



Social Determinants of Syphilis in South China: The Effect of Sibling Position on Syphilis and Sexual Risk Behaviors

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10 Social Determinants of Syphilis in South China: The Effect of Sibling Position on Syphilis and
11 Sexual Risk Behaviors

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3 Objective: This study evaluated the relationship between sibling position and sexual risk based
4 on behavioral and syphilis infection data from sexually transmitted infection (STI) patients in
5 South China.
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11 Design: Cross-sectional study examining sexual behaviors and syphilis infection.
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14 Setting: Four STI clinics in the Pearl River Delta of South China.
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17 Participants: 1792 Chinese men and women attending STI clinics.
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21 Primary Outcome Measures: STI history, syphilis infection defined as positive nontreponemal
22 and treponemal tests.
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26 Results: Among all STI patients, 824 (46.3%) were first-born, 354 (19.9%) were middle-born,
27 and 602 (33.8%) were final-born. Middle-born individuals had a higher percentage of reported
28 STI history (44.7% compared to 34.7%, $p < 0.001$) and syphilis infection (9.7% compared to
29 4.9%, $p = 0.01$) among men compared to other sibling positions in bivariate analyses. The
30 relationship between sibling position and syphilis was independent of income and education
31 level. There was no trend observed between middle-born position and female sexual risk
32 behaviors. Higher education was significantly associated with syphilis among women and men
33 in respective multivariate models.
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46 Conclusion: This study suggests that middle-born men in China have an increased sexual risk
47 compared to other sibling positions. As Chinese family and social structures change, a more
48 thorough understanding of how demographic factors influence sexual risk behaviors is needed.
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Article Summary

Article Focus:

- Understanding the social and family changes that influence sexual risk behaviors are critical for designing effective STD control responses.
- Few studies have examined the influence of sibling position on sexual risk behaviors.

Key Messages:

- Middle-born South Chinese men have an increased sexual risk compared to other sibship positions and this trend is not observed in women.
- The relationship between sibling position and sexual risk was not related to homosexual behavior, income, or education.
- Demographic changes in China related to family norms may have important implications for persistent syphilis transmission.

Strengths and Limitations:

- This was a relatively large study in a region with an expanding syphilis epidemic, using biomarker and behavioral endpoints.
- More detailed information about sibling relationships was not collected as part of this research.

Introduction

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3 Syphilis has made a marked resurgence across China [1 2], raising questions about social,
4 economic, and other contextual factors that may contribute to transmission. Social determinants
5 that likely drive onward syphilis transmission [3] include gender inequality [4], poverty [5], sex
6 ratios [6], and changing family structure [7]. Dynamic family structures in China could
7 influence syphilis transmission through a number of distinct mechanisms. Increases in the
8 number of poor, uneducated men who are unable to find brides (“surplus men”) could lead to an
9 increased demand for unsafe sex [8]. Rises in divorce could also contribute to the expansion of
10 syphilis [7]. In recent years the easing of China’s One-Child Policy has created more families
11 with multi-sibling families [9].

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There are several potential mechanisms whereby sibling position (or birth order) could directly or indirectly contribute to increased sexual risk behaviors. Later born siblings receive less parental investment and consequently have less education [10-12], less income [13 14], and worse health [15 16] compared to their earlier born counterparts. The trend towards lower socio-economic status could increase sexual risk behaviors among later born siblings. Studies among American adolescents have suggested that later born siblings have increased sexual risk behaviors [17-19], but there have not been similar research studies among adults. Men with older brothers have a substantially higher chance of being homosexual [20-22], another potential mechanism linking sibling position and sexual behaviors.

Given rapid changes in Chinese family structure and social dynamics, understanding the influence of demographic variables such as sibling position on sexual risk behaviors is important. The purpose of this study was to examine the effect of sibling position on history of STIs and syphilis among a sample of STI patients in South China.

Methods

This study recruited STI outpatients in China as part of the larger Plum Blossom Study which has been previously described [23]. Briefly, public STI clinics in four sites of the Pearl River Delta region of Guangdong Province were selected using a probability proportional-to-size sampling method [23]. All STI patients were invited to participate and information about those who refused to participate was also collected.

A written survey for public STI outpatients was field tested among 12 patients in one of the cities. The survey had 58 items, with most items coming from the China Health and Family Life Survey, a population-representative study of sexual behaviors in China [24]. The survey included domains on sociodemographic information, sexual behaviors, and sibling position. The sibling position question asked about the total number of younger brothers, younger sisters, older brothers, and older sisters in their family. An only child would be coded “0-0-0-0” since they have zero of each of these types of siblings.

From September 2009 until January 2010, potential study subjects were recruited by physicians and nurses at selected STI clinics. All STI patients older than 17 years old were eligible for participation, regardless of their interest in receiving syphilis testing. Potential participants were referred to a separate, quiet room to speak with a research assistant about joining the study. Participation in the survey was voluntary and no incentives were given to patients to participate in the study. Those who agreed to participate in the study were given STI counseling after providing verbal informed consent to a trained research assistant. STI patients were offered testing and then entered the study.

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3 All participants had approximately five mL of venous blood taken for treponemal syphilis
4 testing. All samples had subsequent nontreponemal confirmation and those with syphilis
5 infection received treatment according to standard guidelines.
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10 The primary outcome of the study was having a positive treponemal syphilis serology.
11 Missing values accounted for less than 10% of all the respective independent variables.
12 Occupation was dichotomized into entertainment and non-entertainment based on earlier work
13 supporting higher sexual risk behaviors at entertainment establishments [25]. First-borns were
14 categorized as being either the eldest or only children. Middle-borns had at least one elder sibling
15 and one younger sibling. Final-borns included those with at least one older sibling and no
16 younger siblings. Multicollinearity was assessed by calculating the variance inflation factor
17 (VIF) and excluding factors with a VIF over 5. Bivariate relationships were analyzed and
18 unadjusted odds ratios with 95% confidence intervals were reported. Bivariate relationships
19 were calculated for all participants, only men, and only women. Multivariate logistic regression
20 models for men and women respectively were developed by taking all bivariate relationships
21 found to be associated with syphilis infection with $p < 0.10$.
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39 This research protocol and consent procedure was approved by the Medical Ethics
40 Committee of Chinese Academy of Medical Sciences Institute of Dermatology (Nanjing, China),
41 the University of North Carolina Institutional Review Board (Chapel Hill, USA), and the
42 Partners Committee on Human Subjects Research (Boston, USA).
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50 **Results**

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53 A total of 1792 eligible individuals (consenting STI patients older than 17 years old)
54 participated in this study. Details of the 271 (13.1%) who refused to participate have been
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3 described elsewhere [23]. Most STI patients were 40 years old or younger, men, unmarried, had
4 an annual income of equal to or less than 3700 USD, had education less than or equal to high
5 school, and were not working in the entertainment industry (Table 1). Among all STI patients,
6 824 (46.3%) were first-born, 354 (19.9%) were middle-born, and 602 (33.8%) were final-born.
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8 HIV risk behaviors are reported in Table 2. 721 (40.3%) of individuals reported having a history
9 of a sexually transmitted infection.
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19 Among the 1792 participants, 1280 (71.4%) had never been tested for syphilis infection
20 in the past. A total of 1705 (95.1%) of patients were willing to be tested for syphilis infection
21 and 1702 (95.0%) accepted testing. A total of 139 (7.8%) of individuals had a positive syphilis
22 test. Most STI patients (1037, 63.6%) reported not using a condom during the last episode of sex
23 with their non-primary sex partner. Relatively few STI patients reported a history of injecting
24 drug use or same-sex behavior (Table 2).
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34 Among all STI patients (N = 1792), the following factors were significantly associated
35 with syphilis in univariate analyses: middle-born (OR 1.72, 95% CI 1.24-2.63) compared to
36 being first-born or final-born; women (OR 2.36, 95% 1.67-3.35) compared to men; unmarried
37 (OR 2.35, 95% CI 1.54-3.60) compared to married; education greater than high school (OR 1.66,
38 95% CI 1.17-2.36) compared to high school or less education; not living in Site D (OR 0.36,
39 95% CI 0.18-0.72) compared to living in the other cities; ever engaged in commercial sex (OR
40 1.81, -1.16-2.94) compared to never having engaged in commercial sex; and history of
41 intravenous drug use (OR 5.86, 95% CI 1.74-19.73). Middle-born sibling position was also
42 associated with a higher percentage of reported STI history (44.7% compared to 34.7%, $p <$
43 0.001). Being middle-born was not associated with reporting homosexual behaviors ($p = 0.4$).
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3 The multivariate model predicting syphilis among male STI patients (N = 1163) included
4 higher education, not living in Site D, and ever engaging in commercial sex (Table 3). Sibling
5 position, age, marital status, and IDU history were not in the final model. Middle-born sibling
6 position was significantly related to ever engaging in commercial sex. The multivariate model
7 predicting syphilis among female STI patients (N = 626) included unmarried, higher education,
8 and not living in Site D (Table 4).
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21 Discussion

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24 The resurgent syphilis epidemic in China forces broader thinking and action about this
25 ancient pathogen. Changing family structure, perhaps through its social and economic effects on
26 individuals, may have important implications for the expansion of syphilis [6]. To our
27 knowledge, this is the first study to examine the sexual risk behaviors of adults according to
28 sibling position. Easing of China's One Child Policy has already resulted in greater multi-sibling
29 families and this trend is likely to increase over time [9]. Both sexual preference and socio-
30 economic status are known to vary according to sibling position and may contribute to
31 differential sexual risk behaviors.
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44 Our results suggest that middle-born men have a higher risk of STI history and a greater
45 risk of purchasing sex. The relationship between middle-born and history of syphilis was
46 independent of self-reported homosexuality, income, and education levels. Adolescent research
47 from the United States has suggested that later sibling positions have an increased sexual risk
48 behaviors [17-19]. This effect in adolescents is thought to be related to the influence of having
49 sexually active older siblings who influence their younger brothers and sisters [26 27] or
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3 relatively less psychological support from parents [28]. The trend of middle-born individuals
4 having a higher risk of STIs and purchasing sex could be related to persistence of the effect
5 found in adolescence. Psychological attributes associated with individuals who are middle
6 siblings (e.g., more relaxed attitude [29]) may also establish a context for increased sexual risk
7 taking.
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16 Our finding that more highly educated women are more likely to have syphilis infection
17 contrasts with studies of other STIs among Chinese women. For example, a population-
18 representative study of chlamydia in China found that women who had less education were more
19 likely to have chlamydia [24] and this trend has been found in a number of other studies [30-32].
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21 The observed association between higher education and syphilis among women in our study,
22 however, is consistent with previous research that demonstrated greater syphilis risk among
23 Chinese men with more education [7 24]. Groups of high-income men in China often
24 incorporate visits to sex venues as part of business banquets, using such opportunities to
25 establish, maintain, and extend social relationships critical for work – and potentially increasing
26 risk of STI transmission to their wives [33].
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40 There are several important limitations in this study. First, our study was not a
41 population-based sample and so generalizations should be made with caution. Second, our study
42 was only cross-sectional and so the cumulative sexual risk could not be captured within a single
43 syphilis measurement. Third, this study only examined public STI clinics but did not explore
44 private clinics where a subset of high-risk men probably seek sexual health services. However,
45 public clinics are the most common source of clinical STI service [24] and the only sector with
46 the physician, laboratory, and nurse capacity to undertake research.
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3 Major family and social changes underway in China are likely to influence sexual risk
4 behaviors and the extent to which unsafe commercial sex becomes normalized. Social
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6 determinants may have an impact at multiple levels – family, neighborhood, city, and higher
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8 levels of organization. A better understanding of how family structure influences sexual risk
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10 behavior is important for designing effective interventions.
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Author Contributions

Conceived and designed the study: JDT, LY, BY. Performed the analysis: JDT, DY. Analyzed the data: LY, BY, JDT, AA. Contributed analysis tools: AA, BY. Wrote the paper: JDT, DY, LY, BY, AA.

Competing interest

We declare that we have no conflicts of interest.

Ethics Statement

All participants received verbal informed consent prior to participation. Verbal consent was used because of the minimal risk associated with participating in this study and documented by the research assistant who enrolled the patient in the study. This research protocol and consent procedure was approved by the Medical Ethics Committee of Chinese Academy of Medical

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3 Sciences Institute of Dermatology (Nanjing, China), the University of North Carolina
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5 Institutional Review Board (Chapel Hill, USA), and the Partners Committee on Human Subjects
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8 Research (Boston, USA).
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For peer review only

48 **Table 1. Socio-demographic correlates and bivariate relationships with syphilis among all**
49 **STI patients (N = 1792).**
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Socio-demographic Variables	No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)

Sibling Position	First-born	824 (46.3)	57 (3.4)	1
	Middle-born	354 (19.9)	40 (12.0)	1.72 (1.24-2.63)
	Final-born	602 (33.8)	41 (7.1)	0.98 (0.64-1.47)
Age	>40 years old	412 (23.0)	41(10.5)	1
	≤40 years old	1380 (77.0)	98 (7.5)	0.69(.47-1.01)
Sex	Male	1163 (65.0)	63 (5.8)	1
	Female	626 (35.0)	76 (12.6)	2.36 (1.67-3.35)
Marital Status	Married	624 (37.9)	29 (4.7)	1
	Unmarried	1021 (62.1)	105 (10.3)	2.35 (1.54-3.60)
Annual Income	≤ 3700 USD	882 (57.5)	79 (9.0)	1
	>3700 USD	651 (42.5)	42 (6.5)	0.70 (0.48-1.03)
Education Completed	≤ High school	1054 (62.8)	70 (6.6)	1
	> High school	625 (37.2)	66 (10.6)	1.66 (1.17 – 2.36)
Site	Site A	355 (20.9)	36 (10.1)	1
	Site B	453 (26.7)	34 (7.5)	0.72 (0.44-1.18)
	Site C	608 (35.8)	58 (9.5)	0.93 (0.60-1.45)
	Site D	283 (16.7)	11 (3.9)	0.36 (0.18-0.72)
Occupation	Entertainment	69 (4.1)	7 (10.1)	1
	Non-entertainment	1604 (95.88)	129 (8.0)	0.78 (0.35 – 1.73)

Table 2. HIV risk behaviors among all STI patients (N = 1792).

Risk Behaviors	No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)
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Condom use for non-primary partner¹	Yes	593 (36.4)	43 (7.3)	1
	No	1037 (63.6)	92 (8.8)	1.25 (0.85-1.82)
Ever engaged in commercial sex	No	1137 (70.8)	24 (5.1)	1
	Yes	468 (29.2)	103 (9.1)	1.81 (1.16-2.94)
IDU history	No	1667 (99.3)	131 (7.9)	1
	Yes	12 (.7)	4 (33.3)	5.86 (1.74-19.73)
Ever engaged in MSM activities²	No	1057(98.5)	61 (5.8)	1
	Yes	16 (1.5)	1 (6.3)	1.09 (0.14-8.38)

¹During the last sex with non-primary partner, did you use a condom?

²Analysis restricted to men only.

Table 3. Multivariate model predicting syphilis among all male STI patients (N =1163).

Predictor		Adjusted OR (95% CI)
Sibling position	First-born	1
	Middle-born	1.58 (0.77-3.28)
	Final-born	0.99 (0.50-1.96)
Age	>40 years old	1
	≤40 years old	0.59 (0.32-1.09)
Marital Status	Married	1
	Unmarried	2.13 (0.89-2.84)
Education	≤ High school	1
	> High school	1.59 (1.20-3.47)
Site	Site A	1
	Site B	0.90 (0.43-1.88)
	Site C	0.69 (0.35-1.37)
	Site D	0.21 (.06-0.73)
Ever engaged in commercial sex	No	1
	Yes	1.90 (1.04-3.50)
IDU history	No	1
	Yes	4.44 (0.05-39.98)

Table 4. Multivariate model predicting syphilis among all female STI patients (N = 626).

Predictor		Adjusted OR (95% CI)
Sibling position	First-born	1
	Middle-born	1.21 (0.63-2.32)
	Final-born	0.90 (0.47-1.73)
Age	>40 years old	1
	≤40 years old	1.17 (0.57-2.43)
Marital Status	Married	1
	Unmarried	2.62 (1.38-4.96)
Education	≤ High school	1
	> High school	1.77 (1.01-3.12)
Site	Site A	1
	Site B	0.46 (0.21-1.00)
	Site C	0.78 (0.38-1.61)
	Site D	0.22 (0.09-0.56)
Ever engaged in commercial sex	No	1
	Yes	0.97 (0.40-2.37)



Social Determinants of Syphilis in South China: The Effect of Sibling Position on Syphilis and Sexual Risk Behaviors

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10 Social Determinants of Syphilis in South China: The Effect of Sibling Position on Syphilis and
11 Sexual Risk Behaviors

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ABSTRACT

Objective: This study evaluated the relationship between sibling position and sexual risk based on behavioral and syphilis infection data from sexually transmitted infection (STI) patients in South China.

Design: Cross-sectional study examining sexual behaviors and syphilis infection.

Setting: Four STI clinics in the Pearl River Delta of South China.

Participants: 1792 Chinese men and women attending STI clinics.

Primary Outcome Measures: STI history, syphilis infection defined as positive nontreponemal and treponemal tests.

Results: Among all clinic patients, 824 (46.3%) were first-born, 354 (19.9%) were middle-born, and 602 (33.8%) were final-born. Middle-born individuals had a higher percentage of reported STI history (44.7% compared to 34.7%, $p < 0.001$) and syphilis infection (9.7% compared to 4.9%, $p = 0.01$) among men ($n=1163$) compared to other sibling positions in bivariate analyses, but not in the final multivariate model. The relationship between sibling position and syphilis was independent of income and education level. There was no trend observed between middle-born position and female sexual risk behaviors ($n=626$). Higher education was significantly associated with syphilis among women and men in respective multivariate models.

Conclusion: This study suggests that middle-born men in China may have an increased sexual risk compared to other sibling positions. As Chinese family and social structures change, a more thorough understanding of how demographic factors influence sexual risk behaviors is needed.

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7 Article Summary
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10 Article Focus:
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- 12 • Understanding the social and family changes that influence sexual risk behaviors are
13 critical for designing effective STD control responses.
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- 16 • Few studies have examined the influence of sibling position on sexual risk behaviors.
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25 Key Messages:
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- 27 • Middle-born South Chinese men have an increased sexual risk compared to other sibship
28 positions and this trend is not observed in women.
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- 31 • The relationship between sibling position and sexual risk was not related to homosexual
32 behavior, income, or education.
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- 35 • Demographic changes in China related to family norms may have important implications
36 for persistent syphilis transmission.
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45 Strengths and Limitations:
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- 47 • This was a relatively large study in a region with an expanding syphilis epidemic, using
48 biomarker and behavioral endpoints.
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- 51 • More detailed information about sibling relationships was not collected as part of this
52 research.
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Introduction

Syphilis has made a marked resurgence across China [1 2], raising questions about social, economic, and other contextual factors that may contribute to transmission. Social determinants that likely drive onward syphilis transmission [3] include gender inequality [4], poverty [5], sex ratios [6], and changing family structure [7]. Dynamic family structures in China could influence syphilis transmission through a number of distinct mechanisms. Increases in the number of poor, uneducated men who are unable to find brides (“surplus men”) could lead to an increased demand for unsafe sex [8]. Rises in divorce could also contribute to the expansion of syphilis [7]. In recent years the easing of China’s One-Child Policy has created more families with multi-sibling families [9].

There are several potential mechanisms whereby sibling position (or birth order) could directly or indirectly contribute to increased sexual risk behaviors. Later born siblings receive less parental investment and consequently have less education [10-12], less income [13 14], and worse health [15 16] compared to their earlier born counterparts. The trend towards lower socioeconomic status could increase sexual risk behaviors among later born siblings. Studies among American adolescents have suggested that later born siblings have increased sexual risk behaviors [17-19], but there have not been similar research studies among adults. Men with older brothers have a substantially higher chance of being homosexual [20-22], another potential mechanism linking sibling position and sexual behaviors.

Given rapid changes in Chinese family structure and social dynamics, understanding the influence of demographic variables such as sibling position on sexual risk behaviors is important.

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3 The purpose of this study was to examine the effect of sibling position on history of STIs and
4 syphilis among a sample of clinic patients in South China.
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10 11 12 **Methods**

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15 This study recruited STI outpatients in China as part of the larger Plum Blossom Study
16 which has been previously described [23]. Briefly, public STI clinics in four sites of the Pearl
17 River Delta region of Guangdong Province were selected using a probability proportional-to-size
18 sampling method [23]. All clinic patients were invited to participate and information about those
19 who refused to participate was also collected.
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27 A written survey for public STI outpatients was field tested among 12 patients in one of
28 the cities. The survey had 58 items, with most items coming from the China Health and Family
29 Life Survey, a population-representative study of sexual behaviors in China [24]. The survey
30 included domains on sociodemographic information, sexual behaviors, and sibling position. STI
31 history was a dichotomized variable based on asking about a history of each of the following
32 infections: syphilis, gonorrhea, chlamydia, condyloma acuminata, NGU/cervicitis, genital
33 herpes, or another STI. The sibling position question asked about the total number of younger
34 brothers, younger sisters, older brothers, and older sisters in their family. An only child would
35 be coded "0-0-0-0" since they have zero of each of these types of siblings.
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48 From September 2009 until January 2010, potential study subjects were recruited by
49 physicians and nurses at selected STI clinics. All clinic patients older than 17 years old were
50 eligible for participation, regardless of their interest in receiving syphilis testing. Potential
51 participants were referred to a separate, quiet room to speak with a research assistant about
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3 joining the study. Participation in the survey was voluntary and no incentives were given to
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5 patients to participate in the study. Those who agreed to participate in the study were given STI
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7 counseling after providing verbal informed consent to a trained research assistant. Clinic
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9 patients were offered testing and then entered the study.
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13 All participants had approximately five mL of venous blood taken for treponemal syphilis
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15 testing. All samples had subsequent nontreponemal confirmation and those with syphilis
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17 infection received treatment according to standard guidelines.
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20 The primary outcome of the study was having a positive treponemal syphilis serology.
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22 Missing values accounted for less than 10% of all the respective independent variables.
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24 Occupation was dichotomized into entertainment and non-entertainment based on earlier work
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26 supporting higher sexual risk behaviors at entertainment establishments [25]. First-borns were
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28 categorized as being either the eldest or only children. Middle-borns had at least one elder sibling
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30 and one younger sibling. Final-borns included those with at least one older sibling and no
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32 younger siblings. These three categories were based on sociology and psychology literature [26
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34 27] suggesting that sibling positions influence behaviors, including sexual behaviors.
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36 Multicollinearity was assessed by calculating the variance inflation factor (VIF) and excluding
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38 factors with a VIF over 5. Bivariate relationships were analyzed and unadjusted odds ratios with
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40 95% confidence intervals were reported. Bivariate relationships were calculated for all
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42 participants, only men, and only women. Multivariate logistic regression models for men and
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44 women respectively were developed by taking all bivariate relationships found to be associated
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46 with syphilis infection with $p < 0.10$.
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53 This research protocol and consent procedure was approved by the Medical Ethics
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55 Committee of Chinese Academy of Medical Sciences Institute of Dermatology (Nanjing, China),
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3 the University of North Carolina Institutional Review Board (Chapel Hill, USA), and the
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5 Partners Committee on Human Subjects Research (Boston, USA).
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10 **Results**

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13 A total of 1792 eligible individuals (consenting clinic patients older than 17 years old)
14 participated in this study. This included 1163 men and 626 women. Details of the 271 (13.1%)
15 who refused to participate have been described elsewhere [23]. Most clinic patients were 40
16 years old or younger, men, unmarried, had an annual income of equal to or less than 3700 USD,
17 had education less than or equal to high school, and were not working in the entertainment
18 industry (Table 1). Among all clinic patients, 824 (46.3%) were first-born, 354 (19.9%) were
19 middle-born, and 602 (33.8%) were final-born. Among the first-born individuals, 187 were only
20 children and 655 had siblings. HIV risk behaviors are reported in Table 2. 721 (40.3%) of
21 individuals reported having a history of a sexually transmitted infection.
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36 Among the 1792 participants, 1280 (71.4%) had never been tested for syphilis infection
37 in the past. A total of 1705 (95.1%) of patients were willing to be tested for syphilis infection
38 and 1702 (95.0%) accepted testing. A total of 139 (7.8%) of individuals had a positive syphilis
39 test. Most clinic patients (1037, 63.6%) reported not using a condom during the last episode of
40 sex with their non-primary sex partner. Relatively few clinic patients reported a history of
41 injecting drug use or same-sex behavior (Table 2).
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51 Among all clinic patients (N = 1792), the following factors were significantly associated
52 with syphilis in univariate analyses: middle-born (OR 1.72, 95% CI 1.24-2.63) compared to
53 being first-born or final-born; women (OR 2.36, 95% CI 1.67-3.35) compared to men; unmarried
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3 (OR 2.35, 95% CI 1.54-3.60) compared to married; education greater than high school (OR 1.66,
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5 95% CI 1.17-2.36) compared to high school or less education; not living in Site D (OR 0.36,
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7 95% CI 0.18-0.72) compared to living in the other cities; ever engaged in commercial sex (OR
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9 1.81, -1.16-2.94) compared to never having engaged in commercial sex; and history of
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11 intravenous drug use (OR 5.86, 95% CI 1.74-19.73). Middle-born sibling position was also
12
13 associated with a higher percentage of reported STI history (44.7% compared to 34.7%, $p <$
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15 0.001). Being middle-born was not associated with reporting homosexual behaviors ($p = 0.4$).
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21 The multivariate model predicting syphilis among male clinic patients ($N = 1163$)
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23 included higher education, not living in Site D, and ever engaging in commercial sex (Table 3).
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25 Sibling position, age, marital status, and IDU history were not in the final model. Middle-born
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27 sibling position was significantly related to ever engaging in commercial sex. The multivariate
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29 model predicting syphilis among female clinic patients ($N = 626$) included unmarried, higher
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31 education, and not living in Site D (Table 4).
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39 Discussion

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42 The resurgent syphilis epidemic in China forces broader thinking and action about this
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44 ancient pathogen. Changing family structure, perhaps through its social and economic effects on
45
46 individuals, may have important implications for the expansion of syphilis [6]. To our
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48 knowledge, this is the first study to examine the sexual risk behaviors of adults according to
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50 sibling position. Easing of China's One Child Policy has already resulted in greater multi-sibling
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52 families and this trend is likely to increase over time [9]. Both sexual preference and socio-
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54 economic status are known to vary according to sibling position and may contribute to
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3 differential sexual risk behaviors. Our finding that Site D had a lower burden of syphilis among
4 men and women is striking, but the low number of sites (n=4) precluded a more formal analysis
5 of site-level characteristics associated with syphilis infection. More comprehensive STI control
6 services in Site D prior to this research project may have contributed to this trend.
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13 Our results suggest that middle-born men have a higher risk of STI history and a greater
14 risk of purchasing sex. The relationship between middle-born and history of syphilis was
15 independent of self-reported homosexuality, income, and education levels. However, middle
16 sibling position was not in the final multivariate model because it was associated with ever
17 having had commercial sex. Adolescent research from the United States has suggested that later
18 sibling positions have an increased sexual risk behaviors [17-19]. This effect in adolescents is
19 thought to be related to the influence of having sexually active older siblings who influence their
20 younger brothers and sisters [28 29] or relatively less psychological support from parents [30].
21 The trend of middle-born individuals having a higher risk of STIs and purchasing sex could be
22 related to persistence of the effect found in adolescence. Psychological attributes associated with
23 individuals who are middle siblings (e.g., more relaxed attitude [26]) may also establish a
24 context for increased sexual risk taking.
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43 Our finding that more highly educated women are more likely to have syphilis infection
44 contrasts with studies of other STIs among Chinese women. For example, a population-
45 representative study of chlamydia in China found that women who had less education were more
46 likely to have chlamydia [24] and this trend has been found in a number of other studies [31-33].
47 The observed association between higher education and syphilis among women in our study,
48 however, is consistent with previous research that demonstrated greater syphilis risk among
49 Chinese men with more education [7 24]. Groups of high-income men in China often
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3 incorporate visits to sex venues as part of business banquets, using such opportunities to
4 establish, maintain, and extend social relationships critical for work – and potentially increasing
5 risk of STI transmission to their wives [34].
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11 There are several important limitations in this study. First, our study was not a
12 population-based sample and so generalizations should be made with caution. Second, our study
13 was only cross-sectional and so the cumulative sexual risk could not be captured within a single
14 syphilis measurement. Third, this study only examined public STI clinics but did not explore
15 private clinics where a subset of high-risk men probably seek sexual health services. However,
16 public clinics are the most common source of clinical STI service [24] and the only sector with
17 the physician, laboratory, and nurse capacity to undertake research.
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29 Major family and social changes underway in China are likely to influence sexual risk
30 behaviors and the extent to which unsafe commercial sex becomes normalized. Social
31 determinants may have an impact at multiple levels – family, neighborhood, city, and higher
32 levels of organization. Better understanding the social context of STDs, such as family
33 structures, can help us to inform structural interventions focused on improving sexual health.
34 For example, the finding that younger male siblings have a higher sexual risk could be used to
35 target younger male siblings in STD control social marketing campaigns. A tailored approach to
36 reaching subsets of high-risk groups has been effective in other settings [35 36]. Further research
37 on the social determinants of sexual health is needed.
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For peer review only

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Author Contributions

Conceived and designed the study: JDT, LY, BY. Performed the analysis: JDT, DY. Analyzed the data: LY, BY, JDT, AA. Contributed analysis tools: AA, BY. Wrote the paper: JDT, DY, LY, BY, AA.

Competing interest

We declare that we have no conflicts of interest.

Ethics Statement

All participants received verbal informed consent prior to participation. Verbal consent was used because of the minimal risk associated with participating in this study and documented by the research assistant who enrolled the patient in the study. This research protocol and consent procedure was approved by the Medical Ethics Committee of Chinese Academy of Medical

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Sciences Institute of Dermatology (Nanjing, China), the University of North Carolina
Institutional Review Board (Chapel Hill, USA), and the Partners Committee on Human Subjects
Research (Boston, USA).

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Table 1. Socio-demographic correlates and bivariate relationships with syphilis among all clinic patients (N = 1792).

Socio-demographic Variables		No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)
Sibling Position	First-born	824 (46.3)	57 (3.4)	1
	Middle-born	354 (19.9)	40 (12.0)	1.72 (1.24-2.63)
	Final-born	602 (33.8)	41 (7.1)	0.98 (0.64-1.47)
Age	>40 years old	412 (23.0)	41(10.5)	1
	≤40 years old	1380 (77.0)	98 (7.5)	0.69(.47-1.01)
Sex	Male	1163 (65.0)	63 (5.8)	1
	Female	626 (35.0)	76 (12.6)	2.36 (1.67-3.35)
Marital Status	Married	624 (37.9)	29 (4.7)	1
	Unmarried	1021 (62.1)	105 (10.3)	2.35 (1.54-3.60)
Annual Income	≤ 3700 USD	882 (57.5)	79 (9.0)	1
	>3700 USD	651 (42.5)	42 (6.5)	0.70 (0.48-1.03)
Education Completed	≤ High school	1054 (62.8)	70 (6.6)	1
	> High school	625 (37.2)	66 (10.6)	1.66 (1.17 – 2.36)
Site	Site A	355 (20.9)	36 (10.1)	1
	Site B	453 (26.7)	34 (7.5)	0.72 (0.44-1.18)
	Site C	608 (35.8)	58 (9.5)	0.93 (0.60-1.45)
	Site D	283 (16.7)	11 (3.9)	0.36 (0.18-0.72)
Occupation	Entertainment	69 (4.1)	7 (10.1)	1
	Non-entertainment	1604 (95.88)	129 (8.0)	0.78 (0.35 – 1.73)

Table 2. HIV risk behaviors among all clinic patients (N = 1792).

Risk Behaviors		No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)
Condom use for non-primary partner¹	Yes	593 (36.4)	43 (7.3)	1
	No	1037 (63.6)	92 (8.8)	1.25 (0.85-1.82)
Ever engaged in commercial sex	No	1137 (70.8)	24 (5.1)	1
	Yes	468 (29.2)	103 (9.1)	1.81 (1.16-2.94)
IDU history	No	1667 (99.3)	131 (7.9)	1
	Yes	12 (.7)	4 (33.3)	5.86 (1.74-19.73)
Ever engaged in MSM activities²	No	1057(98.5)	61 (5.8)	1
	Yes	16 (1.5)	1 (6.3)	1.09 (0.14-8.38)

¹During the last sex with non-primary partner, did you use a condom?

²Analysis restricted to men only.

Table 3. Multivariate model predicting syphilis among all male clinic patients (N =1163).

Predictor		Adjusted OR (95% CI)
Sibling position	First-born	1
	Middle-born	1.58 (0.77-3.28)
	Final-born	0.99 (0.50-1.96)
Age	>40 years old	1
	≤40 years old	0.59 (0.32-1.09)
Marital Status	Married	1
	Unmarried	2.13 (0.89-2.84)
Education	≤ High school	1
	> High school	1.59 (1.20-3.47)
Site	Site A	1
	Site B	0.90 (0.43-1.88)
	Site C	0.69 (0.35-1.37)
	Site D	0.21 (.06-0.73)
Ever engaged in commercial sex	No	1
	Yes	1.90 (1.04-3.50)
IDU history	No	1
	Yes	4.44 (0.05-39.98)

Table 4. Multivariate model predicting syphilis among all female clinic patients (N = 626).

Predictor		Adjusted OR (95% CI)
Sibling position	First-born	1
	Middle-born	1.21 (0.63-2.32)
	Final-born	0.90 (0.47-1.73)
Age	>40 years old	1
	≤40 years old	1.17 (0.57-2.43)
Marital Status	Married	1
	Unmarried	2.62 (1.38-4.96)
Education	≤ High school	1
	> High school	1.77 (1.01-3.12)
Site	Site A	1
	Site B	0.46 (0.21-1.00)
	Site C	0.78 (0.38-1.61)
	Site D	0.22 (0.09-0.56)
Ever engaged in commercial sex	No	1
	Yes	0.97 (0.40-2.37)

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14 Social Determinants of Syphilis in South China: The Effect of Sibling Position on Syphilis and
15 Sexual Risk Behaviors

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19 Research Article

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Objective: This study evaluated the relationship between sibling position and sexual risk based on behavioral and syphilis infection data from sexually transmitted infection (STI) patients in South China.

Design: Cross-sectional study examining sexual behaviors and syphilis infection.

Setting: Four STI clinics in the Pearl River Delta of South China.

Participants: 1792 Chinese men and women attending STI clinics.

Primary Outcome Measures: STI history, syphilis infection defined as positive nontreponemal and treponemal tests.

Results: Among all [STI-clinic](#) patients, 824 (46.3%) were first-born, 354 (19.9%) were middle-born, and 602 (33.8%) were final-born. Middle-born individuals had a higher percentage of reported STI history (44.7% compared to 34.7%, $p < 0.001$) and syphilis infection (9.7% compared to 4.9%, $p = 0.01$) among men ([n=1163](#)) compared to other sibling positions in bivariate analyses, [but not in the final multivariate model](#). The relationship between sibling position and syphilis was independent of income and education level. There was no trend observed between middle-born position and female sexual risk behaviors ([n=626](#)). Higher education was significantly associated with syphilis among women and men in respective multivariate models.

Conclusion: This study suggests that middle-born men in China [may](#) have an increased sexual risk compared to other sibling positions. As Chinese family and social structures change, a more thorough understanding of how demographic factors influence sexual risk behaviors is needed.

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11 Article Summary
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14 Article Focus:

- 15 • Understanding the social and family changes that influence sexual risk behaviors are
16 critical for designing effective STD control responses.
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- 19 • Few studies have examined the influence of sibling position on sexual risk behaviors.
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26 Key Messages:

- 27 • Middle-born South Chinese men have an increased sexual risk compared to other sibship
28 positions and this trend is not observed in women.
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- 31 • The relationship between sibling position and sexual risk was not related to homosexual
32 behavior, income, or education.
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- 35 • Demographic changes in China related to family norms may have important implications
36 for persistent syphilis transmission.
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42 Strengths and Limitations:

- 43 • This was a relatively large study in a region with an expanding syphilis epidemic, using
44 biomarker and behavioral endpoints.
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- 47 • More detailed information about sibling relationships was not collected as part of this
48 research.
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Introduction

Syphilis has made a marked resurgence across China [1 2], raising questions about social, economic, and other contextual factors that may contribute to transmission. Social determinants that likely drive onward syphilis transmission [3] include gender inequality [4], poverty [5], sex ratios [6], and changing family structure [7]. Dynamic family structures in China could influence syphilis transmission through a number of distinct mechanisms. Increases in the number of poor, uneducated men who are unable to find brides (“surplus men”) could lead to an increased demand for unsafe sex [8]. Rises in divorce could also contribute to the expansion of syphilis [7]. In recent years the easing of China’s One-Child Policy has created more families with multi-sibling families [9].

There are several potential mechanisms whereby sibling position (or birth order) could directly or indirectly contribute to increased sexual risk behaviors. Later born siblings receive less parental investment and consequently have less education [10-12], less income [13 14], and worse health [15 16] compared to their earlier born counterparts. The trend towards lower socio-economic status could increase sexual risk behaviors among later born siblings. Studies among American adolescents have suggested that later born siblings have increased sexual risk behaviors [17-19], but there have not been similar research studies among adults. Men with older brothers have a substantially higher chance of being homosexual [20-22], another potential mechanism linking sibling position and sexual behaviors.

Given rapid changes in Chinese family structure and social dynamics, understanding the influence of demographic variables such as sibling position on sexual risk behaviors is important.

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9 The purpose of this study was to examine the effect of sibling position on history of STIs and
10 syphilis among a sample of [STI-clinic](#) patients in South China.
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14 15 16 **Methods**

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18 This study recruited STI outpatients in China as part of the larger Plum Blossom Study
19 which has been previously described [23]. Briefly, public STI clinics in four sites of the Pearl
20 River Delta region of Guangdong Province were selected using a probability proportional-to-size
21 sampling method [23]. All [STI-clinic](#) patients were invited to participate and information about
22 those who refused to participate was also collected.
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28 A written survey for public STI outpatients was field tested among 12 patients in one of
29 the cities. The survey had 58 items, with most items coming from the China Health and Family
30 Life Survey, a population-representative study of sexual behaviors in China [24]. The survey
31 included domains on sociodemographic information, sexual behaviors, and sibling position. [STI](#)
32 [history was a dichotomized variable based on asking about a history of each of the following](#)
33 [infections: syphilis, gonorrhoea, chlamydia, condyloma acuminata, NGU/cervicitis, genital](#)
34 [herpes, or another STI.](#) The sibling position question asked about the total number of younger
35 brothers, younger sisters, older brothers, and older sisters in their family. An only child would
36 be coded “0-0-0-0” since they have zero of each of these types of siblings.
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45 From September 2009 until January 2010, potential study subjects were recruited by
46 physicians and nurses at selected STI clinics. All [STI-clinic](#) patients older than 17 years old were
47 eligible for participation, regardless of their interest in receiving syphilis testing. Potential
48 participants were referred to a separate, quiet room to speak with a research assistant about
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9 joining the study. Participation in the survey was voluntary and no incentives were given to
10 patients to participate in the study. Those who agreed to participate in the study were given STI
11 counseling after providing verbal informed consent to a trained research assistant. [STI-Clinic](#)
12 patients were offered testing and then entered the study.
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16 All participants had approximately five mL of venous blood taken for treponemal syphilis
17 testing. All samples had subsequent nontreponemal confirmation and those with syphilis
18 infection received treatment according to standard guidelines.
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22 The primary outcome of the study was having a positive treponemal syphilis serology.
23 Missing values accounted for less than 10% of all the respective independent variables.
24 Occupation was dichotomized into entertainment and non-entertainment based on earlier work
25 supporting higher sexual risk behaviors at entertainment establishments [25]. First-borns were
26 categorized as being either the eldest or only children. Middle-borns had at least one elder sibling
27 and one younger sibling. Final-borns included those with at least one older sibling and no
28 younger siblings. [These three categories were based on sociology and psychology literature \[26](#)
29 [27\] suggesting that sibling positions influence behaviors, including sexual behaviors.](#)
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37 Multicollinearity was assessed by calculating the variance inflation factor (VIF) and excluding
38 factors with a VIF over 5. Bivariate relationships were analyzed and unadjusted odds ratios with
39 95% confidence intervals were reported. Bivariate relationships were calculated for all
40 participants, only men, and only women. Multivariate logistic regression models for men and
41 women respectively were developed by taking all bivariate relationships found to be associated
42 with syphilis infection with $p < 0.10$.
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48 This research protocol and consent procedure was approved by the Medical Ethics
49 Committee of Chinese Academy of Medical Sciences Institute of Dermatology (Nanjing, China),
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9 the University of North Carolina Institutional Review Board (Chapel Hill, USA), and the
10 Partners Committee on Human Subjects Research (Boston, USA).
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12 13 14 **Results**

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17 A total of 1792 eligible individuals (consenting [STH-clinic](#) patients older than 17 years old)
18 participated in this study. [This included 1163 men and 626 women.](#) Details of the 271 (13.1%)
19 who refused to participate have been described elsewhere [23]. Most [STH-clinic](#) patients were
20 40 years old or younger, men, unmarried, had an annual income of equal to or less than 3700
21 USD, had education less than or equal to high school, and were not working in the entertainment
22 industry (Table 1). Among all [STH-clinic](#) patients, 824 (46.3%) were first-born, 354 (19.9%)
23 were middle-born, and 602 (33.8%) were final-born. [Among the first-born individuals, 187 were](#)
24 [only children and 655 had siblings.](#) HIV risk behaviors are reported in Table 2. 721 (40.3%) of
25 individuals reported having a history of a sexually transmitted infection.
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30 Among the 1792 participants, 1280 (71.4%) had never been tested for syphilis infection
31 in the past. A total of 1705 (95.1%) of patients were willing to be tested for syphilis infection
32 and 1702 (95.0%) accepted testing. A total of 139 (7.8%) of individuals had a positive syphilis
33 test. Most [clinicSTH](#) patients (1037, 63.6%) reported not using a condom during the last episode
34 of sex with their non-primary sex partner. Relatively few [STH-clinic](#) patients reported a history
35 of injecting drug use or same-sex behavior (Table 2).
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40 Among all [STH-clinic](#) patients (N = 1792), the following factors were significantly
41 associated with syphilis in univariate analyses: middle-born (OR 1.72, 95% CI 1.24-2.63)
42 compared to being first-born or final-born; women (OR 2.36, 95% 1.67-3.35) compared to men;
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unmarried (OR 2.35, 95% CI 1.54-3.60) compared to married; education greater than high school (OR 1.66, 95% CI 1.17-2.36) compared to high school or less education; not living in Site D (OR 0.36, 95% CI 0.18-0.72) compared to living in the other cities; ever engaged in commercial sex (OR 1.81, -1.16-2.94) compared to never having engaged in commercial sex; and history of intravenous drug use (OR 5.86, 95% CI 1.74-19.73). Middle-born sibling position was also associated with a higher percentage of reported STI history (44.7% compared to 34.7%, $p < 0.001$). Being middle-born was not associated with reporting homosexual behaviors ($p = 0.4$).

The multivariate model predicting syphilis among male **STI-clinic** patients (N = 1163) included higher education, not living in Site D, and ever engaging in commercial sex (Table 3). Sibling position, age, marital status, and IDU history were not in the final model. Middle-born sibling position was significantly related to ever engaging in commercial sex. The multivariate model predicting syphilis among female **STI-clinic** patients (N = 626) included unmarried, higher education, and not living in Site D (Table 4).

Discussion

The resurgent syphilis epidemic in China forces broader thinking and action about this ancient pathogen. Changing family structure, perhaps through its social and economic effects on individuals, may have important implications for the expansion of syphilis [6]. To our knowledge, this is the first study to examine the sexual risk behaviors of adults according to sibling position. Easing of China's One Child Policy has already resulted in greater multi-sibling families and this trend is likely to increase over time [9]. Both sexual preference and socio-economic status are known to vary according to sibling position and may contribute to

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9 differential sexual risk behaviors. Our finding that Site D had a lower burden of syphilis among
10 men and women is striking, but the low number of sites (n=4) precluded a more formal analysis
11 of site-level characteristics associated with syphilis infection. More comprehensive STI control
12 services in Site D prior to this research project may have contributed to this trend.
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17 Our results suggest that middle-born men have a higher risk of STI history and a greater
18 risk of purchasing sex. The relationship between middle-born and history of syphilis was
19 independent of self-reported homosexuality, income, and education levels. However, middle
20 sibling position was not in the final multivariate model because it was associated with ever
21 having had commercial sex. Adolescent research from the United States has suggested that later
22 sibling positions have an increased sexual risk behaviors [17-19]. This effect in adolescents is
23 thought to be related to the influence of having sexually active older siblings who influence their
24 younger brothers and sisters [28 29] or relatively less psychological support from parents [30].
25 The trend of middle-born individuals having a higher risk of STIs and purchasing sex could be
26 related to persistence of the effect found in adolescence. Psychological attributes associated with
27 individuals who are middle siblings (e.g., more relaxed attitude [26]) may also establish a
28 context for increased sexual risk taking.
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40 Our finding that more highly educated women are more likely to have syphilis infection
41 contrasts with studies of other STIs among Chinese women. For example, a population-
42 representative study of chlamydia in China found that women who had less education were more
43 likely to have chlamydia [24] and this trend has been found in a number of other studies [31-33].
44 The observed association between higher education and syphilis among women in our study,
45 however, is consistent with previous research that demonstrated greater syphilis risk among
46 Chinese men with more education [7 24]. Groups of high-income men in China often
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incorporate visits to sex venues as part of business banquets, using such opportunities to establish, maintain, and extend social relationships critical for work – and potentially increasing risk of STI transmission to their wives [34].

There are several important limitations in this study. First, our study was not a population-based sample and so generalizations should be made with caution. Second, our study was only cross-sectional and so the cumulative sexual risk could not be captured within a single syphilis measurement. Third, this study only examined public STI clinics but did not explore private clinics where a subset of high-risk men probably seek sexual health services. However, public clinics are the most common source of clinical STI service [24] and the only sector with the physician, laboratory, and nurse capacity to undertake research.

Major family and social changes underway in China are likely to influence sexual risk behaviors and the extent to which unsafe commercial sex becomes normalized. Social determinants may have an impact at multiple levels – family, neighborhood, city, and higher

levels of organization. Better understanding the social context of STDs, such as family structures, can help us to inform structural interventions focused on improving sexual health. For example, the finding that younger male siblings have a higher sexual risk could be used to target younger male siblings in STD control social marketing campaigns. A tailored approach to reaching subsets of high-risk groups has been effective in other settings [35 36]. Further research on the social determinants of sexual health is needed. A better understanding of how family structure influences sexual risk behavior is important for designing effective interventions.

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51 Financial Disclosure

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25 **Author Contributions**

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28 Conceived and designed the study: JDT, LY, BY. Performed the analysis: JDT, DY. Analyzed
29 the data: LY, BY, JDT, AA. Contributed analysis tools: AA, BY. Wrote the paper: JDT, DY,
30 LY, BY, AA.
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36 **Competing interest**

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38 We declare that we have no conflicts of interest.
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41 **Ethics Statement**

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43 All participants received verbal informed consent prior to participation. Verbal consent was used
44 because of the minimal risk associated with participating in this study and documented by the
45 research assistant who enrolled the patient in the study. This research protocol and consent
46 procedure was approved by the Medical Ethics Committee of Chinese Academy of Medical
47 Sciences Institute of Dermatology (Nanjing, China), the University of North Carolina
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Table 1. Socio-demographic correlates and bivariate relationships with syphilis among all STI-clinic patients (N = 1792).

Socio-demographic Variables	No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)	
Sibling Position	First-born	824 (46.3)	57 (3.4)	1

	Middle-born	354 (19.9)	40 (12.0)	1.72 (1.24-2.63)
	Final-born	602 (33.8)	41 (7.1)	0.98 (0.64-1.47)
Age	>40 years old	412 (23.0)	41(10.5)	1
	≤40 years old	1380 (77.0)	98 (7.5)	0.69(.47-1.01)
Sex	Male	1163 (65.0)	63 (5.8)	1
	Female	626 (35.0)	76 (12.6)	2.36 (1.67-3.35)
Marital	Married	624 (37.9)	29 (4.7)	1
Status	Unmarried	1021 (62.1)	105 (10.3)	2.35 (1.54-3.60)
Annual Income	≤ 3700 USD	882 (57.5)	79 (9.0)	1
	>3700 USD	651 (42.5)	42 (6.5)	0.70 (0.48-1.03)
Education Completed	≤ High school	1054 (62.8)	70 (6.6)	1
	> High school	625 (37.2)	66 (10.6)	1.66 (1.17 – 2.36)
Site	Site A	355 (20.9)	36 (10.1)	1
	Site B	453 (26.7)	34 (7.5)	0.72 (0.44-1.18)
	Site C	608 (35.8)	58 (9.5)	0.93 (0.60-1.45)
	Site D	283 (16.7)	11 (3.9)	0.36 (0.18-0.72)
Occupation	Entertainment	69 (4.1)	7 (10.1)	1
	Non-entertainment	1604 (95.88)	129 (8.0)	0.78 (0.35 – 1.73)

Table 2. HIV risk behaviors among all **STI-clinic** patients (N = 1792).

Risk Behaviors		No. (%)	No. Positive for Syphilis, (%)	Unadjusted OR (95% CI)
Condom use for non-primary	Yes	593 (36.4)	43 (7.3)	1
	No	1037 (63.6)	92 (8.8)	1.25 (0.85-1.82)

partner ¹				
Ever engaged in commercial sex	No	1137 (70.8)	24 (5.1)	1
	Yes	468 (29.2)	103 (9.1)	1.81 (1.16-2.94)
IDU history	No	1667 (99.3)	131 (7.9)	1
	Yes	12 (.7)	4 (33.3)	5.86 (1.74-19.73)
Ever engaged in MSM activities ²	No	1057(98.5)	61 (5.8)	1
	Yes	16 (1.5)	1 (6.3)	1.09 (0.14-8.38)

¹During the last sex with non-primary partner, did you use a condom?

²Analysis restricted to men only.

Table 3. Multivariate model predicting syphilis among all male **STI-clinic** patients (N =1163).

Predictor	Adjusted OR
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(95% CI)		
Sibling position	First-born	1
	Middle-born	1.58 (0.77-3.28)
	Final-born	0.99 (0.50-1.96)
Age	>40 years old	1
	≤40 years old	0.59 (0.32-1.09)
Marital Status	Married	1
	Unmarried	2.13 (0.89-2.84)
Education	≤ High school	1
	> High school	1.59 (1.20-3.47)
Site	Site A	1
	Site B	0.90 (0.43-1.88)
	Site C	0.69 (0.35-1.37)
	Site D	0.21 (.06-0.73)
Ever engaged in commercial sex	No	1
	Yes	1.90 (1.04-3.50)
IDU history	No	1
	Yes	4.44 (0.05-39.98)

Table 4. Multivariate model predicting syphilis among all female **STI-clinic** patients (N = 626).

Predictor		Adjusted OR (95% CI)
Sibling position	First-born	1
	Middle-born	1.21 (0.63-2.32)
	Final-born	0.90 (0.47-1.73)
Age	>40 years old	1
	≤40 years old	1.17 (0.57-2.43)
Marital Status	Married	1
	Unmarried	2.62 (1.38-4.96)
Education	≤ High school	1
	> High school	1.77 (1.01-3.12)
Site	Site A	1
	Site B	0.46 (0.21-1.00)
	Site C	0.78 (0.38-1.61)
	Site D	0.22 (0.09-0.56)
Ever engaged in commercial sex	No	1
	Yes	0.97 (0.40-2.37)