Sibling Differentiation in Depression as a Response to Shared and Non-shared Environment

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Abstract

Most parents, when making life-changing decisions, consider the possible effect on their children. However, many factors in a child’s environment do not have a well-defined effect, as displayed by the mixed research on children’s depression in response to divorce. These mixed results may be due to differentiation of children in response to environmental stimulation. This study examines the differences in depression in sibling pairs in adverse environmental conditions. Sibling pairs in adverse environments were found to have greater differences in depression than those in non-adverse environments, for both within-family and between-family variables. This indicates that the effects of environment depend not only on the amount of stimulation, but also on how a child experiences or copes with it.
Sibling Differentiation in Depression as a Response to Shared and Non-shared Environment

Most parents, when making life-changing decisions, stop to consider the possible effect on their children. Parents that remain in unhappy marital relationships to protect their children from the potential negative consequences of divorce provide an extreme example of this. However, many factors in a child’s environment do not have a well-defined effect, as displayed by the mixed research on children’s response to divorce. Some researchers have found that children of divorced parents score lower on measures of academics, conduct, psychological adjustment, and social relations (Amato, 2001). Others have asserted that, although children in divorced families have a higher risk for these problems, most of these children develop normally and become well-functioning individuals (Hetherington & Stanley-Hagan, 1999). Such contradictory research conclusions may be due to different reactions of siblings to the same stimulus, resulting in sibling differentiation.

It has often been observed that siblings become dissimilar as they grow into adulthood. Research by McCartney, Harris, & Bernieri (1990) has shown that the similarity of twins’ personalities and intelligence decreases as they age. Furthermore, siblings that are close together in age seem to create or emphasize differences in order to form their own, distinct identities (Feinberg & Hetherington, 2000). There are several hypotheses concerning the reason for this differentiation. Some postulate that, by increasing the differences between siblings, sibling conflict is regulated and minimized, whereas others have said that this differentiation allows siblings to share parent resources more equally. If siblings are very different, parents cannot say that one child is better than another and will, therefore, allocate resources equally between the two. In contrast, when siblings are very similar but one is more adept than another, parents may either try to give more resources to the less adept sibling, in an attempt to improve him, or they
may give more resources to the more adept sibling, considering the other sibling to be a lost cause. Despite repeated observations of this phenomenon of sibling differentiation, the mechanism through which it develops is still unclear. Differentiation may occur either through a conscious effort by the siblings or unconsciously. If siblings are consciously causing their differentiation, they are seeking out differences to create their own unique identity and to avoid comparisons between them. Although this is plausible, it is more likely that the process is unconscious and is influenced by differences in the siblings’ environments and genetics.

A possible cause of the long-term differences in siblings is within-family environmental influences caused by differing objective non-shared environments of the two siblings. Objective environments refer to events that are observable, regardless of whether they influence siblings to become more alike or more different (Turkheimer & Waldron, 2000). Although these objective environments are independent of sibling outcome (either increased similarity or increased differences), differences in these environments would be expected to produce different outcomes, because each sibling is influenced by different environmental factors. For example, if one sibling was paralyzed while the other sibling retained fully functioning legs, we would expect the paralyzed sibling to show higher levels of psychological distress or depression than the other sibling, due to the objective difference in environments the siblings experience. An example of a differential response to non-shared environments is found in a study of twin pairs in which one twin is widowed and the other is married (Lichtenstein, Gatz, Pedersen, Berg, & McClearn, 1996). The bereaved twin experienced more depressive symptoms, more loneliness, and less life satisfaction than the married co-twin. These within-family effects in response to a single objective environmental event may create increased differentiation as the siblings grow older. Siblings may become more different in response to an initial non-shared environmental
event and these differences can then increase over time via a feedback-loop. First, the differences between the siblings influence them to choose different environments, such as engaging in different activities or affiliating with different peer groups. The different environments then cause the siblings to become even more different, as they grow accustomed to these different environments being the norm, which causes the siblings to then choose additional different environments, etc. Through this mechanism, differences in within-family environmental influences may create long-term sibling differentiation.

Although within-family environmental differences are generally assumed to be accessible to objective measurement, not all differences in sibling environment are observable. Different environments between siblings may also be a product of personality and genetic factors that influence the subjective experience of the environment. In a study by Daniels, Dunn, Furstenberg, & Plomin (1985), it was found that siblings in the same family experienced different environments. Both parents and, to a greater extent, the siblings themselves reported differences in the environments shared by the siblings in the same family. The more psychologically well-adjusted sibling reported more maternal closeness, sibling friendliness, peer friendliness, autonomy, and parental chore expectations than the less well-adjusted sibling. Since the siblings lived in the same household, it is doubtful that these environmental factors differed objectively to a great degree, particularly in the cases of autonomy and parental chore expectations. These differences in experiences are most likely due to personality or genetics, which may influence the amount particular environmental factors impact a person, perhaps causing one sibling to act more negatively toward an environment. Research has found that people have different levels of environmental sensitivity and some are more susceptible to both negative and positive environmental conditions than others (Ellis, Boyce, Belsky, Bakermans-
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Kranenburg, & Van Ijzendoorn, 2011). In contrast, there are people that have developmental adaptations to high-stress environments, allowing them to make the best of a bad situation. These differences in sensitivity to the environment may cause shared environments to be experienced differently. The discrepancy in experience may then produce results similar to objective within-family environmental differences. This difference in response to the same objective environment is an example of an effective environment, one that is defined by the outcome it produces (Turkheimer & Waldron, 2000). In these cases, although there is no objective non-shared environment, the effective environment causes increased sibling differentiation and functions as a non-shared environment might, not as we would expect a shared environment to function.

Due to this differential experience of the shared environment, it is possible that siblings will also show differentiation in response to between-family environmental influences, or environments that differ between families. A between-family environmental influence will be objectively the same for entire families rather than individuals in a family. Divorce is an example of this, since some families will have the characteristic of divorced parents while other families will not have that characteristic. Although siblings share these objective environments, long-term differentiation may occur if they experience it differently. For example, if one sibling is devastated by the divorce while the other views it as a chance to have two families, we would expect the first sibling to show an increase in anxiety and depression and the other sibling to either remain the same or become less anxious and depressed. There has been some evidence for such differentiation in objectively shared environments. For instance, sibling differentiation on achievement test scores and negativity has been found to be greater in single parent households than in two-parent families (Conley, Pfeiffer, & Velez, 2006; Jenkins, Dunn, O’Connor,
Rasbash, & Behnke, 2005). The discrepant experiences of the shared environment seem to create an effective environment that creates differences in the siblings.

This process of differentiation in response to objectively shared environments poses a problem for research. Researchers often ignore within-family effects to focus on large-scale between-family effects, which may lead to mistaken inferences. For example, studies that use cross-sectional data when examining the behavioral outcomes of birth order have found large correlations, while those using within-family data have found small or zero correlations (Rodgers, Cleveland, Oord, & Rowe, 2000). This indicates that it is possible that the large correlations of the cross-sectional studies may be due to confounding variables rather than the interaction of interest. One reason for this may be significant differences in variables other than those intentionally measured. If a researcher were to examine birth order in multiple families and compare differences between three families: a first-born child of an affluent Hispanic family, a second-born child of an African American middle class family, and a third-born of a lower class Caucasian family, there would be large behavioral differences observed, but probably not due to the effects of birth order. In this example, the large effects of race and socioeconomic status would probably overshadow the smaller effects of birth order. Although this is an extreme and unlikely example, it does demonstrate an important point about the potential danger of making false inferences. Therefore, it is necessary to examine within-family effects to determine the meaning of any between-family associations (Dick, Johnson, Viken, & Rose, 2000). This principle remains true when studying the effects of other variables, like divorce. Any differences found across different families may be confounded by something other than the independent variable, so it is necessary to examine the differences of children within a family to determine if divorce really has a negative impact on all children that experience it.
All this data suggests that within-family differences, in which siblings do not share some aspect of the environment, cause siblings to become more dissimilar over time. This pattern of sibling differentiation can also occur for between-family differences, in which siblings do share the same objective environment, if siblings experience the environment discrepantly. In order to assess the extent to which this effect occurs across a variety of environments, we decided to test the differences in depression between siblings in response to both within-family and between-family environmental differences. We examined the differential responses of siblings to the within-family variables of physical limitations, teenage pregnancy, being threatened with a gun or knife, and school expulsion. The between-family variables of parent marital status, separation from biological parent, and family economic troubles were also analyzed. We decided to use differences in depression in order to demonstrate the sibling differentiation process. For some examples of long-term sibling differentiation in depression found in our sample, see Figure 1. To determine if differentiation is greater in response to negative environments, we compared the differences in depression in families with the adverse within- and between-family events to families that did not experience the event.

We hypothesized that siblings will be more different in the adverse situations for both within- and between-family variables, but the within-family variables will have a greater effect. The objective within-family differences were predicted to have a greater effect because, in those instances, the differentiation is caused by observable differences in environment. Differentiation in between-family variables is only due to differences in experience of the same environment, which we believe will be weaker in influence. By verifying the presence of this phenomenon in a variety of different situations, we can determine the extent to which it occurs and demonstrate the necessity of using within-family analyses to verify the results of between-family studies.
Method

Participants

This research uses data from the National Longitudinal Study of Adolescent Health (Add Health). Data collection occurred in four different waves. In 1994 – 1995, the Add Health team collected Wave 1 data from a sample of 80 high schools and 52 middle schools in the United States, with unequal probability of selection (Harris, Halpern, Whitsel, Hussey, Tabor, Entzel, & Udry, 2009). The study design incorporated systematic clustered sampling methods and implicit stratification to ensure this sample is representative of U.S. schools with respect to region of country, urbanicity, school size, school type, and ethnicity. Data collection consisted of parent report and adolescent self-report, using techniques that ensured privacy and confidentiality of responses. During this first wave, all students (n=20,728) were in grades 7 to 12. In-home interviews for Wave 2 occurred approximately one year later (1996), with 71% of the adolescents from Wave 1, participants ranging in age from 11 to 23. In-home interviews for Wave 3 were conducted in 2001 – 2003, with approximately 73% of the original wave 1 sample. Finally, Wave 4 data was collected in 2007-08, with participants ranging in age from 23 to 35. For more information about the Add Health research design, see Harris, Halpern, Smolen, & Haberstick (2006).

For this study, we excluded pairs that were missing data on depression measures for one or both of the siblings within the pair at any time point. Our final sample consisted of 1,327 sibling pairs, or 2,654 participants. To control for any gender differences, we only used same-sex sibling pairs, of which 609 were male (46%) and 718 were female (54%). Participants ranged in age from 11 to 20 years at the time of Wave 1 and from 24 to 34 at the time of Wave 4. These sibling pairs differed in levels of relatedness, but all pairs resided within the same household. Of
the 1,327 sibling pairs, 13% were monozygotic (identical) twins, 18% were dizygotic (fraternal) twins, 44% were full siblings, 14% were half-siblings, and 2% were cousins, 2% were non-related, and 7% were of an undefined level of relatedness, due to missing data. Although not all members of a pair were actually siblings, all pairs resided within the same household, and therefore shared a family environment, and we refer to them throughout the paper as sibling pairs in the interest of simplicity.

**Measures**

*Depression.* Nine depression-related questions, drawn from the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), were asked of participants at all four assessment points. See Appendix A for the questions used. These questions inquired about symptoms participants may have experienced during the last week and were rated on a four-point Likert scale (never/rarely, sometimes, a lot of the time, most of the time/all of the time). This resulted in a scale ranging from 0 to 27, with 27 being the maximum possible score. The mean total score was 3.32 (SD = 1.00). The CES-D has been shown to be strongly associated with diagnoses of major depression (Prescott et al., 1998; Pandya, Metz, & Patten, 2005; Dozeman et al., 2011).

*Within-Family Variables.* For within-family variables, we were only interested in sibling pairs where one sibling had experienced the adverse event and the other had not. Therefore, we excluded pairs in which both siblings had experienced the event. We also excluded any sibling pairs for which one or both siblings were missing data concerning the variable of interest. We did use sibling pairs in which neither sibling had experienced the adverse event as control comparisons. For the questions assessing physical limitations, teenage pregnancy, being threatened with a gun or knife, and school expulsion, see Appendix B. We only examined these
variables at Wave 1, because we were interested in long-term differentiation in response to an initial event.

*Between-Family Variables.* When examining between-family variables, we were only interested in siblings with shared environments, so we excluded any pairs in which only one of the siblings experienced the adverse event. Any pairs in which one or both of the siblings were missing data for the variable of interest were also excluded. Sibling pairs in which neither sibling experienced the adverse event were used for control comparisons. For the questions assessing parent marital status, biological mother status, biological father status, and family economic status (family need of public assistance and lack of money to pay bills), see Appendix C. We only examined these variables at Wave 1, because we were interested in long-term differentiation to an early event.

**Statistical Analysis**

We first calculated the difference between sibling depression scores at each time point by subtracting the depression scores of the second sibling from the depression scores of the first.

Then we calculated the intercepts of the siblings by adding together all depression scores of each sibling and dividing the total by 2. We calculated the difference between siblings’ intercepts by subtracting the calculated intercept of the second sibling from the intercept of the first sibling in the pair.

\[
\text{Intercept} = \frac{\text{depression 1} + \text{depression 2} + \text{depression 3} + \text{depression 4}}{2}
\]

Next, we calculated the slope of each sibling’s depression over time. The difference between the siblings’ depression slopes was calculated by subtracting the slope of the second sibling from the slope of the first.

\[
\text{Slope} = \frac{-3(\text{depression 1}) - 1(\text{depression 2}) + 1(\text{depression 3}) + 3(\text{depression 4})}{\sqrt{20}}
\]
To calculate the differentiation effects for within-family variables, we split the pairs by the possible conditions (only one sibling experienced or neither experienced) of each variable of interest (physical limitations, teenage pregnancy, threatened with gun or knife, and school expulsion). We then calculated the means, variations, and standard deviations of each of these pairs for the depression differences at each time point, the intercept differences, and the linear (slope) differences. For these variables we retained the sign (positive or negative) when calculating differences because the sign provides valuable data regarding which sibling became more depressed: the sibling that experienced the adverse event or the sibling that did not.

For between-family variables, we divided pairs into the conditions of interest (both experienced the event or neither experienced the event) of each variable we examined (parent marital status, biological mother status, biological father status, need of public assistance, and lack of money for bills). We calculated the means, variations, and standard deviations of the absolute values of the depression differences at each time point, the intercept differences, and the linear differences. We did not retain the signs of these differences, and instead took the absolute value of each calculated difference, for between-family variables because, when both siblings share the environment and have an equal likelihood of responding negatively, it is not relevant to our research which sibling became more depressed, only that they differed in response to the adverse event.

For both within- and between-family variables, we calculated Cohen’s $d$ of the mean intercept differences and mean linear differences to determine the effect sizes of the observed differences. Cohen’s $d$ is the mean difference between groups divided by the pooled standard deviation. A $d$ of 0.2 indicates a small effect, .05 a medium effect, and .08 a large effect.

$$d = \frac{(x_1 - x_2)}{s_{\text{pooled}}} \quad \text{where} \quad s_{\text{pooled}} = \sqrt{\left[\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 + n_2)}\right]}$$
Results

The mean differences at each time, the mean intercept differences, the mean linear differences, and effect sizes (Cohen’s $d$) are presented in Table 1 for within-family variables and in Table 2 for between-family variables. These analyses indicate that siblings differentiate in depression in response to both objective non-shared environments within-families and effective non-shared environments between-families.

Sibling differentiation in response to within-family environmental differences was observed in the adverse event conditions as a small effect for all four variables. Pairs in which only one sibling experienced an adverse life event became more different in depression over time than pairs in which neither sibling experienced the event. There was a difference between mean linear differences of depression for pairs in which one sibling was physically limited ($n=117$, $M=.199$, $SD=.637$, $d=.316$) and pairs in which neither sibling was physically limited ($n=2469$, $M=-.024$, $SD=.537$). Similarly, teenage pregnancy of one sibling in a pair ($n=49$, $M=.136$, $SD=.632$, $d=.332$) and teenage pregnancy of neither sibling ($n=1905$, $M=-.077$, $SD=.524$) were different in slopes of depression. The same trend was found in the conditions in which one sibling was threatened with a gun or knife two or more times ($n=105$, $M=-.125$, $SD=.580$, $d=.188$) or once ($n=234$, $M=-.092$, $SD=.585$, $d=.124$), as compared to neither sibling being threatened ($n=1993$, $M=-.025$, $SD=.530$). There was also a difference between sibling pairs in which one sibling experienced school expulsion ($n=210$, $M=-.187$, $SD=.599$, $d=.286$) and pairs in which neither sibling was expelled ($n=2359$, $M=-.032$, $SD=.538$). As predicted, these effect sizes were greater than those observed for the between-family variables.

Interestingly, for the variables of school expulsion and being threatened with a gun or knife, the sibling experiencing the adverse condition was not the sibling that experienced an
increase in depression over time. For sibling pairs in which one sibling was expelled from school, the sibling that was expelled was the most depressed at Wave 1. However, the differences in depression decreased over time, until measurement at Wave 4, when the sibling with the initial adverse event was the least depressed in the pair. This resulted in a negative overall difference in the mean slopes of the siblings’ depression scores. These results indicate that, although the sibling that experienced the adverse event was the most depressed at the first measurement, he decreased in depression over time as compared to his sibling. Similarly, for siblings pairs in which one sibling was threatened two or more times, at Wave 1 the sibling with this adverse condition had a greater depression than the other sibling, but for Waves 2 – 4, they were less depressed than their sibling. This resulted in a negative depression difference slope, indicating that, with time, the sibling that had not experienced the adverse experience became more depressed than the sibling that had. The differences in depression slopes for all the within-family variables are displayed in Figure 2.

In all between-family adverse conditions, there was a small effect of the siblings being more different in linear depression than in the siblings in non-adverse conditions. Sibling pairs in families experiencing negative environments became more different in depression over time than pairs in families that did not experience adverse events. For parent marital status, the differences between siblings’ depression slopes was greater in families with divorced parents (n=161, M=.437, SD=.422, d=.144) and single-parent families (n=5, M=.596, SD=.729, d=.663) than in households where both parents were married (n=1049, M=.390, SD=.308). These results are displayed graphically in Figure 3. Siblings who were separated from their living biological mother (n=158, M=.465, SD=.408, d=.156) or their dead biological mother (n=13, M=.378, SD=.339, d=.103) were more different in linear depression than siblings still living with their
biological mother ($n=1955$, $M=.412$, $SD=.334$). This same trend was found, to a lesser extent, for separation from a biological father that was alive ($n=522$, $M=.443$, $SD=.365$, $d=.136$) or dead ($n=51$, $M=.385$, $SD=.236$, $d=.041$), compared to still living with him ($n=1409$, $M=.398$, $SD=.317$). The differences in mean depression slopes for the variables of biological mother and father statuses are seen in Figure 4. Family economic troubles displayed the same pattern with greater effect sizes. Siblings in families that required public assistance like welfare ($n=261$, $M=.511$, $SD=.420$, $d=.293$) were more different than siblings in families that didn’t ($n=1983$, $M=.410$, $SD=.334$). In addition, siblings whose family did not have enough money to pay household bills ($n=460$, $M=.486$, $SD=.385$, $d=.254$) were more different in depression trends than siblings in families that did ($n=1668$, $M=.399$, $SD=.330$). These differences in depression slopes are displayed graphically in Figure 5.

**Discussion**

In this study, we sought to determine the degree to which sibling differentiation occurs as a response to potentially adverse environments. As predicted, siblings who either had objective non-shared environments or had a shared, negative environments were more different in depression than siblings that did not experience these environments. This occurred in a variety of environments, indicating that sibling differentiation may be more common than previously expected. In addition, our hypothesis that the effect of sibling differentiation would be greater for within-family environmental discrepancies was also supported. However, our expectation that the sibling affected by the negative environment would be more depressed was not supported in some cases.

The differentiation in sibling depression that we observed suggests that siblings in the same family do differ in response to shared, effective and non-shared, objective environments.
When children are exposed to discrepant environments, development of divergent characteristics and differing levels of those characteristics may occur (McCall, 1983). Although it was commonly assumed that this sort of differentiation would only occur when there were objective differences between these environments, it now appears that this is not necessarily the case. Children in the same environment can have discrepant experiences of the environment, due to personality or genetic factors, leading them to react in different ways (Furstenberg, & Plomin, 1985). Therefore, the amount of environmental stimulation is not the only important factor in determining a person’s response to environmental change. The subjective experience of that stimulation and the manner in which the person handles or copes with it are also influential in determining its consequences.

Although our assumption concerning which sibling would become depressed in response to within-family environmental variation was not supported in the conditions of school expulsion and being threatened with a gun or knife, these results still demonstrate that differentiation is occurring in response to different objective environments, as the sibling not experiencing the event becomes more depressed while the sibling that does experience it does not. Furthermore, these unexpected results may be explained in terms of protective factors, coping mechanisms, or different negative response patterns. When the sibling that experiences the adverse event does not become depressed, he may have some protective factor, genetic or environmental, that buffers him from the negative experience. For example, if an adolescent has an unexpected teenage pregnancy, but has a strong system of social support, she may not respond to this event with depression because her friends and family help her to deal with the situation. Likewise, a child might not respond negatively to being physically handicapped if he has a natural propensity to view the positive aspects of situations. Another possible explanation is the use of effective
coping strategies. If someone has learned to write down his thoughts and feelings in a journal and it helps him to avoid becoming depressed, exposure to an adverse life event may not have a large effect on him. Coping strategies may have been learned before the event occurred, preventing the event from creating any depressive response at all, or may be learned afterword as the person attempts to diminish the depression response that had already occurred. Since our results display an increased level of depression followed by a decrease in depression for siblings experiencing the adverse event, it is likely that coping strategies are being learned in response to the adverse event. Finally, siblings that experienced these adverse life events but do not react with increased depression may still respond negatively, in a way that we did not test for. For example, children will often react to negative environmental influences with externalizing behavior, such as getting in fights. This reaction is probable for children who are threatened with a gun or knife and children who have been expelled from school: the two variables in which we observed a trend of siblings that experienced the event being less depressed than siblings that did not. If a child is threatened with violence, it is likely that he had either already developed a habit of acting violently or that he will respond with the same behavior as the aggressor. In addition, children who are expelled from school generally have already displayed disruptive or violent behavior in order to warrant such a punishment. Therefore, although unexpected, these results can be easily explained and still demonstrate the phenomenon of sibling differentiation.

In discussing these findings, it is important to note the limitations of this study. First, the number of siblings in adverse environments was disproportionately small when compared with the number of siblings in the non-adverse environment control groups. For some findings, such as the large effect size for single-parent families, the limited number of participants resulted in an inflated variation and a large standard deviation. This disproportionate variation in sibling
depression differences decreased the reliability of these results and made it difficult to determine how different the two populations actually were. In addition, our sample had relatively low depression scores and low variation in those scores. Due to this low variation, the potential for large differences in scores was greatly decreased. Large differences would be much more visible in a population containing a subgroup of clinically depressed children and their siblings.

Despite these weaknesses, this study does effectively demonstrate that within-family variation in siblings does occur for both within- and between-family environmental differences. To determine the reason for this effect, future research could examine this differentiation response using a twin-paradigm. This would allow researchers to determine if differentiation in response to shared, effective environment is primarily due to genetic factors or non-shared features of their environments. Future studies may also examine possible protective factors possessed by siblings that do not become depressed in response to environmental stimuli. If these protective factors can be easily taught or given to children at risk for depression, we may be able to decrease the incidence of depression and treat pre-existing cases more effectively.

These results may also have more direct implications for future research methodology. The phenomenon of sibling differentiation is an important factor to take into account when examining between-family effects. If participants are responding to environmental stimulus differently, the stimulus may appear to not have an effect when it actually does. For example, in response to a large crowd, some people may show increased anxiety while others decrease in anxiety. These opposite reactions, when averaged, may seem to indicate no anxiety change, when in reality there is a large change that varies among people. Knowledge of within-family sibling differentiation may also provide a good validity test for researchers examining between-family differences. When looking at differences across people, sometimes a seemingly large
difference that occurs between families may be due to outside environmental factors rather than the variable of interest. If researchers check their between-family data by analyzing the within-family responses of both siblings, they can determine if this effect is real. As in the example of birth-order researchers, if a researcher found large behavioral differences between first- and second-born children and then found that these differences are not observed within families, he can conclude that the behavioral factors he found initially were due to some confounding variable. Perhaps acknowledging the occurrence of this phenomenon in response to a wide variety of environmental factors will prevent some inference errors in future research and change the way we think about between-family effects.
References


Appendix A

Depression Questions
Taken from the National Longitudinal Study of Adolescent Health
Feelings Scale (Add Health; Harris, 2009)

Instructions: These questions will ask about how you feel emotionally and about how you feel in general. How often was each of the following things true during the past week?

Likert scale: 0 = never or rarely, 1 = sometimes, 2 = a lot of the time, 3 = most of the time or all of the time

1. You were bothered by things that usually don’t bother you.
2. You felt that you could not shake off the blues, even with help from your family and your friends.
3. You felt that you were just as good as other people.
4. You had trouble keeping your mind on what you were doing.
5. You felt depressed.
6. You felt that you were too tired to do things.
7. You enjoyed life.
8. You felt sad.
9. You felt that people disliked you.
Appendix B

Within-family Variable Questions
Taken from the National Longitudinal Study of Adolescent Health (Add Health; Harris, 2009)

*Physical Limitations:*
Do you have difficulty using your hands, arms, legs, or feet because of a permanent physical condition?

no
yes

*Teenage Pregnancy:*
Have you ever been pregnant? Be sure to include if you are currently pregnant and any past pregnancy that ended in an abortion, stillbirth, miscarriage, or a live birth after which the baby died.

no
yes
legitimate skip [male]

*Threatened with Gun or Knife:*
During the past 12 months, how often did each of the following things happen?
Someone pulled a knife or gun on you.

never
once
more than once

*School Expulsion:*
Have you ever been expelled from school?

no
yes
Appendix C

Between-family Variable Questions
Taken from the National Longitudinal Study of Adolescent Health (Add Health; Harris, 2009)

*Biological Father Status:*
Do you know anything about your biological father?

- no
- yes
- legitimate skip [living with biological father]

Is he still living?

- no
- yes
- legitimate skip [living with biological father]

*Biological Mother Status:*
Do you know anything about your biological mother—the woman who gave birth to you?

- no
- yes
- legitimate skip [living with biological mother]

Is she still living?

- no
- yes
- legitimate skip [living with biological mother]

*Family Economic Status:*
Are you receiving public assistance, such as welfare?

- no
- yes

Do you have enough money to pay your bills?

- no
- yes
Table 1

Signed pair differences by within-family variables

<table>
<thead>
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<th>Variable</th>
<th>Condition</th>
<th>Mean Difference 1</th>
<th>Mean Difference 2</th>
<th>Mean Difference 3</th>
<th>Mean Difference 4</th>
<th>Mean Intercept Difference</th>
<th>Cohen’s d Intercept</th>
<th>Mean Linear Difference</th>
<th>Cohen’s d Linear</th>
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<tr>
<td>Threatened with Gun or Knife</td>
<td>One Sibling – 2 or more times (n=105)</td>
<td>.139</td>
<td>-.010</td>
<td>-.091</td>
<td>-.046</td>
<td>.351</td>
<td>.390</td>
<td>-.125</td>
<td>.188</td>
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<td>One Sibling – 1 time (n=234)</td>
<td>.096</td>
<td>.027</td>
<td>.064</td>
<td>-.019</td>
<td>.049</td>
<td>.030</td>
<td>-.092</td>
<td>.124</td>
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<td></td>
<td>Neither Sibling (n=1993)</td>
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<td>.031</td>
<td>-.007</td>
<td>-.001</td>
<td>.029</td>
<td>-.025</td>
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<tr>
<td>School Expulsion</td>
<td>One Sibling (n=210)</td>
<td>.156</td>
<td>.057</td>
<td>.020</td>
<td>-.053</td>
<td>.127</td>
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<td>-.187</td>
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<td>Neither Sibling (n=2359)</td>
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<td>.023</td>
<td>.002</td>
<td>-.011</td>
<td>.029</td>
<td>-.032</td>
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### Table 2

*Absolute pair differences by between-family variables*

<table>
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<tr>
<th>Variable</th>
<th>Condition</th>
<th>Mean Difference 1</th>
<th>Mean Difference 2</th>
<th>Mean Difference 3</th>
<th>Mean Difference 4</th>
<th>Mean Intercept Difference</th>
<th>Cohen’s d Intercept</th>
<th>Mean Linear Difference</th>
<th>Cohen’s d Linear</th>
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<tbody>
<tr>
<td><strong>Parent Marital Status</strong></td>
<td>Divorced (n=161)</td>
<td>.442</td>
<td>.459</td>
<td>.476</td>
<td>.494</td>
<td>.716</td>
<td>.191</td>
<td>.437</td>
<td>.144</td>
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<td>Single parent (n=5)</td>
<td>.733</td>
<td>.433</td>
<td>.422</td>
<td>.622</td>
<td>.667</td>
<td>.103</td>
<td>.596</td>
<td>.663</td>
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<td></td>
<td>Married (n=1049)</td>
<td>.431</td>
<td>.424</td>
<td>.390</td>
<td>.446</td>
<td>.613</td>
<td>.390</td>
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<tr>
<td><strong>Biological Mother Status</strong></td>
<td>Separated – Dead (n=13)</td>
<td>.701</td>
<td>.709</td>
<td>.367</td>
<td>.500</td>
<td>.867</td>
<td>.821</td>
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<td>Separated – Alive (n=158)</td>
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<td>.446</td>
<td>.484</td>
<td>.477</td>
<td>.632</td>
<td>.008</td>
<td>.465</td>
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<td>Living With (n=1955)</td>
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<td>.431</td>
<td>.424</td>
<td>.464</td>
<td>.636</td>
<td>.412</td>
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<td><strong>Biological Father Status</strong></td>
<td>Separated – Dead (n=51)</td>
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<td>.400</td>
<td>.549</td>
<td>.410</td>
<td>.690</td>
<td>.131</td>
<td>.385</td>
<td>.041</td>
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<td>Separated – Alive (n=522)</td>
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<td>.447</td>
<td>.442</td>
<td>.458</td>
<td>.643</td>
<td>.037</td>
<td>.443</td>
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<td>Living With (n=1409)</td>
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<td>.438</td>
<td>.397</td>
<td>.458</td>
<td>.623</td>
<td>.398</td>
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<td><strong>Need Public Assistance</strong></td>
<td>Yes (n=261)</td>
<td>.464</td>
<td>.488</td>
<td>.441</td>
<td>.545</td>
<td>.695</td>
<td>.140</td>
<td>.511</td>
<td>.293</td>
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<td></td>
<td>No (n=1983)</td>
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<td>.431</td>
<td>.432</td>
<td>.461</td>
<td>.622</td>
<td>.410</td>
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<td><strong>Money for Bills</strong></td>
<td>Not Enough (n=460)</td>
<td>.474</td>
<td>.457</td>
<td>.476</td>
<td>.512</td>
<td>.619</td>
<td>.191</td>
<td>.486</td>
<td>.254</td>
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<tr>
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<td>Enough (n=1668)</td>
<td>.445</td>
<td>.434</td>
<td>.422</td>
<td>.461</td>
<td>.638</td>
<td>.103</td>
<td>.399</td>
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</table>
Figure 1. Two examples of sibling differentiation in depression over time.
Figure 2. Signed pair differences in slopes of depression by within-family variables.
Figure 3. Absolute pair differences in slopes of depression scores by parent marital status.
Figure 4. Absolute pair differences in slopes of depression scores by biological parent status.
Figure 5. Absolute pair differences in slopes of depression scores by family economic status.