MULTIDIMENSIONAL DISCRIMINATIVE FACTORS FOR UNPROTECTED SEX AMONG ADOLESCENTS IN SOUTHERN TAIWAN

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Establishing the discriminative factors for unprotected sex among adolescents is essential for early identification of at-risk teens and for the prevention of unplanned pregnancy and sexually transmitted diseases. The aim of this study was to examine the discriminative effects of demographic, individual, family, peers, and school life factors on unprotected sex in a large-scale, representative adolescent population in Southern Taiwan. A total of 9,736 adolescent students were recruited into this study and completed the questionnaires. The multidimensional discriminative factors for unprotected sex were examined using χ^2 automatic interaction detection analysis and logistic regression models. The results of the χ^2 automatic interaction detection analysis revealed that having friends, using illicit drugs, being of an older age, suspension from school, and low family monitoring had discriminative effects on unprotected sex in adolescents. The logistic regression analysis further confirmed the discriminative effect of these factors. Because of the adverse effects of unprotected sex in adolescents, we suggest that parents and health professionals should pay attention to adolescents with the discriminative factors for unprotected sex identified in this study.

Key Words: adolescents, condom use, risk indicator, safe sex
(*Kaohsiung J Med Sci* 2009;25:193–202)

Pregnancy and sexually transmitted diseases (STDs) can result in medical and psychological problems in adolescents [1]. Unprotected sex is a sex-related risk behavior that contributes to pregnancy and STD transmission amongst adolescents [2,3]. Although adolescents, as a population, have high rates of unprotected sex and STDs, adolescents *per se* do not represent a homogeneous group; certain subpopulations may be at increased risk for adverse behaviors and outcomes. Understanding the risk factors related to adolescent unprotected sex is essential for early identification and care of at-risk teens and in the design of primary and secondary prevention programs in schools and communities [4].

Adolescent development is the result of interactions between individuals and social contexts [5]. Previous studies have found that several demographic and individual factors, including older age [6], living in rural areas [7], low socioeconomic status (SES) [8], depression [9,10] and substance use [11], were associated with unprotected sex. Family, peers and school

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are important social contexts for the development of adolescents. The family is the earliest and most important influence on sexuality [12], and peer influence on sexual activity becomes increasingly important over time, as adolescents move away from the family [13]. Meanwhile, for adolescents who are receiving education, school is important in gaining sexual knowledge, beliefs and attitudes. Previous studies have found that marital conflict between parents [14], not living with parents [15], low family support [16], low family monitoring [17], high family conflict [18], having peers who engage in deviant behaviors [19] and limited connection with the school [15], were all associated with increased risk of unprotected sex amongst adolescents.

Although establishing risk factors for unprotected sex in adolescents is one of the essential steps in developing primary and secondary prevention programs, few studies have simultaneously considered the demographic, individual, family, peers and school life characteristics when studying unprotected sex in adolescents. Thus, the aim of this study was to examine the discriminative effects of demographic (sex, age, residential background and SES), individual (depression and substance use), family (living with parents, marital conflict between parents, family conflict, family monitoring, family support and family members with substance abuse), peers (connection with the peer group, time spent with friends, friends with substance abuse, criminal record and gang affiliation), and school life characteristics (school affinity, suspension from school and academic achievement) on unprotected sex in a large-scale, representative adolescent population in Southern Taiwan.

METHODS

The current study was based on data from the Project for the Health of Adolescents in Southern Taiwan in 2004, which consisted of data collected from three metropolitan cities and four counties. In 2004, there were 257,873 adolescent students in 209 junior high schools and 202,456 adolescent students in 140 senior high/vocational schools in this area. A stratified random sampling strategy was used based on the definitions of urban and rural districts in the Taiwan Demographic Fact Book [20] and school and grade characteristics, to ensure that the study participants comprised a proportional representation of districts, schools and grades. Six randomly selected schools (three junior high and three senior high/vocational schools; four from urban districts and two from rural districts) refused to join this study. Finally, 12 junior high and 19 senior high/vocational schools were randomly selected from the urban districts; similarly, 11 junior high and 10 senior high/vocational schools were randomly selected from rural districts. The school classes were further stratified into three levels based on grades in both the junior high and senior high/vocational schools. A total of 12,210 adolescent students from 207 classes were randomly selected based on the ratio of students in each grade.

Procedure

The protocol was approved by the Institutional Review Board of Kaohsiung Medical University. Written informed consent was obtained from the adolescents before commencing the study. Research assistants explained the purpose and procedure of this study to the students in each class, emphasizing our respect for their privacy, and encouraging them to participate. The adolescents were asked to anonymously complete the questionnaires based on the explanations of the research assistants. All students received a gift that was worth 33 NT dollars (US$1) at the end of the assessment. In addition, another 76 adolescents (40 junior high school students and 36 senior high school students), and their parents, were recruited into a pilot study to examine the reliability and validity of the research instruments.

Assessment

Unprotected sex

One item from the *Adolescent Sexual Experience Questionnaire* was adapted to assess the participants' engagement in unprotected sex [21]: "Have you ever engaged in sexual intercourse without using condoms?" The 2-week test–retest reliability (κ) was 0.76 ($p < 0.001$).

Depression

The 20-item Mandarin-Chinese version [22] of the *Center for Epidemiological Studies' Depression Scale* [23] was used to assess the frequency of depressive symptoms in the preceding week. Cronbach's α for the *Center for Epidemiological Studies' Depression Scale* in the present study was 0.93 and the 2-week test–retest

reliability was 0.78. Based on the results of a previous study using the scale in a two-phase survey for depressive disorders among non-referred adolescents in Taiwan [24], the participants whose total score was > 28 were defined as having significant depression.

Alcohol consumption and illicit drug use

The *Questionnaires for Experience in Substance Use* were used to inquire dichotomously whether participants have drunk alcohol regularly (at least once per week) and have ever used illicit drugs in the preceding year, as well as regular alcohol consumption and illicit drug use among parents, siblings and peers [25]. The range of the 2-week test–retest reliability of these eight items in this study (κ) was 0.66–0.72 ($p < 0.001$).

Adolescent Family and Social Life Questionnaire

A subscale on the *Adolescent Family and Social Life Questionnaire* was adapted to assess the levels of family conflict (3 items), family monitoring (4 items), connection with the peer group (4 items), and school affinity (4 items) [26,27]. The Cronbach's α range was 0.68–0.74 and the 2-week test–retest reliability range was 0.64–0.71. The participants whose total scores in these four subscales were higher than the median were classified as having high family conflict, low family monitoring, low connection with their peer group, and low school affinity, respectively. The questionnaire also assessed the time that the participants spent with friends after school per day, and whether they had friends with a criminal record or gang affiliation.

Family APGAR Index

The 5-item Chinese-version [28] of the *Family APGAR Index* [29] was used to measure the participants' perceived family support. Cronbach's α was 0.91 and the 2-week test–retest reliability was 0.68 in this study. Participants whose total APGAR score was lower than the median were classified as having low family support.

The participants' sex, age (< 15 years old *vs.* ≥ 15 years old), residential background (urban *vs.* rural), and SES were collected. In this study, the parental education level was used to represent adolescents' high SES (parental education level > 9 years) and low SES (parental education level ≤ 9 years). The participants' experience of being suspended from school, academic achievement (the first two-thirds *vs.* the last one-third of their classmates, by rank, in the recent semester), living with parents or not and parental marital status were also collected.

Statistical analysis

Two different statistical methods were used to identify factors that discriminated the adolescents with experience of unprotected sex from those without experience of unprotected sex. First, the χ^2 automatic interaction detection (CHAID) analysis using Answer Tree 3.1 software (SPSS Inc., Chicago, IL, USA) [30] was used to detect mutually exclusive subgroups of the sample that differed markedly with regard to the experience of unprotected sex. The analysis selected the best predictors of the outcome and divided the sample into subgroups based on that variable while merging the nonsignificant categories. This process was repeated within each subgroup until no further predictors could significantly contribute to the analysis. The statistical software randomly split the research sample into a calibration sample and a cross-validation sample. Because this is an exploratory procedure, the reproducibility of the resulting subgroup categories was investigated by conducting the analysis on the calibration sample and by examining the replication with the cross-validation sample. Second, the logistic regression analysis models were conducted to confirm the results of the CHAID analysis. In the initial step, the significant factors identified by the CHAID analysis were entered into the logistic regression analysis (the fully entered model). Then, the interactions between the significant factors were selected (the fully entered model). In the last step, other factors were selected into the logistic regression analysis to examine the possible discriminating factors that were not identified in the CHAID analysis (the forward stepwise selection model) in the calibration sample. The results of logistic regression analyses in the calibration sample were further confirmed in the cross-validation sample using the fully entered logistic regression analyses. A two-tailed *p* value less than 0.05 was considered statistically significant.

RESULTS

A total of 11,111 (91.0%) adolescents gave written informed consent. Of these, 9,736 (87.6%) participants completed all research questionnaires without omission. Their demographic, individual, family, peer and

Table 1. Demographic, individual, family, peer and school life characteristics, and percentage of unprotected sex among 9,736 participants*

Have ever had unprotected sex	201 (2.1)
Demographic characteristics	
• Male	4,734 (48.6)
• Older age (≥15 yr)	4,844 (49.8)
• Living in rural areas	4,036 (41.5)
• Low paternal education (≤9 yr)	3,306 (34.0)
• Low maternal education (≤9 yr)	3,885 (39.9)
Individual characteristics	
• Significant depression (CES-D score >28)	1,174 (12.1)
• Have drunk alcohol regularly	152 (1.6)
• Have ever used illicit drugs	101 (1.0)
Family characteristics	
• Not living with parents	656 (6.7)
• Marital conflict between parents	1,334 (13.7)
• High family conflict (subscale score of the AFSLQ >2)	2,054 (21.1)
• Low family monitoring (subscale score of the AFSLQ >1.67)	3,307 (34.0)
• Low family support (APGAR score <14)	4,434 (45.5)
• Have family members drinking habitually	2,375 (24.4)
• Have family members using illicit drugs	130 (1.3)
Peer characteristics	
• Low connectedness to peer group (subscale score of the AFSLQ >1.75)	4,001 (41.1)
• Spending ≥1 hr with friends per day	3,318 (34.1)
• Have friends who drink regularly	1,428 (14.7)
• Have friends who use illicit drugs	758 (7.8)
• Have friends with any criminal record or gang affiliation	1,896 (19.5)
School characteristics	
• Low school affinity (subscale score of the AFSLQ >1.8)	3,530 (36.3)
• Have ever been suspended from school	185 (1.9)
• Low academic achievement	2,395 (24.6)

*Data presented as *n* (%). CES-D = Center for Epidemiological Studies' Depression Scale; AFSLQ = Adolescent Family and Social Life Questionnaire.

school life characteristics are shown in Table 1. In total, 201 participants (2.1%) reported having had unprotected sex.

To conduct stepwise CHAID analysis, 4,868 participants were randomly selected as the calibration sample and 4,868 participants selected as the cross-validation sample. The results of the stepwise CHAID analysis for correlates of unprotected sex in the calibration and cross-validation samples are shown in the Figure. In the calibration sample, the first and the most significant variable selected was having peers who used illicit drugs. Overall, 11.28% of adolescents who had peers using illicit drugs reported having had unprotected sex, whereas only 1.3% of adolescents without peers using illicit drugs had unprotected sex. Among the adolescents without peers using illicit drugs, age was another discriminating

factor; a total of 2.33% of adolescents who were 15 years of age or older reported having had unprotected sex, while only 0.34% of adolescents who were younger than 15 years of age said that they had engaged in unprotected sex. Experience of suspension from school was another discriminating factor in the older adolescents who did not have peers using illicit drugs: some 12.00% of those who had been suspended from school reported to have unprotected sex versus only 2.10% of those who had never been suspended from school. Among the older adolescents who did not have peers who used illicit drugs and had never been suspended from school, family monitoring had a further discriminating effect: a total of 3.55% of adolescents who perceived low family monitoring reported experience of unprotected sex versus 1.37% of those who perceived high family monitoring. Results in the
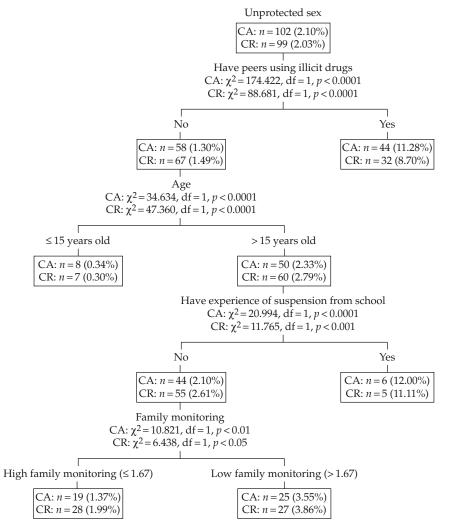
Unprotected sex

CA: $n = 102$ (2.10%)
CR: $n = 99$ (2.03%)

Have peers using illicit drugs
CA: $\chi^2 = 174.422$, df = 1, $p < 0.0001$
CR: $\chi^2 = 88.681$, df = 1, $p < 0.0001$

No

CA: $n = 58$ (1.30%)
CR: $n = 67$ (1.49%)

Yes

CA: $n = 44$ (11.28%)
CR: $n = 32$ (8.70%)

Age
CA: $\chi^2 = 34.634$, df = 1, $p < 0.0001$
CR: $\chi^2 = 47.360$, df = 1, $p < 0.0001$

≤ 15 years old

CA: $n = 8$ (0.34%)
CR: $n = 7$ (0.30%)

> 15 years old

CA: $n = 50$ (2.33%)
CR: $n = 60$ (2.79%)

Have experience of suspension from school
CA: $\chi^2 = 20.994$, df = 1, $p < 0.0001$
CR: $\chi^2 = 11.765$, df = 1, $p < 0.001$

No

CA: $n = 44$ (2.10%)
CR: $n = 55$ (2.61%)

Yes

CA: $n = 6$ (12.00%)
CR: $n = 5$ (11.11%)

Family monitoring
CA: $\chi^2 = 10.821$, df = 1, $p < 0.01$
CR: $\chi^2 = 6.438$, df = 1, $p < 0.05$

High family monitoring (≤ 1.67)

CA: $n = 19$ (1.37%)
CR: $n = 28$ (1.99%)

Low family monitoring (> 1.67)

CA: $n = 25$ (3.55%)
CR: $n = 27$ (3.86%)

Figure. *Discriminating factors for unprotected sex in the CHAID analysis. CA = calibration sample; CR = cross-validation sample; df = degrees of freedom.*

cross-validation sample are shown in the Figure, which confirms that the results of the CHAID analysis were replicable.

We then used logistic regression analyses to examine the factors related to unprotected sex in the calibration sample. The results further supported the results of the CHAID analysis showing that adolescents with friends using illicit drugs (odds ratio [OR], 29.22; 95% confidence interval [CI], 9.39–90.87), adolescents who were aged 15 years or older (OR, 5.21; 95% CI, 2.00–13.59), or had been suspended from school (OR, 9.73; 95% CI, 3.34–28.41) were more likely to report having had unprotected sex. The same significant associations were also found in the cross-validation sample. However, the association between unprotected sex and low family monitoring (OR, 4.04; 95%

CI, 1.23–13.24) was only found in the cross-validation sample and not in the calibration sample. No interactions between the significant factors were found to be significantly associated with unprotected sex in either the calibration or cross-validation samples.

We also examined the factors related to unprotected sex regarding age and having peers with substance use using logistic regression analyses (Table 2). Low family monitoring was confirmed to be associated with unprotected sex in the younger or older adolescents without peers with substance use. Having been suspended from school was associated with unprotected sex in the older adolescents without peers using substances. Meanwhile, being female and using illicit drugs were associated with unprotected sex in the younger adolescents without peers with substance

Table 2. Factors related to unprotected sex according to age group and having peers with substance use

	Age ≤15 yr No peer with substance use		Age ≤15 yr Peer with substance use		Age >15 yr No peer with substance use		Age >15 yr Peer with substance use	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Male	0.21	0.056–0.76	0.54	0.13–2.28	0.83	0.55–1.24	0.94	0.51–1.71
Living in rural areas	1.79	0.56–5.77	1.40	0.42–4.69	1.12	0.76–1.67	1.07	0.58–1.97
Low paternal education	3.04	0.83–11.18	0.93	0.27–3.29	0.64	0.40–1.03	0.95	0.49–1.84
Low maternal education	0.60	0.17–2.06	0.81	0.24–2.76	1.72	1.11–2.64	0.88	0.44–1.74
Significant depression	0.88	0.16–4.84	1.29	0.33–5.06	1.30	0.75–2.23	1.02	0.50–2.07
Drinking alcohol regularly	0.70	0.01–49.66	0.41	0.04–4.69	3.71	1.49–9.23	2.04	0.81–5.14
Using illicit drugs	145.72	10.30–2,061.08	3.69	0.70–19.49	*	*	2.24	0.95–5.29
Not living with parents	2.09	0.35–12.36	8.14	1.19–55.81	0.68	0.32–1.44	0.73	0.25–2.12
Marital conflict between parents	1.26	0.25–6.37	0.22	0.04–1.38	2.34	1.44–3.79	1.18	0.53–2.66
High family conflict	1.95	0.55–7.0	4.09	1.02–16.48	0.92	0.56–1.51	2.72	1.45–5.13
Low family monitoring	5.59	1.43–21.82	0.43	0.12–1.55	1.81	1.19–2.76	1.08	0.58–2.03
Low family support	0.30	0.08–1.05	0.90	0.23–3.48	1.05	0.69–1.62	0.92	0.48–1.76
Families drinking habitually	1.01	0.30–3.38	1.31	0.40–4.26	0.68	0.41–1.12	0.66	0.35–1.26
Families using illicit drugs	2.71	0.27–27.28	0.17	0.01–2.31	1.44	0.29–7.14	0.69	0.22–2.20
Low connectedness to peers	0.33	0.09–1.19	2.65	0.69–10.19	0.71	0.46–1.08	0.38	0.19–0.76
Spending much time with friends	0.62	0.19–2.03	1.64	0.49–5.51	1.48	0.99–2.19	1.23	0.69–2.20
Friends drinking regularly	1.32	0.28–6.27	1.68	0.49–5.73	1.41	0.87–2.29	0.98	0.53–1.81
Friends with behavioral problems	1.25	0.35–4.54	0.87	0.20–3.80	1.60	0.99–2.59	1.22	0.63–2.36
Low school affinity	1.96	0.58–6.62	1.76	0.39–7.90	1.33	0.88–2.03	1.92	0.96–3.83
Suspension of schooling	0.88	0.01–56.48	*	*	4.45	2.20–9.00	1.17	0.46–2.98
Low academic achievement	2.22	0.69–7.14	1.54	0.40–5.93	1.38	0.90–2.09	1.16	0.63–2.13

*95% confidence interval could not be obtained due to multilinearity. OR = odds ratio; CI = confidence interval.

use. Not living with parents and high family conflict were associated with unprotected sex in the younger adolescents with peers with substance use. Drinking alcohol regularly and marital conflict between parents were associated with unprotected sex in the older adolescents without peers with substance use. Finally, high family conflict and high connection with peers were associated with unprotected sex in the older adolescents with peers with substance use.

DISCUSSION

This study examined the discriminative effects of demographic, individual, family, peer and school life factors on unprotected sex in a large-scale, representative population of southern Taiwanese adolescents using CHAID and logistic regression analyses. The results of the CHAID analysis indicated that having friends using illicit drugs, older age, having been suspended from school and low family monitoring had a discriminative effect for unprotected sex in adolescents, and the results of the logistic regression analysis confirmed the discriminative effect of the first three factors.

In this study, adolescents who had friends that used illicit drugs had the highest risk for reporting unprotected sex. Illicit drug use is a type of deviant behavior, and previous research also reported that adolescents who have peers with deviant behaviors were more likely to engage in risky sexual behaviors themselves [19]. Consistent with peer cluster theory [31] and social learning theory [32], peers are likely to exert substantial influence on the beliefs, attitudes and behaviors of youths about what is appropriate sexual behavior. In particular, delinquent peers are more likely to engage in and promote maladaptive practices including risky sexual behavior, and youths who associate with such peer groups may be influenced or pressured into behaving similarly [6]. Meanwhile, illicit drug use may impair the ability and motivation to use condoms in sexual intercourse. Furthermore, interacting with peers who use illicit drugs may increase the risk of adolescents having unprotected sex with them.

This study found that adolescents who were older than 15 years of age were more likely to engage in unprotected sex. Developmentally, it is expected that older youths would have more opportunity and be more likely to spend time engaging in various behaviors, including risky sex [6]. This study also found that having been suspended from school had a discriminative effect on adolescent unprotected sex. Schools are in a unique position to provide a safety net, protecting adolescents from hazards that affect not only their learning, but also their development and psychological wellbeing [33]. During periods of suspension from school, adolescents might spend time with peers outside the campus, and may learn health-risk behaviors, including unprotected sex, from peers [32,34]. Meanwhile, suspension from school may have a negative impact on adolescents' self-esteem [35], which may increase the risk of unprotected sex in adolescents [10].

The results of the CHAID analysis in this study revealed that the adolescents who perceived low family monitoring were more likely to report unprotected sex, which is consistent with the results of previous studies [17,36,37]. Parental supervision may directly and indirectly influence the adolescent's likelihood of involving in risk behaviors by imposing limits or expectations on when, where and with whom the youth may recreate [38]. Although the level of family monitoring was not confirmed as a discriminative factor in the logistic regression analysis, considering the importance of parenting on the development of sexuality in the youths, parents should be included in interventions to reduce adolescent unprotected sex.

Except for the four discriminative factors for unprotected sex identified by the CHAID and logistic regression analyses, several factors were also found to be associated with unprotected sex using the logistic regression analysis models regarding age and peers using substances. For example, not living with parents was associated with unprotected sex only in adolescents who were younger than 15 years of age and had peers with substance use, but not in other groups. Taking these risk indicators into consideration will increase the accuracy of screening for adolescents with experience of unprotected sex among groups regarding age and peers using substances.

This is one of few studies that has examined the discriminative effects of multidimensional factors on unprotected sex in a large-scale population of adolescents. The selection bias is minimized by sampling the participants in a non-referred representative school-based sample. Meanwhile, two statistical methods (CHAID

analysis and logistic regression analysis) were conducted to examine the discriminative factors for unprotected sex and can reduce possible statistical errors. However, some limitations of this study should be addressed. First, the cross-sectional research design of this study limited our ability to draw conclusions regarding the causal relationships between unprotected sex and correlates. Second, the data were provided by the adolescents themselves, and the authenticity or validity of some data cannot be easily quantified. Third, this study recruited adolescent students as the research population; however, adolescents who had dropped out from school or who were students of night schools were not included in this study. Although the proportion of these is small, they may have different patterns of sexual behaviors and correlates compared with the adolescents recruited in this study. Thus, the rate of unprotected sex might be underreported.

Implications

This study found that multiple factors of demographic, family, peer and school life, including having friends who use illicit drugs, older age, having been suspended from school, and parental monitoring, had discriminative effects on unprotected sex in adolescents. Because of the adverse effects of unprotected sex in adolescents, we suggest that parents and health professionals should pay attention to adolescents with the discriminative factors for unprotected sex identified in this study.

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青少年未經防護性行為的多向度區辨因子研究

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由於青少年進行未經防護性行為將增加罹患性病和非計畫懷孕的危險，故調查能區辨出青少年是否進行未經防護性行為的因子是進行預防衛教的重要步驟。本研究的目的在於以大規模、具代表性的青少年族群，檢驗能區辨出青少年進行未經防護性行為的人口學、個人、家庭、同儕和學校因子為何。共有 9,736 位青少年學生參與本研究並完成研究問卷的填寫，青少年未經防護性行為的多向度區辨因子以 Chi-squared automatic interaction detection (CHAID) analysis 和 logistic regression analysis models 進行檢驗。CHAID 的結果發現：有朋友使用非法物質、年紀較大、曾休學、家庭監督性較低的青少年，有較高危險性會進行未經防護性行為，而 logistic regression analysis 的結果進一步確認這些因子的區辨效果。依據研究結果，建議家長和健康從業人員須注意具有這些區辨因子的青少年進行未經防護性行為的可能性。

關鍵詞：青少年，使用保險套，危險指標，安全性行為

(高雄醫誌 2009;25:193–202)