2019

Risk domains and adolescent depression

Nathan Kawczynski

University of North Florida

RISK DOMAINS AND ADOLESCENT DEPRESSION

by

Nathan Paul Kawczynski

A thesis submitted to the Department of Psychology

in partial fulfillment to the requirements for the degree of

Master of Science in Psychological Science

UNIVERSITY OF NORTH FLORIDA

COLLEGE OF ARTS AND SCIENCES

April, 2019

ACKNOWLEDGEMENTS

I would like to thank everyone who made the completion of this thesis possible. First, my readers, Dr. Jennifer Wolff and Dr. Jody Nicholson-Bell, without whom this thesis would have remained unfinished. Their near constant guidance and encouragement were of tremendous importance to me personally, and to the final completion of this work. They, along with my lab partner, Sarah Beard, are what I aspire to as both a student and a person. Through their mentorship, their impact on this work, my time at UNF, and my life, cannot be overstated. I would also like to thank Dr. Christopher Leone and Megan Kuehner, both of whom have been instrumental to the completion and submission of this work through both guidance and patience.

I would also like to thank the members of my cohort, namely Evan Copello, Dominique Levert, and, again, Sarah Beard, for being both excellent friends and inspiring mentors during my time at UNF. One and all have continued on to great things, and I hope to one day stand with you again.

Finally, I must thank my family and friends for their love and support, without which I would not be in the position I am today. To Chelsea Bohaty and Joshua Bauer, without whom I would not have been able to attend UNF, let alone succeed, from the bottom of my heart, thank you.

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Abstract

Adolescence and young adulthood are the periods of development associated with the highest amount of risk-taking. One theory, the Dual-Systems model, suggests that this could be due to an imbalance in the maturation of two brain systems: reward appraisal, which matures first, and cognitive control, which matures later. This imbalance may be the cause of adolescents' tendency to favor immediate rewards, disregarding consequences. Depressed adolescents, however, behave differently. While it is not exactly clear whether they take more risks or fewer risks, depressed adolescents display different interactions and decision making with their peers than non-depressed adolescents. This study attempted to use these patterns of behavior already identified in previous research to predict where an adolescent would fall on a depression continuum based on their Self-Focused and Other-Focused risk behaviors. Results did not find a link between depression and either type of risk. Results may be inconclusive due to issues within the data and data collection process.

Risk Domains and Adolescent Depression

Risk-taking, or any decision that entails an opportunity for a negative outcome, is present during all stages of human development. Risk-taking is a well-documented and frequently studied phenomenon, however, adolescence and emerging adulthood is the period in which risky decisions are particularly prevalent (Defoe, Dubas, Figner, & van Aken, 2015). Risky decisions can include unsafe sex, reckless behavior, or substance use. Substance abuse in particular can have immediate and long-term negative consequences including overdose, legal trouble, and addiction. In fact, over half of all addictions in adulthood began during adolescence (Murphey, Barry, & Vaughn, 2013). Depressed adolescents exhibit risk patterns different from those of their non-depressed counterparts. One study showed that depressed adolescents are overall less risky than their non-depressed peers (Garcia-Retamero, Okan, & Maldonado, 2015), but another study found that depressed adolescents exhibit higher rates of sexual risk-taking (McDonald, Sommers, & Fargo, 2014). Currently, the relationship between depression and decision making in adolescents and young adults is not well understood. This study attempts to predict levels of depression in young adults based on categories of risk. This research could be used to assist in identifying adolescents with a higher likelihood of depression, allowing caretakers to intervene before depression manifests into self-destructive behavior.

The theoretical groundwork of the current study relies primarily on the Dual-Systems Model (see Steinberg, 2008). The Dual-Systems Model posits that there are two brain systems that govern adolescent and young adult risky decision-making processes: reward appraisal and cognitive self-control (Steinberg, 2008). These two processes develop at different rates, creating a "neurological imbalance." The reward appraisal system, located in the ventral tegmental area, extended amygdala, and ventral pallidum, matures before the cognitive control system has fully

developed. Beginning in adolescence and continuing into young adulthood, this imbalance

creates a period in which rewards are incredibly salient in the brain, resulting in quick, irrational,

reward-focused behavior, with little regard for the consequences of the behavior (Steinberg,

2008). As adolescents grow into early adulthood and their independence and resources increase,

their access to venues of risk increase as well. As such, risky behaviors involving drug use,

alcohol use, and tobacco peaks in early adulthood (Mahalik et al., 2013). Risk during

adolescence is also directly linked to risk in young adulthood, such as adolescent alcohol abuse

linked to adulthood sexual risk behaviors (Dogan, Stockdale, Widaman & Conger, 2010). It is

not until around the mid-20s that these risk patterns level off or decrease (Dogan et al., 2010;

Mahalik et al., 2013). Consistent with the Dual-Systems Model, the decrease begins in adulthood

as the prefrontal cortex matures, allowing leading to developed emotional regulation and

cognitive control (Yurgelun-Todd, 2007). However, though this neurological pattern is

considered rather universal, the resulting risk-taking is not. In other words, there is great

variation in some adolescents and young adults risk-taking, which could be due to individual

differences in mental health.

Depression

Clinical depression affects millions of people worldwide. Unfortunately, more than half

of all mental disorders and substance abuse issues begin by age 14, and 75% by age 24 (Murphey

et al., 2013). As such, many people are dealing with mental illnesses that are present or

manifesting while their brains are still maturing. In fact, 14% of U.S. children aged 13 to 18

years old (45 million) currently have or have had a mood disorder in their lifetimes (National

Institute of Mental Health, 2010). Further, depression is much more widely studied and

understood as it pertains to late adolescents, who are considered the most "at-risk" age

demographic (Sikora, 2016). This compounded by the difficulty found in diagnosing depression in children and younger adolescents means that depression can often go undiagnosed, or even misdiagnosed, until late adolescence or early adulthood, leading to further negative outcomes (Allen-Mears, Colarossi, Oyserman, & DeRoos, 2003; Fu-I & Wang, 2008).

Given the prevalence of mood disorders, understanding how depression interacts with the risky decision-making process is crucial. Previous research indicates that depression, even post-recovery, can have lingering cognitive deficits in adolescents (Shehab, Brent, & Maalouf, 2016) and presumably young adults as well. As cognition plays such a major role in decision-making, identifying cognitive deficits may help explain part of their decision-making process. However, cognitive deficits are not the only negative outcomes of childhood and adolescent depression. Problem behaviors occur more frequently in children and young adolescents with depression. Though children and adolescents may not engage in the same level of risk as older adolescents and young adults do, comparatively less harmful risk behaviors such as truancy or curfew braking occur more commonly in those with depression, and these "light" risks are often predictors of much riskier behavior as they grow older (Sikora, 2016).

Further, there is estimated to be medium to high comorbidity between depression and conduct disorders (Wolff & Ollendick, 2006). Which precedes the other is not yet clear, as some evidence points to depression preceding conduct problems in adolescents (Kovacs, Paulauskas, Gatsonis, & Richards, 1988), but the majority of evidence does seem to support that a conduct disorder usually occurs before a formal diagnosis of depression or other mood disorder (Nock, Kazdin, Hiripi, & Kessler, 2006). It is also estimated that at least a third of adolescents do not "grow out" of their problem behaviors, and instead carry them into adulthood indicating even more tangential negative outcomes, and a greater need for early detection (Sikora, 2016).

Depression also affects, and is affected by, physical brain development. For example, the size of the hippocampus seems to affect adolescents' sensitivity to social contexts, both negative and positive (Schriber et al., 2017). That is, depressed adolescents with larger hippocampi were more positively protected by their home life and more negatively influenced by community crime rates than those with lower hippocampal volume in the same conditions (Schriber et al., 2017). Research in depression as it pertains to risk-taking seem to be contradictory, with some studies indicating that depressed adolescents and young adults risk more, and others that they risk less. However, the one constant is that depressed adolescents and young adults seem to risk *differently* than their non-depressed peers. This study attempts to pursue this constant, by sorting risk behaviors into two categories: Other-Focused and Self-Focused.

Categorizing Risk

A major focus of the current study is to understand this relation between depression and decision making. The risk behaviors studied discussed are classified into two types: Self-Focused and Other-Focused because depressed people may perceive risk situations differently if peers are involved (Silk et al., 2014).

Other-Focused Risk. Other-Focused risk is defined in this study as any risk that involves any other person, such as unprotected sex, fighting, or likelihood of being involved in unsafe situations with peers. Fear of interpersonal loss seems to be a driving force behind much of adolescent risk taking, as the mere presence of peers is associated with increased risk-taking (Weigard, Chein, Albert, Smith, & Steinberg, 2014). Weigard and colleagues (2014) posit that this increase may possibly be caused by an increase in reward saliency when in the presence of peers. The effect of peer observation is so strong, risk-taking increases even when the exact risks

and negative outcomes are understood (Smith, Chein, & Steinberg, 2014). This increased risk-taking under peer scrutiny could be due to the fear of peer rejection. Indeed, when compared to non-depressed adolescents, adolescents with major depressive disorder showed a greater neurological reactivity to peer rejection and acceptance (Silk et al., 2014). Though reactivity to peer rejection is typically high during adolescence, depressed adolescents were even more sensitive to peer acceptance and rejection (Silk et al., 2014). Another study found that depressed individuals are better at predicting peer behaviors, perhaps indicating increased attention towards their peers (Garcia-Retamero, Okan, & Maldonado, 2015). Garcia-Retamero et al. (2015) also found that when making a decision for one of their friends in a fictional scenario, depressed individuals were less likely to choose a risky option. These results indicate that, across several different scenarios, depressed adolescents exhibit more sensitivity to interpersonal factors, whether it be the physical well-being of those around them, or simply the opinions of those around them. Additionally, during adolescence, depression is associated with lower rates of condom usage, and higher rates of risky sexual behaviors (Brown et al., 2006). Depressed adolescents are also more likely to experience dating violence, which itself is correlated with risky sexual behaviors, such as unprotected sex, or other HIV-related risk factors (Rizzo et al., 2011).

Self-Focused Risk. Self-Focused risk is defined as any risk that may result in damage to personal well-being, but don't *necessarily* involve another person. This includes risks such as risky driving, drug use, and tobacco use. Adolescents and young adults engage in behaviors that facilitate corporeal risk, like substance use, even when the consequences are understood (Smith et al., 2014). In laboratory tasks, adolescents were significantly more likely to engage in risky driving than adults (Kim-Spoon et al., 2015). Furthermore, risky driving (either through

hostile/reckless driving, drinking and driving, or a combination of the two), not only occurs at

higher rates during adolescence, but occurs at even higher rates for adolescents with depression

(McDonald, Sommers, & Fargo, 2014). When extrapolating laboratory risk to corporeal risk in

the "real world," Kim-Spoon et al. (2015) compared driving behavior to substance abuse, finding

a link between risky behavior during a laboratory task and substance use, but only for

adolescents. That is, risky behaviors in hypothetical, controlled settings tend to translate to actual

risky behavior in their real lives, which is not seen in older adults.

Using tobacco in any form can have long-term negative effects. Nicotine causes long-

term negative emotional and cognitive effects (Holliday et al., 2016), yet tobacco, which

contains significant amounts of nicotine, is used by 7.4% of adolescents in middle school and

25.3% of adolescents in high school (Singh et al., 2016). Nicotine is specifically more dangerous

during adolescence, as the possible emotional effects, such as depression and anxiety, begin

immediately after cessation, and continue into adulthood (Holliday et al., 2016). Based on these

findings it may be possible that depressed adolescents take risks differently than non-depressed

adolescents.

Current Study

The purpose of the present study is to examine the relation between depression and risk

across two domains of risk. Depression often goes undiagnosed and untreated, especially in

adolescents (Allen-Mears et al., 2003). Understanding that depressed youth take different types

of risks may help with diagnosing depression. As adolescents with depression have been shown

to behave differently across these domains than non-depressed adolescents, creating factors to

represent these domains may be used to predict depression. If depression can be predicted by a

certain type of risk or risk pattern, parents, school officials, and peers will have an easier time

recognizing the symptoms of depression. Understanding these nuances would allow for earlier detection of depression during an age where suicide is the second leading cause of all deaths (Center for Disease Control, 2015).

Research questions informing the hypotheses are as follows: Is there relation between depression and the different types of risk? That is, will different patterns of behavior be able to predict depressive symptoms?

Hypotheses

Participants who take more risks will be in a more severe category of depression and this will be espeically true for self-focused risk

Methods

Participants

The sample was comprised of 126 participants hired through Amazon's Mechanical Turk (MTurk) online survey service. MTurk allows for easier recruitment of young adults (who may be considered late adolescents) who may not be enrolled in school and might otherwise be difficult to contact. MTurk also allows recruitment of participants without the need to physically host them in a lab, decreasing time and resources needed for data collection, while still allowing for a community sample to be obtained through its filtering program. Participants were compensated $10 for their participation in the study, in addition to a capped potential $5 that could be earned through their performance on some tasks. By adding monetary incentive to some tasks, the saliency of the risk involved is increased. Due to a coding error, participants were shown a random assortment of surveys and data from only 32 participants, ranging in age from 18 to 24, were viable for the depression measure. There were 96 participants who completed the

risk behavior survey. The majority of participants were white males, and all participants were

selected from the Southeastern United States using the MTurk filtering system.

Table 1
Demographic Information

Characteristic	$N = 32$
Age, mean (*SD*)	22.5 ± 1.62
Education	
High school education	4 (12.5%)
Some college/Associate's degree	6 (18.8%)
Bachelor's degree	7 (21.9%)
No answer	15 (46.9%)
Gender	
Male	11 (34.4%)
Female	4 (12.5%)
Non-binary	1 (3.1%)
Other	1 (3.1%)
No answer	15 (46.9%)
Ethnicity	
White	10 (31.3%)
Black	4 (12.5%)
Multi-racial	3 (9.4%)
No answer	15 (46.9%)

Procedure

    The study consisted of two sections: the survey/questionnaire section through Qualtrics,

an online survey service, and the task battery section through Inquisit Web, an online version of

the Inquisit Lab, a program that runs test scripts. MTurk members who chose to participate were

given a link to Qualtrics and a unique string of letters and numbers as an identifier to link the

Qualtrics portion to the Inquisit portion. The Qualtrics section began with an informed consent

form that the participant must agree to have read in order to continue. After the surveys were

completed, the final page of Qualtrics contained a link to the Inquisit Web section. The entire

study took about an hour to complete.

Measures

The following are the measures were used in the present study, in addition to a basic demographics survey that contained questions regarding race, sex, age, and household factors.

CDC State and Local Youth Risk Behavior Survey (CDC, 2017). There were 18 questions from the CDC's YRBS used, with the rest of the survey's questions excluded for irrelevance to the current study (such as school-based behaviors) or due to lack of variability (such as use of hard drugs, gun carrying, or dating violence). Remaining questions concerned sexual risk behaviors, drug-related risk behaviors, and personal safety (risky driving behaviors and carrying weapons). Questionnaires were scored on a Yes/No-Risk basis, with exceptions for normative behaviors (Terzian, n.d.).

Patient Health Questionnaire (PHQ-8) (Kroenke et al., 2009). The PHQ-8 is an 8-item questionnaire to measure depressive symptoms (α = .86). Each question has a score range from 0 to 3. Thus, overall scores for the PHQ-8 range between 0 and 24. All questions follow the format of: "How often during the past 2 weeks were you bothered by…" with possible options being "Not at all" (0), "Several days" (1), "More than half the days" (2), and "Nearly every day" (3) (Kroenke, et al., 2009). An example item would be "How often during the past 2 weeks were you bothered by… **Feeling down, depressed, or hopeless**" (Kroenke et al., 2009). A score of 10 to 19 is considered major depression, and a score of 20 or more is considered severe major depression.

Analysis Plan

Relevant items were conceptually categorized based on the Self-Focused and Other-Focused categories. Reliability analyses confirmed that these items are indeed related, and non-

related items were removed. Correlations for each scale were conducted with PHQ-8 scores.

Finally, ANOVAs were conducted with the two scales and the actual diagnostic categories of the

PHQ-8 (non-depressed, major depression, and severe depression.)

Results

Descriptive Statistics

The main variables of interest were the scores for the PHQ-8 and the YRBS. All

participant responses are included, as all participants completed these portions of the test battery.

Table 2
Descriptive Statistics: PHQ-8

Task	$N = 45$
PHQ-8 score, mean (SD)	6.7 ± 5.2
< 9 (no depression)	32 (71.1%)
10–19 (major depression)	12 (26.7%)
> 20 (severe major depression)	1 (2.2%)

Table 3
Descriptive Statistics: CDC Youth Risk Behavior Survey

Risk Behavior	$n = 93$
Self-Focused	N = Engaged in Risk
Wore a helmet while on a bicycle	26 (28%)
Wore a seatbelt while riding in a car	11 (11.8%)
Passenger in a car with a drunk driver	18 (19.4%)
Experienced sexual assault	12 (13%)
Smoked first cigarette before age 18	22 (23.9%)
Smoked in the past 30 days	18 (19.6%)
Used a vapor product in last 30 days	40 (43%)
Consumed alcohol before age 17	44 (47.3%)
How many days have you consumed alcohol in the last 30 days	56 (60.2%)
Consumed 5 or more drinks at one time in the past 30 days	24 (26.4%)
What is the largest number of alcoholic drinks you've had in a row in the last 30 days	37 (40.7%)

How old were you when you tried marijuana for the first time	22 (23.7%)
How many times in your life have you used marijuana	53 (57%)
How many times have you used marijuana in the past 30 days	21 (22.6%)
How many times in your life have you used ecstasy	17 (18.3%)
How many times in your life have you used synthetic marijuana	16 (17.2%)
How many times in your life have you abused prescription drugs	29 (31.2%)
Other-Focused	
First time intercourse before age 15	14 (15.1%)
During the past 30 days, how many times did you drive a vehicle after drinking alcohol	12 (12.9%)
During the past 30 days, how many days did you text or email while driving	40 (43%)
Did not use any contraceptive during last intercourse	25 (26.8%)

ANOVAs were conducted in order to identify common covariates of risk and depression (age, gender, etc.), but none were identified. Reliability analyses were then used to confirm the conceptual categorizations, removing items until the most internally consistent items were left, forming the scales. For Self-Focused risk, the final scale was created from the sum of the 17 items indicated above, with high internal reliability ($\alpha = .81$). The scale for Other-Focused risk included the sum of only 4 items. As the scale consisted of so few items, inter-item correlation coefficient (.26) was used as a measure of internal reliability instead of traditional reliability analyses using Cronbach's alpha (Piedmont & Hyland, 1993). A correlation was conducted for each scale with PHQ-8 raw scores. The Self-Focused scale correlation yielded a weak, non-significant correlation with PHQ-8 scores ($r(45) = .22, p = .15$). The Other-Focused scale correlation also yielded a weak, non-significant correlation with PHQ-8 scores ($r(45) = .24, p =$

.12). As a strong preliminary correlation was not established, no further analyses were

conducted.

Discussion

The hypothesis posited that categories of risk could be formed based on a

conceptualization of Self-Focused and Other-Focused risk, and that higher scores across these

scales would indicate higher PHQ-8 scores. That is, higher scores in the risk categories would be

associated with depression. While statistical analysis confirmed the conceptualized scales were

indeed internally consistent and correlated, neither scale was significantly correlated to PHQ-8

score. Indeed, even raw YRBS scores themselves were not significantly correlated to PHQ-8

scores, indicating that this was not simply an issue of the scales having weak correlations, but the

risk assessment in general. While it could simply be the case that we did not find a significant

relationship between risk and depression, several other factors may have influenced the results,

obscuring the possible conclusions.

First, many participants who completed the YRBS did not also complete the PHQ-8, with

less than half actually completing both, limiting sample size. While it is not clear whether the

participants skipped the PHQ-8 portion of the test intentionally, or if there was an issue arising

from remote, online participation, is not clear, as participants were given the option to skip

whichever portions of the battery as they pleased without penalty. The remote nature of the data

collection also lead to issues in the design stage as well, limiting the questions asked and the

scales for depression used. That is, because researchers had no way of immediately addressing

participants that indicated thoughts or behaviors of self-harm forced researchers to use the PHQ-

8, which does not directly ask about self-harm, as well as forced the removal of self-harm

questions on the YRBS. Relying on binary risk assessment allowed for total consistency in the

items but may have eliminated the nuances that may have influenced results. Future research using the YRBS would require a better scoring system then the system used in the current study. Finally, the Other-Focused scale included a very small number of items that were internally consistent. Many items that were originally conceptualized as Other-Focused risk needed to be removed in order to achieve this internal consistency, indicating a potential flaw in the researcher's conceptualized categories. In-person participation may have also eliminated some of the issues that arose in data collection, if indeed they were due to participant error or other technological issues. In-person participation would also allow for greater flexibility in study design, as the issues described above would be able to be addressed in the moment, with resources available to participants that would not be as accessible remotely.

While the link between depression and risk remains unclear, the present study was able to establish that certain types of risk are conceptually relevant, namely those that have been conceptualized as Self-Focused. However, given the difficulty in forming the Other-focused scale, it may indicate simply that the likelihood of risking in one area does indeed increase the likelihood of risking in another. There may be better ways of categorizing risk, though the analyses did not necessarily indicate one given the current variables.

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