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Relationship between unsupervised time and participation in an emotion regulation intervention and risk outcomes

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Abstract

Objective—This study is a secondary analysis of outcomes examining sex and substance use risk behavior in the context of the naturalistic occurrence of parental monitoring and participation in an emotion regulation intervention over a 12-month period.

Method—Early adolescents with mental health symptoms (N=420), ages 12–14 years, were recruited, enrolled, and randomized into either an Emotional Regulation (ER) or Health Promotion (HP) control condition. Assessments included adolescent self-report of unsupervised time, substance use and sexual behavior at baseline, 6-months, and one year post intervention. Analytic groups were formed by intervention condition (ER or HP) and baseline reports of unsupervised time (1X per week or >1X per week of unsupervised time with opposite sex peers) resulting in a total of four groups. Logistic regression and time-to-event analyses were used to test differences in substance use and delay of sexual initiation between the groups.

Results—Participation in an emotional regulation intervention in the presence of low unsupervised time was superior in reducing both substance use and sexual initiation than either factor alone; and either factor alone was more effective than the absence of both.

Conclusion—Findings suggest that interventions targeting health risk behaviors, including substance use and sexual risk behavior, among early adolescents with mental health symptoms may be more effective when targeting both internal (e.g., emotional regulation) and external (e.g., unsupervised time spent with peers) protective factors. Limiting unsupervised time spent with peers through parental monitoring may serve to scaffold and reinforce early adolescent acquisition of effective emotion regulation which can be employed during emotionally arousing risk situations.

Early adolescent experimentation with both substances and initiation of sexual activity are associated with marked risk outcomes. Those who have sex in early adolescence continue to exhibit greater sexual risk (more sexual partners, less condom use) than their peers as they

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grow older,¹ resulting in more unintended pregnancies² and STIs³. Substance use and abuse during adolescence is predictive of early mortality⁴ and problematic use in early adulthood, particularly among those who initiate substance use before age 13⁵. Notably, among youth with elevated mental health symptoms these rates of risk behavior are even greater⁶. In fact, a large scale study of youth in psychiatric care revealed that adolescents meeting criteria for Mania, externalizing disorder (Oppositional Defiant, Conduct, and Attention Deficit Hyperactivity Disorders) or comorbid internalizing (Major Depressive, Generalized Anxiety, and Post-Traumatic Stress Disorders) and externalizing disorders were significantly more likely to report a lifetime history of vaginal or anal sex. Those with mania symptoms were significantly more likely to have two or more partners in the past 90 days and test positive for a STI⁷. Therefore, the prevention and/or reduction of risk behavior among early adolescents with mental health concerns is key to disrupting the long term trajectory of risk.

Several individual and familial factors have been linked to higher risk among adolescents with mental health concerns. One such individual level factor is emotion regulation or the set of processes used to manage feelings and their expression to achieve goals⁸. Early adolescents' performances on tasks of emotion recognition tend to be particularly poor, and this poor performance has been linked to high activation of the amygdala and low activation of the frontal lobes⁹. Performance improves as adolescents age, when their frontal lobes become more active in processing¹⁰. These findings indicate that while emotional centers in the brain are highly activated, areas of self-regulation and impulse control are under activated. These difficulties in emotion processing are thought to impact early adolescents' ability to recognize and regulate these emotions in emotion-laden situations. Indeed, poor emotion regulation has been linked to greater frequency of substance use¹¹ and engagement in sexual risk behaviors¹², due to impairment in adolescents' ability to access risk reduction strategies such as refusing substances or condom negotiation with a partner¹³. For early adolescents with mental health problems, this pattern can be even more problematic¹⁴.

Familial factors have also been shown to influence adolescent engagement in risk behavior. Specifically, parental monitoring has consistently been shown to decrease the likelihood of adolescent sexual and substance use risk taking behaviors. Parental monitoring is comprised of several components including parental solicitation, adolescent disclosure of information, direct supervision of time spent with peers, and limit setting with consequences¹⁵. Among early adolescents (ages 11–14), parental monitoring has been found to be one of the strongest and most consistent factors preventing adolescent substance use and promoting the delay of sexual initiation^{16–18}. Previous reviews of risk prevention interventions have highlighted parental monitoring as a necessary component to include in adolescent risk prevention programs¹⁹.

Further complicating the role of emotion regulation, parental monitoring, and risk behavior can be the background presence of mental health problems. In addition to the greater levels of sexual risk noted earlier, the presence of mental health disorders is associated with early onset substance use behavior²⁰. Prior longitudinal studies demonstrate that mental health disorders precede the onset of substance use disorders for the majority of youth²¹ and that mental health disorders in early adolescence are predictive of greater alcohol use across adolescence²². Importantly, the family environment, including the presence of parental

monitoring, has been shown to impact the influence of dysregulation on the development of mental health problems and substance use disorders²⁰. For these reasons, understanding whether emotion regulation and family factors combine to protect early adolescents with mental health symptoms may be key to developing effective interventions to reduce this risk and preventing subsequent negative outcomes in adolescence and adulthood.

The purpose of the current study was to examine whether participation in an emotion regulation intervention and the presence of parental monitoring combine to protect youth with mental health problems from engaging in substance use and sexual risk behaviors longitudinally. These data come from a cohort of middle school youth with mental health problems participating in a large scale sexual risk prevention trial that compared an emotion regulation intervention (ER) to a health promotion control condition (HP) using a counterbalanced within school design. Prior examination of study outcomes (blind cite) indicated that the ER condition delayed sexual initiation one year after adolescents had participated in the intervention relative to those in the HP condition (Adjusted Hazard Ratio = 0.58, 95% CI: 0.36 to 0.94, $p = .01$). Furthermore, a significant difference between conditions was observed on a behavioral measure of emotion recognition at the 6-month follow-up (unstandardized estimate [b] = 2.91, CI = .29 to 5.52), with the ER condition outperforming the HP condition. Despite impacting emotional competence generally and delay of sexual initiation specifically, the ER condition did not significantly impact adolescent substance use behavior.

Based on these data and prior literature demonstrating the importance of impacting multiple domains, we chose to examine whether the combined influence of baseline levels of unsupervised time spent with opposite gender peers (a proxy for parental monitoring) and participation in an emotion regulation intervention impacted adolescent substance use and sexual risk behavior. The small-group intervention delivered to adolescents did not address familial factors, but participants were asked about the amount of unsupervised time they spent with opposite gender peers, an important component of parental monitoring. Using this information about unsupervised time, we used causal modeling approaches (i.e., inverse probability of treatment weighting) to approximate the design of a 4-arm randomized trial²³. We chose to examine both delay of sexual initiation and cumulative substance use for purposes of consistency with the original study aims (see blinded cite). We hypothesized that lower levels of unsupervised time at baseline and participation in the ER condition would be associated with the lowest levels of risk behaviors (greater delay in sexual initiation and lower cumulative substance use) through the 12-month follow-up assessment. We also hypothesized that higher levels of unsupervised time at baseline and participation in the HP condition would show the highest levels of risk behaviors and that the other two groups (low unsupervised time and HP, high unsupervised time and ER) would fall between these two extremes.

METHODS

Participants

Four hundred twenty seventh grade adolescents were recruited from five urban public schools in the Northeast between September 2009 and February 2012 for participation in

randomized control trial examining the impact of an emotion regulation intervention on delaying sexual initiation. Adolescents were eligible if they were in 7th grade, aged 12–14 years, spoke English, and were identified by school personnel (e.g., counselors, administrators, nurses) using a symptom checklist that was used to make counseling referrals. Students who were known to have a history of being sexually aggressive, be HIV-infected, have developmental delays, be currently pregnant, or have a sibling who had previously participated in the program were excluded.

See Figure 1 for participant retention in the study. Of the 1,283 students attending seventh grade across the five schools each of the three study years (3,849 students), 27% of students were referred to the study after identification by school staff as having significant mental health symptoms (e.g., hyperactivity, withdrawing, erratic behavior/mood swings, or disruptive behavior). Of those referred, 53% were able to be contacted (n=556); 10% of these students were ineligible (n=58). Of the remaining eligible families, 84% were enrolled (n=420). Fifteen participants did not provide data regarding unsupervised time at baseline and were therefore not included in the present analyses, resulting in a sample of 405 adolescents.

Interventions

Adolescents participated in either an Emotion Regulation (ER) or Health Promotion (HP) intervention condition; both were developed and piloted using focus groups with early adolescents during a pilot study (R34 MH078750). Each manualized intervention consisted of twelve, twice-weekly, hour-long sessions, run in single-gender groups of 4 to 8 adolescents. Booster sessions reviewing the content of the intervention were offered at 6 and 12 months after baseline. Delivered in schools after the school day, groups were led by male-female pairs that included a mental health clinician (or clinician in training) and a research assistant. The interventions used games, videos, group discussions, and workbook activities to personalize information learned. Both ER and HP used the same activities about sexual development and safer sexual practices except that activities in the ER condition with an emotion regulation component were modified for the HP condition to eliminate discussion of emotions.

To reduce contamination, schools participated in one condition each school year. Participating schools were organized by grade level, thus 7th graders generally had limited contact with 8th graders. The five schools were randomly assigned to an order of conditions over two school years (i.e., ER in Year 1, HP in Year 2 or HP in Year 1, ER in Year 2); schools were re-randomized for the third year of recruitment. Thus, all schools participated in both interventions to avoid nesting intervention condition within school environments.

To ensure intervention fidelity, a treatment manual and annual facilitator trainings were used. Senior project staff observed 15% of sessions throughout the project to provide recommendations for improving group process and determine whether facilitators completed each section of the manual in the manner intended. These ratings indicated excellent (97%) adherence.

The Emotion regulation intervention is consistent with Gross' process model⁸. The process model identifies five families of emotion regulation strategies: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. Via these strategies, individuals can target emotion management at various points in the process of emotional experience (e.g., attending to a stimulus, appraising a stimulus). The intervention aimed to enhance ER skills to reduce poor decision making that can lead to early initiation of sex or other health risk behaviors, such as substance use. The first half of the program presented the relationship between emotions and behaviors as well as emotion education, such as identifying emotional arousal in oneself through somatic cues, labeling these feelings, and recognizing their sources ("triggers"). The second half of the program taught developmentally appropriate strategies for regulating emotions during moments of decision making. The program presented connections between emotion regulation and peer relationships, media representations, and substance use. Adolescents also received sexual health education, including information about anatomy, sexually transmitted infections (including HIV), and disease/pregnancy prevention (abstinence, condoms, non-penetrative sexual behaviors).

The Health promotion intervention (HP) aimed to encourage healthy decision making through information on a breadth of topics. This intervention was not explicitly rooted in a theoretical model but was modeled off of the structure of many public school health education curricula that emphasize information to reduce risk. The HP intervention included topics such as drug and alcohol use, internet safety, violence, nutrition, exercise, sleep, and cigarette smoking. The sexual health content of the ER intervention was also included, with modifications to eliminate discussion of emotions related to decision making.

All procedures were approved by the Institutional Review Board at the study site.

Data Collection and Measures

The current study used data from assessments completed at baseline, post-intervention (~2 months), 6 months post-baseline, and 12 months post-baseline. The post-intervention assessment was abbreviated and did not include questions about substance use. To ensure privacy, minimize bias in self-reports of potentially sensitive behaviors, and allow for programming that skipped items that did not apply (e.g., frequency of sexual activity for adolescents who reported no partnered sexual behavior), participants completed questionnaires via audio-assisted computer self-interview (ACASI) on a laptop computer. Adolescents completed ACASI separately from parents, after school, in small groups, using headphones with adequate spacing from other teens to ensure privacy. Adolescents were compensated for their time completing assessments.

Demographics—For purposes of identifying the sample, adolescents reported their age, race, and ethnicity, whereas parents provided information on household income.

Unsupervised Time—Adolescents reported how often they were with peers in situations without adult supervision with the following question: "About how many times have you been with a group of boys and girls in places with no grown-ups around (for example, in a room with the door closed or outside) in the last six months?"²⁴. Participants were grouped

into two categories: those who reported unsupervised time about once a week or less (“1X per week”) and those who reported unsupervised time more than once a week (“> 1X per week”). Only data from the baseline assessment were used to form analytic groupings.

Delay of sexual initiation—Questions related to sexual activity were prefaced with the following: “When we ask about sexual experiences, we are asking about experiences that were NOT abuse.” To assess time to first sexual encounter, participants were asked at each assessment whether they had ever engaged in oral, vaginal, or anal sex. Those responding yes were asked more detailed questions about their sexual behavior in the last 6 months, including whether they had had vaginal sex for the first time. Adolescents who reported that their first vaginal sex had occurred in the previous 6 months were also asked in which of the past 6 months their first time had occurred. These questions were asked at baseline, 6-months, and 12-months. Adolescents were also asked about transitioning into sexual activity immediately following the intervention (~2 months from baseline). Data were summed across these assessment intervals to categorize those who had and had not initiated sexual intercourse over the 12-month period.

Cumulative substance use—Substance use was assessed via four items that measured the occurrence of alcohol, marijuana, inhalants, and “other drug” use in the past 6-months, each separately. These items were then summed and dichotomized into whether participants had used any substance in the past 6 months (yes/no) for each assessment point. Cumulative substance use was defined by adolescent reports of any substance use at 6- or 12-month assessment..

Data Analysis

Defining “Treatment” Groups—For purposes of the current study, 4 groups were formed by crossing intervention condition (ER or HP) and baseline reports of unsupervised time (1X per week or >1X per week). Groups consisted of those who received the ER intervention and reported low unsupervised time (1X per week; ER_{LUT}), those who had received the ER intervention with high unsupervised time (>1X per week; ER_{HUT}), those randomized to HP with low levels of baseline unsupervised time (HP_{LUT}), and finally those in HP with high unsupervised time (HP_{HUT}).

Causal Modeling Approach—Propensity score methods were used to reduce selection bias and approximate a 4-arm randomized design. Specifically, stabilized inverse probability of treatment weights were generated using a multinomial logistic model that included demographics, school, and baseline characteristics (i.e., sexual initiation and substance use). These weights were used for all analyses. Using propensity scores to approximate causal inference requires four assumptions. Consistency (within each group the dose and type of treatment is identical for all members of the group), exchangeability (there are no unmeasured third variables that influence both treatment assignment and the outcome), positivity (it is hypothetically possible for participants to be randomized to each group and a sufficient number have been assigned to each group), and correct specification of the propensity score model²³. When these four assumptions are met, it has been demonstrated that propensity score methods generate estimates consistent with a fully randomized design.

Nesting within Schools & Missing Data—Retention is shown in Figure 1. For baseline characteristics, there were complete data for all but participant race (16% missing) and household income (18% missing). Rates of missing data were 11% at 6-months and 14% at 12 months for sexual initiation and 8% and 12% respectively for substance use. Participants who missed tended to be older than those with complete data ($F(1,417) = 7.98, p < .01$), with no other differences on baseline characteristics. Consequently, age was included in all statistical models. Time-to-event analyses account for drop-out by assuming that at the time of drop-out, those who drop out do not differ from those who are in the risk set (i.e., those who have yet to experience the event). For the substance use outcome, multiple imputations^{25, 26} were used for all analyses to address potential bias due to dropout. Multiple imputation assumes data are missing at random (i.e., missingness is unrelated to the outcome after accounting for variables included in the imputation model). Chained equations using predictive mean matching were used to generate 50 multiply imputed datasets. This semi-parametric approach reduces potential bias due to misspecification of the imputation model and allows for mixing various types of variables (e.g., normally distributed, binary). The imputation model included treatment group, school, inverse probability weight, age at all three time-points, and substance use at all three time points.

Delay of sexual initiation—Time-to-event analyses were used to test differences between the groups. Time in months from beginning the study to the first sexual event was calculated for every participant. Participants who reported sex prior to the beginning of the study were not included in the time-to-event analyses. A Cox-proportional hazard model was used to test study hypotheses using three planned comparisons. These contrasts were as follows: 1) ER_{HUT} and HP_{LUT} were compared, 2) ER_{LUT} was compared to the combined ER_{HUT} / HP_{LUT} groups, and 3) the HP_{HUT} group was compared to the combined ER_{HUT} / HP_{LUT} groups. The proportional hazard assumption was checked using visual inspection of the Kaplan-Meier survival function and by checking the scaled Schoenfeld residuals. Effect sizes were estimated using hazard ratios.

Cumulative substance use—Logistic regression was used to test whether participants engaged in substance use at any time across the 12 month follow-up. Adjusted odds ratios were used to estimate effect size. The model included participant school, participant age, and the baseline assessment as covariates. The same three contrasts that were used in the time-to-event analyses were used in the logistic regressions to test for differences between groups. The following R packages were used to generate the imputations and perform the analyses of group differences: survey 3.31–5²⁷ ipw1.0–11²⁸, mice v2.25²⁵.

RESULTS

Baseline Characteristics

Table 1 describes the baseline characteristics by each of the four groups (e.g., ER_{LUT} , ER_{HUT} , HP_{LUT} , and HP_{HUT}). There were no demographic differences among the four groups. The groups did differ on the number who had ever engaged in vaginal/anal sex at baseline ($\chi^2(3) = 9.06, p = .03$) and those who reported substance use during the six months prior to baseline ($\chi^2(3) = 21.41, p < .05$). These behaviors, along with the other baseline

characteristics, were included in the calculation of the propensity scores. After applying the stabilized probability weights, there were no differences among the groups for any baseline characteristic.

Delay of sexual initiation

For delay of sexual initiation, time-to-onset of vaginal sex by the 12-month follow-up indicated that after controlling for school, age, and adjusting for baseline differences among groups, there were no differences between the ER_{HUT} and HP_{LUT} groups (Adjusted Hazard Ratio (AHR) = 1.07, 95% confidence interval = .72 to 1.60, $p = .73$). There were differences between the ER_{LUT} and combined ER_{HUT}/HP_{LUT} groups (AHR = 0.56, 95% CI = 0.36 to 0.86, $p < .01$), and between the HP_{HUT} and combined ER_{HUT}/HP_{LUT} groups (AHR = 1.64, 95% CI = 1.01 to 2.66, $p = .04$). The model-estimated survival functions from the Cox-proportional hazard models are depicted in Figure 2.

Cumulative substance use

For cumulative substance use, results were similar to those from the delay of sexual initiation analyses. Namely, there were no differences between the ER_{HUT} and HP_{LUT} groups at 12 months (Adjusted Odds Ratio (AOR) = 1.35, 95% CI = 0.93 to 1.97, $p = .12$). There were differences between the ER_{LUT} and combined ER_{HUT}/HP_{LUT} groups at 12 months (AOR = 0.58, 95% CI = 0.39 to 0.87, $p < .01$). However, unlike findings on sexual initiation, there was no difference in substance use between the HP_{HUT} and combined ER_{HUT}/HP_{LUT} groups at 12-months (AOR = 1.42, 95% CI = 0.79 to 1.18, $p = .23$). See Figure 3 for percentile comparisons.

DISCUSSION

To our knowledge, this is the first study to longitudinally evaluate the combined effect of an emotion regulation intervention and unsupervised time on cumulative substance use and delay of sexual initiation in early adolescents with mental health symptoms. As hypothesized, those who participated in the emotion regulation condition and who reported low unsupervised time with opposite gender peers (ER_{LUT}) showed the biggest delay in sexual initiation and the lowest odds of using a substance when compared to the other groups over a one-year follow-up. Also as hypothesized, those in the health promotion condition who reported high unsupervised time (HP_{HUT}) showed the highest rate of transition into sexual activity and the highest odds of substance use (although they did not statistically differ from the mixed treatment groups (ER_{HUT} & HP_{LUT}) on the latter outcome). There were no differences between those groups with only one protective factor (ER_{HUT} and HP_{LUT}), and these groups were more risky than the ER_{LUT} group and less risky than the HP_{HUT} group.

As stated previously, early adolescence is a developmental period marked by high activation of the amygdala and low activation of the front lobes⁹. Recent neuro-biological research suggests that differential brain maturation occurs in which the affective-reward sensitivity system, and not the cognitive control system, is more strongly influenced by the hormonal changes of puberty, rendering early adolescents more vulnerable to the influences of socio-

emotional factors on health risk behaviors including substance use and sexual risk behavior²⁹. As a result, these situations may act as a trigger that activates the hypersensitive reward processing system, while the cognitive control system is still developing. Therefore, early adolescents have a tendency to make more impulsive, rash decisions and struggle with inhibiting unwanted behavior when experiencing emotionally arousing stimuli.²⁹ In line with previous research, this study suggested that it may be beneficial to target multiple factors to elicit change in early adolescent health risk behaviors. Targeting both individual (e.g., emotion regulation skills) and environmental (e.g., time spent in unsupervised settings) factors may be most effective at eliciting change, especially in early adolescents with mental health symptoms who struggle with emotional and behavioral regulation. Parents are likely critical to fostering both sets of factors.

Previously, the development of emotion regulation abilities was thought to be primarily due to innate internal processes including neurobiological processes (e.g., underlying autonomic arousal, etc.) and cognitive abilities. However, researchers have begun to highlight the role that parents can play in promoting the development of emotion regulation processes in children⁸. Parents have the opportunity to prevent engagement in health risk behaviors through supervising time spent with peers. While early adolescents are developing emotion regulation strategies, parents can shape and positively reinforce their development. Parents are also able to limit early adolescent access to situations that they perceive may be emotionally overwhelming and lead to risk behaviors⁸. As adolescents age and develop emotion regulation strategies, parental scaffolding can selectively limit adolescent exposure to emotionally arousing situations, thereby, building a strong foundation for self-efficacy for more challenging situations, which in turn may improve long-term decision making. Extensive longitudinal studies are needed to determine whether higher levels of supervision and concurrent building of emotion regulation skills in early adolescence will translate to longer term reductions in risk behaviors.

Notably, analyses for the primary outcomes paper for this study revealed that participation in an emotion regulation intervention significantly impacted delay of sex but was not sufficient to impact substance use among this sample of early adolescents with mental health symptoms. One potential explanation for this finding is that early adolescents may be more frequently presented with opportunities to engage in substance use compared to sexual risk behavior. Therefore, they may be in need of environmental factors such as parental monitoring of time spent with peers to decrease the number of “trials” they face. Furthermore, research has indicated that adolescents engaging in substance use have higher rates of comorbid psychiatric disorders³⁰. Substance use may serve to regulate psychiatric distress for adolescents³¹. Thus, early adolescents with mental health symptoms may seek out opportunities to engage in substance use more readily than sexual risk behavior to help manage their mental health symptoms. Within this context, targeting multiple domains would be most efficacious. Parental supervision may help reduce opportunity, while increased emotion regulation strategies may improve decision making during emotionally laden situations but again will need further investigation to fully substantiate this theory.

There are several limitations to this secondary analysis that impact our ability to make firm conclusions from this single study. First, the study utilized adolescent self-report of

behaviors (unsupervised time, substance use and sexual risk behavior). Respondents may under-report behaviors that are viewed to be socially undesirable and may have difficulty recalling behaviors across 6-months. To help minimize a biased response style, assessments were delivered via audio computer-assisted self-interview software (ACASI), and this has been shown to minimize these³² effects. Recall bias is less problematic for highly salient and infrequent behaviors such as the onset of sexual activity or remembering any substance use. We chose to dichotomize unsupervised time to help minimize the recall bias in this more frequently occurring behavior. Second, measurement of of unsupervised time does not fully capture the full array of behaviors that comprise parental monitoring. Other important components, such as parental knowledge of peer associations and limit setting around these opportunities, were not assessed in this study and thus limit our ability to detect the impact of the broader construct of parental monitoring within the current study. Third, the design of the parent study was counter-balanced within school, which controlled for school-level confounders. However, this design does not account for potential differences in the social milieu among cohorts, which may affect familial processes and risk behaviors. Fourth, the study used causal modeling approaches to approximate results from a 4-arm randomized design. Results are only consistent with those of a randomized trial when making fairly strong assumptions of consistency, exchangeability, positivity, and correct specification of the propensity score model. Given the connections among mental health symptoms, family processes and risk behaviors, as well as the possibility of cohort effects noted above, there may be unmeasured confounders that may influence both unsupervised time at baseline and risk behaviors (exchangeability). It also may be that the “exposure” to the constructs of interest were not uniform among individuals within each of the four conditions (e.g., group attendance, differences in amount of unsupervised time; consistency), both of which limit the ability to infer causality. Fifth, the study is a secondary analysis from a study powered to a two-arm clinical trial. Our analyses were underpowered in approximating a 4-arm design, particularly for the ER_{HUT} and HP_{HUT} groups, which had fewer participants than the other two groups. Nonetheless, significant differences were observed. Finally, it is important to note that the sample consisted of early adolescents with mental health symptoms. Group differences observed in the present study may not generalize to a broader community sample of early adolescents. Taken together, these limitations suggest that these results should be viewed with caution until replicated in a full randomized control trial.

The current findings suggest that the combined effect of participation in an emotion regulation intervention and less unsupervised time was superior to either factor alone in reducing both substance use and sexual risk behavior in a sample of early adolescents with mental health symptoms over a 1-year follow-up. This suggests that interventions targeting health risk behaviors, including substance use and sexual risk, in early adolescents, particularly those with mental health symptoms, may be more effective when targeting both internal (e.g., emotional regulation) and external (e.g., parental monitoring/unsupervised time) protective factors. Findings also highlight the important role of parental behaviors in the context of intervention development. Brain maturation during early adolescence may leave them more vulnerable to risky decision making, and therefore in need of external supports such as parental monitoring. Parental monitoring may serve to scaffold and reinforce early adolescent acquisition of effective emotion regulation which can be

employed during emotionally arousing decision making, such as substance use and sexual risk behavior.

Future studies are needed to determine whether interventions aimed at both improving adolescent emotion regulation and reducing the frequency of unsupervised time could decrease engagement in health risk behaviors over time. This research would also benefit from a more robust approach to measurement. For example, electronic momentary assessment could be used to more directly assess unsupervised time spent with peers, thus limiting the need for extensive recall of these occurrences. This type of measurement would also provide further insight into the question of whether opportunity or duration of unsupervised time may influence adolescent risk taking. Lastly, studies examining adolescent risk behavior, emotion regulation and parenting behaviors should consider examining parental mental health and how this influences both adolescent adoption of emotion regulation strategies, as well as, parental adoption of parental monitoring skills..

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Figure 1.
CONSORT summary of participant retention.

Figure 2.
Group by delay of sex over 1 year.
Notes. Models were adjusted for missing data.

Figure 3.

Group by substance use rates over 1 year.

Notes. Models were adjusted for school, group imbalance, and missing data.

Table 1

Baseline Comparisons of Demographics and Risk Outcomes by Group

	ER_{LUT} N=152	ER_{HUT} N=60	HP_{LUT} N=142	HP_{HUT} N=51
	M (SD)/n (%)	M (SD)/n (%)	M (SD)/n (%)	M (SD)/n (%)
Age (years)	12.92 (0.52)	13.04(0.60)	12.89(0.52)	13.03(0.49)
Gender (%Male)	75 (49%)	35 (58%)	68 (48%)	33 (65%)
Race				
White	44 (35%)	25 (48%)	40 (34%)	22 (47%)
Black	47 (37%)	13 (25%)	38 (32%)	16 (34%)
Multi-Racial	28 (22%)	11 (21%)	25 (21%)	7 (15%)
Hispanic	60 (39%)	24 (40%)	58 (41%)	15 (29%)
Sexually Active ^a	11 (7%)	9 (15%)	14 (10%)	13 (27%)
Substance Use	28 (18%)	21 (35%)	41 (29%)	26 (51%)

Note:

^aReported a history of vaginal or anal sex at baseline;^bReported substance use in the past 6 months.

ER= emotion regulation, HP= health promotion, LUT= low unsupervised time, HUT= high unsupervised time.