School Disadvantage and Sexual Debut in Malawi

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Introduction

Numerous studies in less developed countries have documented the determinants of early sexual intercourse among young people at the individual level (e.g., Clark, Poulin, and Kohler 2009; Lloyd 2005).Yet, the possible effects of a broader social context such as neighborhood and school have been ignored in past research. As access to education has improved, a growing number of young people in less developed countries appear to initiate their first sexual intercourse while enrolled in school (Biddlecom 2007; Biddlecom et al. 2008). Undoubtedly, schools are one of the most important ecological contexts that influence young people's norms, values, attitudes and beliefs regarding sexual initiation (Furstenberg and Morgan 1987; Lloyd 2007; Marteleto, Lam, and Ranchhod 2008). Despite the importance of school as a social context influencing adolescents, however, little effort has been made to examine the effects of socioeconomic characteristics of schools on premarital sexual activity in less developed countries.

In less developed countries, lack of adequate data has hampered the examination of the link between school-level factors and individual-level outcomes. This study uses two waves of data from a large-scale school-based survey in Malawi to examine whether school disadvantage, is associated with students' sexual debut in a less developed country setting. Employing multilevel modeling, I estimate the relationships between the exposure to school disadvantage at Wave I of the survey and students' likelihood of initiating sexual intercourse by Wave II. Given that social environments or contexts are often assumed to influence adolescents indirectly through more proximal individual behaviors (Leventhal and Brooks-Gunn 2000; Roosa and Deng 2005), I also investigate the mechanisms by which school disadvantage might impact students' sexual debut. Based on the relevant theoretical frameworks largely borrowed from neighborhood studies and numerous empirical findings (Jencks and Mayer 1990; Leventhal and Brooks-Gunn 2000; Wilson 1987), the potential mechanisms of school advantage are thoroughly tested. The potential mediating mechanisms tested in this study include school satisfaction, grade repetition, academic effort, martial aspirations, labor participation, and peer influences. I further explore how specific characteristics of school-level socioeconomic status are associated with the risk of students' sexual debut.

Data and Setting

This study uses two waves of data collected in 2011 through 2013 by a research project of Daeyang Luke Hospital (DLH) of Malawi, in partnership with Korea International Cooperation Agency (KOICA) and Africa Future Foundation. The main objectives of the project were to examine the combined effects of various HIV/AIDS prevention interventions including HIV/AIDS education, male circumcision, and cash transfer. The target population of the baseline survey was all students who were enrolled in thirty-three public secondary schools in major traditional authorities (TA) within Lilongwe District: Chimutu, Chitukula, Kalumba, and

Tsabango. The four TAs cover almost all urban and sub-urban Lilongwe District. These TAs were chosen as target areas for the project because they are the catchment area of DLH. As of 2005, the estimated number of secondary schools in Malawi is 978 where 183,854 students (about 17% of the age cohort) are enrolled. Secondary school education in Malawi is offered mainly through three types of schools (i.e. conventional secondary schools (CSSs), community day secondary schools (CDSSs), and private secondary schools. CSSs are universally favored because they are run by the government and provide better quality education although most of Malawian students attend community-run CDSSs. The project excludes the private secondary schools because the quality and characteristics of private secondary schools significantly varies depending on funders.

The baseline survey consists of two sets of questionnaires: 1) an in-class self-report survey and 2) a private interview with HIV Voluntary Counseling and Testing (VCT). In the first part, students completed the questionnaires about basic demographics, household assets, health, labor market participation, school performance, time/risk preference, HIV-related knowledge and behaviors, attitudes towards HIV/AIDS, and friend networks. After the in-class survey, each student was interviewed about sexual experiences by a same-sex enumerator in a confidential manner. In total, 7,968 secondary school students from Form 1 to Form 3 (equivalent to grade 9 through grade 11 in the U.S. education system) ended up participating in the baseline survey (Wave I), reaching approximately 85% participation rate. Those whose marital status is not "Never married" at the time of survey were also excluded (25 respondents including 7 respondents with missing values) because sexual activity for those who have ever cohabited or married or are currently married is universally accepted and expected. At Wave II, 5,068 students were successfully followed up, reaching 64% follow-up rate. In order to reduce sample attrition bias, 431 students or 15% of students lost to follow up (2,875 students) were randomly sampled to track and interview. 267 students (62%) were successfully located and tracked, such that these students are given a weight of 6.67 (i.e., 2,875/267) because they are a group of sub-sample representing 2,875 students who were lost to follow up. In order to understand the effect of the school environment on students' sexual activity, this analysis was confined to the students who had not engaged in sexual activity by the time of the baseline survey (this excludes 653 respondents, or 12.3%). 336 students (6.3% of cases) who provided inconsistent information about their sexual debut and 12 students who have missing values on sexual debut were also dropped. I further excluded students who were missing information on independent variables (53, or 1.2% of cases). So, the final sample size for this study is 4,278 students attending 33 public secondary schools in Malawi.

Variables

This study uses sexual debut as a main outcome variable. Students in both Wave I and II surveys were asked at which age they had sexual intercourse for the very first time. The variable of sexual debut was coded as 1 if students who had not been sexually experienced until Wave I began to have sex at Wave II. Socioeconomic status of neighborhood or school has been conceptualized and operationalized in many different ways. School effects studies have often used the aggregated measure of proportion of students who are eligible for free or reduced meals as a proxy for school-level SES (Bevans et al. 2007; Bradshaw, Sawyer, and O'Brennan 2009; Henry and Slater 2007; Henry, Stanley, and Edwards 2009; Kirk 2009; Koth, Bradshaw, and Leaf 2008). On the other hand, some neighborhood literatures construct a composite measure of

multiple items related to socioeconomic status of the residents (Ainsworth 2002; Baumer and South 2001; Snedker, Herting, and Walton 2009; South and Baumer 2000; South and Crowder 1999). Drawing on a combination of these ways of operationalizing cluster-level disadvantage, I measure school disadvantage by a standardized index comprised of five items: (a) the percentage of students from female-headed households, (b) the percentage of students whose father has no job, (c) the percentage of families that belong to bottom 10 percentile in terms of wealth index, (d) the percentage of students whose parent completed secondary school or more (reverse scored), and (e) the percentage of students whose father belongs to the occupation category of "professional/managerial" or "government officer" (reverse scored). The internal consistency reliability for these five items, measured by a Cronbach's alpha (0.80) is high.

In the mediation analysis, the six selected potential mechanisms of the effects of school disadvantage will be tested. First, school satisfaction is measured by averaging respondents' responses (1=Very Dissatisfied, 2=Dissatisfied, 3=So-so, 4=Satisfied, and 5=Very Satisfied) to the five questions (Cronbach's alpha=0.74): ''How satisfied are you with classroom facilities (desks & chairs, blackboard, classroom)?'', ''How satisfied are you with school facilities (toilet, hand washing, playground)?'', "How satisfied are you with teacher quality?", and "How satisfied are you with your school overall?" Second, to measure students' academic efforts, students were asked how frequently they study after class either at home or school. The choices are given as follows: 1=No, not at all, 2=Rarely, less than once a month, 3=One or two times a month, 4=About once a week, 5=Two or three times a week, and 6=Four times or more a week. Students who study more than two times a week were coded 1; all others were coded 0. Third, a measure of marital aspirations was created by subtracting a student's current age from his or her ideal age at marriage (Clark et al. 2009). Sixteen years or more in marital aspirations were truncated to be coded 15. Fourth, grade repetition was measured from the question "Have you ever repeated a grade when you were in secondary school?" Students who reported no repetition since secondary school were coded as 0. Students who have repeated once were coded as 1, and more than twice as 2. Fifth, labor participation was coded 1 if students reported that they engaged in any income generating activity/work in the last 30 days. Lastly, a measure of peer influences was constructed by summing the total number of nominated best friends who reported having ever had sex. During the private survey, students were asked to nominate three best friends (regardless of sex) from the school rosters, and then using uniquely assigned identification numbers a respondent's data were matched with his or her best friends' survey data.

Methodology and Analytical Model

In this study, multilevel modeling is employed with hierarchical structure of the data to predict student's sexual activity. Since the outcome variable is dichotomous, the two-level logistic regression model is used where the intercept varies across schools. This multilevel modeling approach is based on the assumption that each school is responsible for a part of variations in students' sexual activity. I adopt both grand mean and group mean centering methods in the present study, following Enders and Tofighi's recommendation that both grand mean and group mean centering methods are encouraged to be used even in a single study so as to address different substantive research questions (Enders and Tofighi 2007; Raudenbush and Bryk 2002). In the mediation analysis, I employ Karlson, Holm, and Breen's procedure to decompose the differences in the coefficient of interest across models into the percent attributable to confounding/mediating and rescaling (Karlson, Holm, and Breen 2012). This analysis offers an

understanding of how much these mediating factors explain the relationship between school disadvantage and students' sexual debut. In addition to a composite measure of school disadvantage, I also specify various aspects of school disadvantage to examine which aspects are meaningfully contribute to the effects of school disadvantage on sexual activity.

Preliminary Findings

The intra-class correlation is known as less informative when using the nonlinear link functions like logit link in this study because the level-1 variance is heteroscedastic (Raudenbush and Bryk 2002). Yet, assuming the level-1 random effect has a standard logistic distribution with a mean of 0 and variance$\pi^2/3$, the intra-class correlation is 0.073, indicating that approximately 7.3% of variance in students' sexual debut lies between schools. Table 1 presents the results from the multilevel logistic regression designed to examine the impact of the explanatory and control variables on the risk of initiating sexual intercourse. As seen in all models, only gender, age, and age-squared are statistically significantly associated with the risk of sexual debut. It appears whether that higher household-level socioeconomic characteristics are protective in students' sexual debut in Malawi (Bärnighausen et al. 2007; Dinkelman, Lam, and Leibbrandt 2007; Dodoo, Zulu, and Ezeh 2007; Mishra et al. 2007). Model 1 presents the bivariate coefficients describing the relationship between each of the explanatory variables and sexual debut. Form 3 students are more likely to have sex than Form 1 students. Living with both parents and having wealthier families are associated with decrease in the risk of sexual debut. Of the six potentially mediating factors, two are statistically significantly associated with the risk of sexual debut. Students who are eager to marry later are significantly less likely to initiate sexual activity. And having one more sexually experienced best friends is associated with a 43% increase (i.e., 1.43=exp(.375)) in the probability of sexual debut.

(Table 1 here)

The coefficients for two mediating variables which were statistically significant in the bivariate analysis remain statistical significant even after controlling for a set of individual- and family-level control variables (Model 4 and 7). Consistent with prior findings that marital aspirations are closely connected to one's desirability for sexual activity and types of potential sexual partners (Clark et al. 2009; Rani, Figueroa, and Ainsle 2003), Model 4 suggests that the longer the desired time until marriage, the less likely he or she is to initiate sexual activity. For example, having five year longer desired time until marriage decreases the odds of having sex by almost 26% ($1/\exp(-0.047)^5$). Model 7 demonstrates that for having one more best friend who is sexually experienced, the odds of a respondent's having sexual activity are expected to increase by a factor of 1.23 (exp(0.204)), holding all other variables constant. Model 8 presents the full model estimates where the magnitude of coefficient and statistical significance for marital aspirations and peer influences remain almost the same as in the individual models, suggesting that these variables operate independently to some degree despite the fact that theoretically they are inter-connected.

Table 2 presents the results from random intercept logistic regression where the effect of school disadvantage on sexual debut and potential mediation processes are thoroughly examined, simultaneously controlling for individual- and school-level factors. In this analysis, our focus is to examine whether school disadvantage holds the impact on students' sexual activity after controlling for key variables at both individual and school level, and explore whether the effects

of school disadvantage are mediated by controlling sequentially for potentially mediating variables. It should be noted that the coefficients of level-1 variables in this analysis are not clearly interpretable because the coefficients of grand mean centered level-1 variables are a mixture of the within- and between-cluster association between independent and dependent variable (Enders and Tofighi 2007; Raudenbush and Bryk 2002). Thus I intentionally focus on interpreting the coefficient of level-2 variables, particularly school disadvantage.

(Table 2 here)

Model 1 shows that accounting only for level-2 control variables, neighborhood disadvantage is strongly associated with students' risk of sexual debut. Model 2 suggests that school disadvantage is associated with an increased likelihood of students' engaging in sexual activity, even accounting for an extensive set of important control variables at both individual- and school-level. In Model 3-8, I examine the mechanisms of school disadvantage to test whether and how much sequentially adding each potentially mediating variable reduces the coefficient of school disadvantage. Although in OLS regression it is common to examine the change in the coefficients of a given variable across differently specified models to confirm mediation effects of a variable, however, in logistic regressions the change in the coefficient is not necessarily due to inclusion of additional variables. Because in logistic regressions the variance of the underlying latent variable and the error distribution are different across models, the change may be attributable to rescaling as well as confounding. Thus I employ Karlson, Holm, and Breen's procedure to decompose the differences in the coefficient of interest across models into the percent attributable to confounding and rescaling (Karlson et al. 2012). The results show that the inclusion of marital aspirations variable change the coefficient for school disadvantage by 13.39%, and this change is statistically significant at 95% confidence level (Model 3). This finding suggests that marital aspirations play a mediating role in linking school disadvantage and students' sexual debut. Model 4 shows that the addition of peer influences also statistically significantly reduces the coefficient for school disadvantage by 7.09%. This finding provides limited evidence that the relationship between school disadvantage and sexual debut is mediated by influences of peers who have experienced sexual activity. Adding both marital aspirations and peer influences variables in Model 5 reduces the school disadvantage coefficient by 21.62%. Yet, the fact that the coefficients for school disadvantage remain statistically significant even after the key potential mediating variables being accounted for suggest the possibility that other important mediating variables are missing in this analysis. In sum, this mediation analysis offers evidence that marital aspirations and peer influences explain a modest of amount of the observed impact of school disadvantage on students' sexual debut.

(Table 3 here)

I further explore how specific characteristics of school-level socioeconomic status are associated with the risk of students' sexual debut. In Table 3, the effects of each characteristics of school disadvantage are also examined by specifying the same model as in Table 2, yet with replacing school disadvantage variable with these specific characteristics. The results reveal that even after controlling for individual-level responses as well as a set of control variables at both level 1 and level 2, many socioeconomic characteristics of schools considerably influence students' decision to initiate sexual activity. Model 1 and 2 shows that high rate of female-headed households do not appear to affect students' sexual onset while the proportion of single-headed households does. Model 3 through 5 suggest that school-level parental education is associated with the risk

of sexual debut while educational attainment of students' own parents is not. High concentration of educated parents seems to play a positive role in keeping students from engaging in sexual activity. Model 6 and 9 suggest that school-level wealth and poverty are associated with the risk of sexual debut. Of the four aspects of economic characteristics of schools, the proportion of richest 10 percent appears to have the strongest impact (Model 8). Model 10 and 11 show that the proportion of fathers who have a decent job (i.e., managerial and professional occupations) is also strongly associated with students' sexual debut while the coefficient for the proportion of unemployed fathers is not statistically significant. It is worth noting that in all models no individual-level socioeconomic disadvantage is found to be associated with the risk of sexual debut while many aspects of school-level socioeconomic characteristics tend to affect the risk. Interestingly enough, these findings from the analysis suggest that students' sexual debut tends to be influenced more by socioeconomic disadvantage at the school level, rather than at the family level.

Summary

Despite the importance of schools as a context that influences students' attitudes and behaviors, little is known, particularly in less developed countries, the effects of socioeconomic characteristics of schools on students' sexual debut. Using two waves of data from a large-scale school-based survey in Malawi, this study focuses on examining whether attending socioeconomically disadvantaged schools is associated with sexual debut, and how this school disadvantage shapes students' sexual activity. The present study advances our understanding of the relationship between school context and adolescents' premarital sexual activity in less developed countries. Rich information from the data used on potentially mediating factors linking school disadvantage and sexual debut enables a thorough examination of the underlying mechanism of school disadvantage. Moreover, the fact that the mediation analysis in this study is rigorously based on the theoretical frameworks of neighborhood studies is one of the strengths of this study. This study has two main findings.

First, this study suggests that school disadvantage, measured by an index based on family disruption, parental educational attainment, household-level wealth, and father's occupational status, is associated with the probability of students' initiating premarital sexual activity, even controlling for an extensive set of important control variables at both individual- and school-level. More specifically, all of the aggregated indicators of parental educational attainment and household-level wealth and poverty are statistically significantly associated with the risk of sexual debut. And yet, not all variables of family disruption and fathers' occupational status are associated with the risk of sexual debut. It is found that the proportions of single-headed households and fathers' holding a decent job predict students' sexual debut while the proportions of female-headed households and unemployed fathers are not associated with the probability of students' initiating sexual intercourse. These two statistically insignificant variables are the least correlated with school disadvantage index and other statistically significant school-level socioeconomic variables. These findings enhance our understanding of which socioeconomic characteristics may be harmful and which may be not in terms of the risk of students' sexual debut. Furthermore, interestingly enough, this study suggest that students' sexual debut appears to be influenced more by the aggregated-level socioeconomic disadvantage than individual-level socioeconomic disadvantage. It may be due to selection because only students who have not engaged in sexual activity until Wave I (or grade 1 in secondary school) were included in the

analysis. Perhaps, students who started their first sex during the primary school are different from those who did not.

Second, this study provides comprehensive tests for the potentially mediating factors at the individual level that might explain the relationship between school disadvantage and sexual debut. As a result, this study contributes to our understanding of the mechanism by which school disadvantage shapes students' sexual activity. Although due to the constraints of available data some important potential variables such as parental social networks and monitoring are missing, the mediation analysis does offer some useful insights on the mechanism of school disadvantage. The study finds that approximately one quarter of the impact of school disadvantage on sexual activity is attributable to marital aspirations and peer influences. A combination of collective socialization and contagion models from neighborhood studies sheds some light on these relationships. Attending disadvantaged schools lacking role models may increase students' marital aspirations, which in turn heighten the risk of sexual debut. In addition, disadvantaged schools may increase the risk of sexual debut through a higher density of sexually experienced peers. It is likely that problem behaviors are contagious at much faster rate in disadvantaged schools. Having more sexually experienced best friends might lead to increased risk of engaging in sexual activity. Though not tested in this study, lack of monitoring system and ineffective social ties among parents, teachers and community might also contribute to the increased risk. Further research might investigate whether effective parental monitoring or strong ties between parents and school moderates the effect of attending disadvantaged schools.

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Appendix

Table 1. Coefficients for Multilevel Logistic Regression of Sexual Debut

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Individual-level variables								
Age		2.487***	2.492***	2.445***	2.475***	2.489***	2.457***	2.431***
Age squared		-0.066***	-0.066***	-0.066***	-0.066***	-0.066***	-0.065***	-0.066***
Girl		-0.549***	-0.526***	-0.604***	-0.535***	-0.535***	-0.469***	-0.569***
Ethnicity (ref: Yao)								
Chewas	0.165	0.075	0.044	0.049	0.043	0.039	0.015	0.067
Tumbukas	0.306	0.417	0.404	0.389	0.401	0.406	0.395	0.391
Ngoni	0.270	0.281	0.251	0.250	0.257	0.248	0.244	0.282
Others	0.181	0.280	0.262	0.271	0.268	0.260	0.235	0.271
Form (ref: Form 1)								
Form 2	0.219	-0.045	-0.045	-0.059	-0.061	-0.056	-0.075	-0.076
Form 3	0.485**	0.019	-0.026	-0.038	-0.044	-0.031	-0.057	-0.035
Parent's highest education (ref: Secondary Completed)								
No Education	0.414	-0.182	-0.212	-0.190	-0.207	-0.212	-0.234	-0.175
Some Primary	0.293	-0.195	-0.176	-0.191	-0.177	-0.176	-0.174	-0.204
Primary Completed	0.414*	-0.300	-0.292	-0.293	-0.298	-0.301	-0.293	-0.285
College or Higher	-0.255	-0.459	-0.430	-0.428	-0.435	-0.439	-0.442	-0.445
N/A	-0.158	-0.517	-0.497	-0.500	-0.494	-0.497	-0.491	-0.522
Living with both parents	-0.260*	-0.142	-0.147	-0.146	-0.145	-0.145	-0.141	-0.150
Household wealth (ref: Low)								
Low-Middle	-0.148	-0.015	0.007	-0.003	0.006	0.001	0.012	-0.013
High-Middle	-0.261	-0.008	0.005	-0.007	0.003	-0.010	-0.005	-0.025
High	-0.537*	-0.221	-0.198	-0.198	-0.202	-0.217	-0.210	-0.234
Mediating variables								
School satisfaction index	0.097	0.160						0.153
Academic effort	-0.138		-0.092					-0.081
Marital aspirations	-0.071***			-0.047*				-0.046*
Grade repetition (ref: Never)								
Once	0.424				0.155			0.151
More than twice	-0.205				-0.531			-0.609
Labor participation	0.267					-0.051		-0.042
No. of sexually experienced best friends	0.375***						0.204*	0.202*
Constant		-1.737***	-1.728***	-1.734***	-1.731***	-1.730***	-1.721***	-1.737***
N (schools)		33	33	33	33	33	33	33
N (students)		4278	4278	4278	4278	4278	4278	4278
Log-likelihood		-2178.857	-2184.159	-2177.243	-2183.141	-2184.469	-2179.415	-2164.704

Note: Level-1 variables were group mean centered; Level-2 variables were grand mean centered
*p<.05; **p<.01; ***p<.001

Table 2. Coefficients for Multilevel Logistic Regression of Sexual Debut on Level 1 and Level 2 Variables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
School-level variables						
School size	-0.000	0.000	0.000	0.000	0.000	0.000
Rurality	0.007	-0.069	-0.111	-0.079	-0.122	-0.110
Conventional Secondary School	-0.248	-0.292	-0.270	-0.277	-0.255	-0.334
School disadvantage	0.098***	0.072*	0.068*	0.069*	0.065*	0.069*
Mediating variables						
School satisfaction index						0.140
Academic effort						-0.088
Marital aspirations			-0.049*		-0.049*	-0.047*
Grade repetition (ref: Never)						
Once						0.174
More than twice						-0.593
Labor participation						-0.034
No. of sexually experienced best friends				0.221*	0.221*	0.220*
Constant	-1.670***	-1.787***	-1.792***	-1.777***	-1.782***	-1.793***
Difference in coefficient (school disadvantage)			0.0092*	0.0049*	0.014**	
Percent of change due to mediation			13.39	7.09	21.62	
N (schools)	33	33	33	33	33	33
N (students)	4278	4278	4278	4278	4278	4278
Log-likelihood	-2322.476	-2171.894	-2164.024	-2165.694	-2157.839	-2151.029

Note: Level-1 and level-2 variables are grand mean centered.
Model 2-6 control for gender, age, age squared, ethnicity, grade, parent's highest education, wealth index (quartile).
*p<.05; **p<.01; ***p<.001

Table 3. Coefficients for Multilevel Logistic Regression of Sexual Debut on Multiple Characteristics of School Disadvantage

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Variables	female-headed household	single-parent household	mother's education	father's education	parent's highest education	lowest 10% wealth index	lowest 20% wealth index	highest 10% wealth index	highest 20% wealth index	father has a decent job	father has no job
School-level (aggregated)	3.660	5.306*	-1.794*	-2.195**	-1.779**	1.958*	1.313**	-3.795**	-1.931**	-3.033*	4.721
	(2.749)	(2.600)	(0.845)	(0.802)	(0.688)	(0.781)	(0.421)	(1.173)	(0.728)	(1.438)	(3.599)
Individual-level	-0.114	-0.101	-0.070	-0.176	-0.166	0.241	-0.084	-0.459	-0.330	-0.172	-0.050
	(0.159)	(0.165)	(0.226)	(0.149)	(0.176)	(0.237)	(0.195)	(0.247)	(0.278)	(0.195)	(0.298)
N (schools)	33	33	33	33	33	33	33	33	33	33	33
N (students)	4278	4278	4274	4274	4278	4278	4278	4278	4278	4273	4273
Log-likelihood	-2175.478	-2174.002	-2178.986	-2176.596	-2177.792	-2173.196	-2174.173	-2169.313	-2169.303	-2169.272	-2173.523

Note: Logit coefficients with standard errors in parentheses
All models include a set of control variables such as gender, age, age squared, ethnicity, grade, parent's highest education, wealth index (quartile), rurality, school type, school size.
Model 3-5: It is coded 1 if a parent completed secondary school or higher.
Level-1 and level-2 variables were grand mean centered
*p<.05; **p<.01; ***p<.001