescents who reported no sexual intercourse experience, they are coded as censored. J1 respondents who missed the Waves 8 and 9 surveys and J3 respondents who missed the Waves 6 and 7 surveys are excluded.

Appendix B. Descriptive Statistics of Independent Variables

Variable	Mean	Standard Deviation	Min.	Max.	Notes/Coding
# of days using the internet per week	3.01	2.52	0	7	Measured in 9th grade
# of days visiting internet café per week	0.68	1.05	0	7	Average in high school
Family bonds [a]	2.81	0.63	0	4	Composite variable; higher value = stronger family bonds
Parental suppervision	3.55	1.18	0	5	Does dad/mom always know where you are? 1 = never, 5 = always
Female	0.49	0.50	0	1	Yes = 1
Age in 9th grade	15.34	0.49	14	19	Years
Attended an academic high school	0.43	0.49	0	1	Yes = 1
Class ranking in 9th grade	18.39	10.49	3	35	Higher value = lower school ranking
Highest parental education	11.43	3.08	6	20	Years
# of dependents in the household	3.80	1.54	1	10	Student respondent included
Family income in 9th grade	12.74	21.33	0	900	NT$10K per month
Two-parent families	0.86	0.35	0	1	Yes = 1
School location: Taipei County	0.40	0.49	0	1	Reference group = Taipei City
School location: Yilan County	0.22	0.42	0	1	Reference group = Taipei City

Data source. Taiwan Youth Project, 2000-09.

Notes. N for number of days using the internet per week in 9th grade = 4,427; N for number of days visiting internet cafe per week in high school = 5,108. N = 5,541 for all other independent variables after using multiple imputations (m = 20) for missing cases. [a] Based on 6 items: 1) When making decisions, I discuss with my family members, 2) my family enjoys free time together, 3) all family members would participate in family activities, 4) my family accepts each other's friends, 5) whenever frustrated, I can always find comfort from my family, and 6) I depend on my family for advises and suggestions whenever I need one. Cronbach's alpha = .836.