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Political conflict, child mental health, and cognitive development

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Political conflict, child mental health, and cognitive development

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Abstract

Children living in the occupied Palestinian territories are exposed to poverty as well as continued physical and psychological violence and human rights violations, leading to low levels of mental health compared to children in Western countries. We use test score and survey data on approximately 4,000 students in grades 5 to 9 in the West Bank to study the effect of poor mental health on cognitive development. We show that low cognitive test scores are significantly linked with measures of mental health such as the Birleson depression self-rating scale or the parent-rated Strengths and Difficulties (SDQ) scores also after controlling for a wide range of potential confounders. Using self-reported exposure to potentially traumatizing events related to the Israeli-Palestinian conflict as instruments for the prevalence of mental health problems, we find evidence for a causal link between mental health and cognitive development. Since our estimators identify the effect only for those whose exposure to potentially traumatizing events has impaired their mental health (non-resilient types), we find IV estimates that are substantially larger than OLS estimates. We conclude that physical and psychological violence related to political conflict harms children's mental health and thus impairs their cognitive development. Although in the long run, addressing the underlying causes of the Israeli-Palestinian conflict is preferable, the results of this study call for short-term measures to improve the mental health and thus the cognitive ability of Palestinian children, such as increased availability of psychiatric counseling in schools and communities.

JEL classification: O15, J13, I15, I31

Keywords: child mental health, cognitive development, trauma, West Bank

1 Introduction and background

In its effort to set priorities among proposals for confronting the world's most important challenges, the Copenhagen Consensus 2012 found public health interventions in pre-school and school aged children to have top priority (Kydland et al., 2012). These interventions have been identified on the grounds of their low costs and high economic returns. Indeed, recent research in education, health and development economics has highlighted the crucial role of early life health (at all stages of infancy and childhood) in human cognitive and non-cognitive development and subsequent later-life outcomes. The importance of early life circumstances has been shown both theoretically (Cunha and Heckman, 2007) and by providing credible evidence from observational data and cleverly designed field experiments (Gertler et al., 2013). To name but a few examples, this literature has looked at the effects of intrauterine malnutrition and infection (Almond and Currie, 2011), low birth weight (Black et al., 2007), early childhood malnutrition (Alderman et al., 2006, 2009; Maccini and Yang, 2009), anemia (Bobonis et al., 2006), iodine deficiency (Field et al., 2009), infectious diseases like malaria (Thuilliez, 2010), or worms (Miguel and Kremer, 2004; Bleakley, 2007). This literature implies that policy interventions that increase schooling outcomes by improving child health are preferable to interventions that simply increase the number of years in school (Paxson and Schady, 2007; Alderman and Bleakley, 2013).

Most of the existing studies on the link between health and cognitive development in both developed and developing countries have focused on physical health. However, poor mental health is another emerging public health priority (Patel et al., 2007). Globally, depression is the top cause of illness and disability, and suicide ranks third among causes of death during adolescence. Half of all mental health disorders appear to start by age 14, but often go unrecognized and untreated, with serious consequences for mental health throughout life (WHO, 2014). Compared to the effects of poor physical health, e.g., undernutrition or childhood infections, on cognitive development, little is still known about the link between poor mental health in childhood and long-term outcomes mediated especially through cognitive development. This

is despite the possibility that the effects of poor mental health may be more important than those of poor physical health.

Studies addressing effects of mental health often investigate Attention Deficit Hyperactivity Disorder (ADHD) because it is the largest single diagnosis in mental health problems in Western countries (Currie and Stabile, 2009). Descriptive results point to children with hyperactivity symptoms suffering large negative consequences: they have worse outcomes in adolescence and young adulthood, for example, they obtain less schooling, have higher retention rates, are less likely to graduate from high school or to attend college (Currie, 2009; Loe and Feldman, 2007), and they may even achieve lower family income in later life (Goodman et al., 2011).

Research on long-term effects of poor mental health in developing countries is rare. One important reason for this knowledge gap is lack of data. The present paper adds to the literature on the effects of mental health on cognitive development among school-aged children by using newly collected data from the West Bank. The West Bank is not just economically poor and suffering from weak institutions. It is a region affected by a long-lasting violent political conflict, resulting in instability, violence, and other adverse life circumstances. Children living in this region are exposed to recurrent physical and psychological violence and human rights violations – mostly but not exclusively by the Israeli army and settlers (Giacaman et al., 2007). In such a context, children and young adolescents face severe development challenges, both in terms of poor physical and mental health.

As in the context of physical health, the main empirical challenge in studying the effects of childhood mental health on cognitive development is that health, educational attainment and cognitive ability may be determined simultaneously and even strong associations do not necessarily reflect causal effects. Health and education outcomes are influenced by choices made by children, their parents, and the larger family. Thus theoretically plausible causal links leading from (childhood) mental health to cognitive development may be hard to identify from observational data. Low educational attainment may be explained by confounders, such as poverty, educational background, physical health, malnutrition, or bad parenting styles, that

are in turn closely related to mental health problems. In fact, the identification problem might be even more severe than with physical health.

In the present paper, we use the exceptional circumstances in the West Bank to shed light on the relationship between the experience of traumatic events, poor mental health and educational outcomes. Potentially traumatizing events may include experiencing or witnessing physical assault, terrorist attacks, military combat, imprisonment, or public humiliation. Previous research had found that about one third of the Palestinian youth have been individually exposed to traumatic events, such as being beaten by Israeli army, being body searched or interrogated. Two thirds have experienced collective traumatic events such as being exposed to sound bombs and tear gas, and witnessing the humiliation or even the killing of friends, neighbors, or strangers (Giacaman et al., 2007). More than one third of Palestinian students meet criteria for Post Traumatic Stress Disorder (PTSD) and may be in need of mental health interventions (Abdeen et al., 2008; Lavi and Solomon, 2005; Pat-Horenczyk et al., 2009; Harel-Fisch et al., 2010; Lev-Wiesel et al., 2007; Thabet et al., 2014). Further, exposure to traumatic events is related to more pessimistic future orientation (Lavi and Solomon, 2005), depressive symptoms and decreased life satisfaction in adolescence (Qouta et al., 2008).

Exposure to traumatic events can severely burden mental capacity and information processing, it has been shown to affect concentration and memory capacity (Yehuda and McEwen, 2004). Especially recurrent traumatic events promote developing of Posttraumatic Stress Disorder (PTSD), which is the most prevalent psychological diagnosis in this context. Yehuda (2004) reports a lifetime prevalence about 8-9% in the U.S. – with PTSD developing especially in those who repeatedly experience traumatic events. Individuals who are diagnosed with PTSD have difficulties in regulating memories or emotional content, reliving traumatizing events in the form of nightmares or flashbacks. They have difficulty falling asleep and experience irritability and an impaired concentration. Research has documented many ways in which exposure to war-related traumatic events is associated with changes in behavior, e.g., risk seeking (Voors et al., 2012), physical health problems (Akresh et al., 2012), mental distress (Pat-Horenczyk et al., 2009), and in even long-term psychopathology in children and adolescents (Lustig et al., 2004; Barenbaum et al., 2004; Betancourt and Williams, 2008).

So far, only very few economic studies exist that address causality between mental health and educational, developmental or labor market outcomes. Some recent papers use a sibling fixed effects approach to control for unobserved confounders at the family level. Currie and Stabile (2006, 2007) find that children with symptoms of hyperactivity in the U.S. and Canada have significantly worse achievement test scores and a much higher probability of repeating a grade or of being in special education and the effects of mental problems are larger than those of physical health problems. Smith and Smith (2010) use retrospective data from the U.S. Panel Study of Income Dynamics and find long-lasting negative effects of psychological problems in childhood on adult education and earnings, especially if mental problems in childhood continue into adulthood. Among those reporting childhood depression, about 44% have psychological problems as adults and the authors roughly estimate an individual's lifetime cost of childhood psychological problems of about 300,000 USD. Finally, based on Add Health data and also employing family-fixed effects models, Fletcher (2014) reports ADHD-related earnings reductions of about 30%. Even when controlling for years of education and co-morbidity, he finds an negative effect on labor force participation rates of about 10 percentage points among those ever diagnosed with ADHD.

It must be noted, however, that some of the papers using sibling fixed effects report estimates that are even larger than OLS estimates, which in our view casts some doubt on this identification strategy. Sibling fixed effects identify the causal effect only if the onset of mental illness in one child does not change parental investments into the health or education of another child. If a mental health shock to one child reduces this child's capacity to learn, education investments in that child will have lower returns and the parents might react by reallocating educational investments to the non-affected child (whose *relative* returns have increased). Thus, sibling fixed effects might actually overestimate the direct effect of poor mental health on educational attainment.

Instead of sibling fixed effects, Johnston et al. (2014a) suggest an instrumental variables approach (among other alternative strategies) to identify the causal effect of poor mental health on educational attainment. Their idea is very similar to what we do in the present paper: they use a child's experience of a potentially traumatizing event as instrument. The authors are

careful to use only those traumatic events that are unlikely to change the child’s own educational investment directly or the investment of the parents in their children. For instance, child illness or injury may interrupt learning, and the death of a parent may directly affect family income or total parental time allocated to raising that child. In contrast, the experience of the death of a friend should affect cognitive development only via its effect on mental health. Using “loss of friend” as instrument yields small and insignificant estimates. However, this may be explained by the fact that losing a friend is a rare event and identification effectively relies on small numbers of observations. In our study, traumatizing events are a lot more common, so that achieving statistical significance is less of a problem.

Another recent study that is closely related to ours is Brück et al. (2014). The authors estimate the “reduced form” effect of local violent conflict on high school exams in the West Bank. Specifically, they focus on the period 2000-2006 (the Second Intifada, which was characterized by high levels of violence) and estimate the effect of the number of fatalities at the school locality in the year preceding the exam on pass rates. Using year and school fixed effects to control for unobserved locality and time effects, they find significantly decreasing pass rates with each additional fatality. Moreover, fatalities closer to the exam dates exerted stronger effects. Since they use administrative data, the authors are not able to identify causal channels, but they speculate that mental health might be one important mechanism by which politically motivated violence in the West Bank translates into worse educational attainment. Our paper directly addresses this gap in the causal chain, albeit in somewhat younger children, and using survey information on individual exposure to violence.

Based on a school-based sample of roughly 4,000 children in grades 5 to 9, we show that mental health is in fact poorer in the West Bank than in European countries such as Britain or Sweden. Further, we show that low cognitive test scores are significantly correlated with measures of mental health such as the Birmleson depression self-rating scale or the parent-rated Strengths and Difficulties (SDQ scores), also after controlling for a very wide range of potential confounders. Using self-reported exposure to (carefully selected) potentially traumatizing events – related to the Israeli-Palestinian conflict – as instruments, we find additional evidence for a causal link between mental health and cognitive development. In fact, we obtain IV es-

timates that are larger than OLS estimates. This is plausible if we interpret our estimators as local average treatment effects, i.e., they reflect the effect of poor mental health on cognitive development for those whose exposure to traumatizing events has impaired their mental health. An alternative explanation for the large IV estimates would be that our exclusion restriction is invalid and that traumatizing events affect cognitive development also through other channels than mental health. We address this concern in a series of robustness checks and so far, we find no evidence that our instruments are invalid. Yet independent of the interpretation, our results establish a clear link between exposure to political violence and cognitive development and support the policy conclusion that extra effort must be given to shield children from experiencing traumatizing events.

The remainder of the paper is structured as follows. In the next section, we describe our sample of students in the West Bank and the measurement of key variables. Section 3 shows descriptive evidence on the link between mental health and cognitive development. In Section 4 we describe our identification strategy. Instrumental variables regression results and robustness checks are reported in Sections 5 and 6, respectively. Section 7 concludes.

2 Data and measurement

The data we use have been collected in May to September 2013 in the context of a multidisciplinary research project on the determinants of health and cognitive development in the West Bank and East Jerusalem, funded by the German Research Foundation (DFG). The general aim of the project is to contribute to the research on causal pathways between health, schooling, and cognitive ability. The study population consists of all students in the West Bank in grades 5 to 9 (aged 10 to 15) at single-sex schools administered by the Palestinian Authority or the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA).¹ 100 schools have been randomly selected stratified by school authority (60 governmental, 40 UNRWA) and by region (proportional to size). From each selected school, 60 students were randomly selected, stratified by grade (twelve students from each grade level), yielding a gross

¹Private schools, gender mixed schools and schools missing one or more of grades five to nine have been excluded from the study population. 436 schools matched our sampling requirements, among which there were 382 governmental schools (160 boys/222 girls) and 54 UNRWA schools (20 boys/34 girls)

sample of 5,981 students. Some of the selected schools had less than twelve students in some of the targeted grades. Twice as many girls schools than boys school met our sampling requirements, hence girls are overrepresented in our student sample (4,004 girls and 1,957 boys).

Data collection consisted of several different parts: (1) a standardized cognitive test administered in class, (2) a student health questionnaire answered by the students in class, (3) a nutrition diary administered by school nurses, (4) anthropometric measurements collected by school nurses, (5) a school principal questionnaire, (6) grades obtained from school records, and (7) a parental background questionnaire (paper and pencil – administered at home). Due to the nature of the sample and the data collection mode (group administered tests), participation rates were high (all student-reported instruments >95%, parental questionnaire 84%). Among those who participated in the cognitive test (5,739 students) we also have measurements of mental health for at least 78% (4,483 students).² After deletion of cases with missing values, approximately 4,100 cases remain for the analyses presented below (under full specification, see Table 3). Our collected data provide us with individual measures of cognitive ability, mental health, and exposure to potentially traumatizing events, which we describe in more detail below. In addition, the data include broad information on physical health, health behavior, anthropometrics, family background, including data on income, wealth and on parents' investments into health and education of their children, as well as context data on school resources and the quality of schooling.

2.1 Mental health measures

We use two survey-based instruments for measuring student's mental health, one answered by the student and the other reported by the parents. The depression self-rating scale (DSRS), also known as the Birleson depression scale, was developed for children between the age of 8 and 14 years (see, e.g., Birleson et al. (1987) for details). Students are asked to rate themselves with regard to the occurrence of depressive symptoms during the preceding week. Exemplary items are "I enjoy the things I do as much as I used to", "I feel very lonely", "I am easily cheered up", "I feel like running away". The DSRS used in our study consists of 17 different items,

²97% of students with cognitive test score filled out a depression self-rating scale (5,547 students) and for 78% we received a parent-report on mental health (4,483 students).

each with answer categories “mostly” (0), “sometimes” (1), or “never” (2), with scoring in the direction of depression. Children who score 14 or more out of 34 points are classified as having abnormal depressive symptoms.³

The Strengths and Difficulties Questionnaire (SDQ) is a brief screening questionnaire for 3-16 year olds. Three different variants of the questionnaire were developed to be administered to children, parents or teachers, respectively. We used the parent version, which was part of the parental background questionnaire. The SDQ consists of 25 items which cover positive and negative attributes, each answered with a response “not true” (0), “somewhat true” (1), “certainly true” (2). Each of the five SDQ subscales assesses different dimensions of functioning:

- Emotional symptoms, e.g. “often unhappy, downhearted or tearful”
- Conduct problems, e.g. “often has temper tantrums or hot tempers”
- Hyperactivity/inattention, e.g. “constantly fidgeting or squirming”
- Peer relationship problems, e.g. “picked on or bullied by other children”
- Prosocial behavior, e.g. “shares readily with other children”

Conduct problems and hyperactivity are often summarized as “externalizing” problems, which are related to deviant and aggressive behaviors, whereas emotional symptoms and peer problems are summarized as “internalizing” symptoms, which are linked to anxiety and depression (see e.g. Currie, 2009). The total score for assessing mental health problems does not include the prosocial behavior score (Goodman, 1997). Children who score 17 or more out of 40 points are classified as having abnormal difficulties. Children who score 14 to 16 are classified “borderline”.⁴ Our measures of mental health show good internal consistency, for both total scales as well as the internalizing and externalizing sub-scales.⁵

According to our sample, about 42% of students aged 11 to 15 years have at least borderline symptoms of difficulties measured by the parent-reported SDQ, and according to their

³The original test consists of 18 items with threshold of 16 for classifying depressive symptoms. We found that girls very often answered “never” regarding the item ‘I like to go out to play’. We believe this has nothing to do with depression but rather may represent a cultural issue, i.e., girls are just less likely to play in the streets than boys. The item was thus skipped from the analysis.

⁴These boundaries are derived from the normative distribution in the UK, see <http://www.sdqinfo.com/> for details.

⁵One of the conduct problems (‘Often fights with other children’) was accidentally omitted of the instrument, i.e. the scale representing conduct problems consists only of four items and was scaled up to a maximum of 10.

self-reports, about 28% have abnormal depressive symptoms (see Table 1). These are fairly large proportions when compared to corresponding figures from Western countries such as the U.S., Britain or Sweden. For instance, in the U.S. and Britain, less than 15% of children of the same age have borderline or abnormal difficulties, and only 7% of Swedish children have abnormal self-reported depressive symptoms. Our findings clearly demonstrate that children and young adolescents in the West Bank suffer from higher difficulties levels and from a higher prevalence of depressive symptoms than children of the same age in Western countries.

Table 1: Summary of mental health measures, West Bank sample in international comparison

	West Bank (11-15 yrs.)	United States ^a (11-14 yrs.)	Great Britain ^a (11-15 yrs.)	Sweden ^b (13-17 yrs.)
SDQ				
total score (mean)	12.7	7.1	8.2	
externalizing (mean)	6.5	4.0	4.7	
internalizing (mean)	6.1	3.0	3.6	
normal (%)	57.6	87.3	84.6	
borderline (%)	17.3	5.2	7.8	
abnormal (%)	25.1	7.5	7.6	
DSRS				
total score (mean)	10.6			7.1
normal (%)	71.6			7.0
abnormal (%)	28.4			93.0

^a Norms derived from nonclinical populations, parent-reported SDQ; source: <http://www.sdqinfo.com/>.

^b Derived from Ivarsson and Gillberg (1997).

Measurement error is an important concern when assessing child mental health because assessors like parents, teachers or children themselves tend to report differently on behavioral and emotional problems (Goodman et al., 2000; Johnston et al., 2014a,b). Different individuals may not only have different perceptions of what constitutes abnormal behavior. Childrens' behavior may also vary by setting, e.g., at school and at home, and children may not always report symptoms of poor mental health when asked by their teacher or parents. Existing studies show that the self-assessments of children have less explanatory power than parents' or teachers' assessments (Goodman et al., 2000; Johnston et al., 2014b). We use both parent- and child-reported measures of mental health to address possible measurement error problems due to differences in assessors, although it must be noted that the SDQ and DSRS measure different

dimensions of mental health. The DSRS is usually used for screening depression and morbidity in clinical settings whereas the SDQ is an widely excepted instrument for nonclinical screening, especially for diagnosing ADHD. Our measurements of depressive symptoms based on the DSRS are only moderately correlated with the total SDQ score ($r=0.25$) and as expected show a slightly stronger association with emotional and peer problems ($r=0.23$) than with conduct problems, hyperactivity, and inattention ($r=0.20$).

2.2 Cognitive test scores

Cognitive ability is our key outcome. It is measured by three major cognitive tests (verbal, numerical, and figural), each consisting of several subtests covering a wide range of item content (e.g., analogies, series, sentence completion, vocabulary). The subtests were selected and adapted from established tests of general ability: the Cognitive Ability Test (CAT; Thorndike and Hagen (1971), Milta - a Hebrew version of the Lorge Thorndike Test (Ortar and Shachor, 1980), Standard Progressive Matrices (Raven, 1983), and the Cattell and Cattell (1965) Culture Fair Intelligence Test. The original cognitive test included 182 items; after item analysis, one inadequate item was deleted from the analysis, yielding a total of 181 items. Table 2 shows a high grade of internal consistency (Cronbach's α) of the 12 subscales.

The raw cognitive test score, computed as the percentage of correctly answered items, has a left-skewed distribution with arithmetic mean of 60.5 and standard deviation of 17.0 score points, see Figure 1. Cognitive test scores are clearly related to grade and sex. Average scores increase from on average 50.6 points in grade 5 to 67.5 in grade 9. Regressing the cognitive test score on grade and age shows an average improvement of about 6.2 points per grade. Independent of school grade, girls perform better than boys, with on average 52.4 points in grade 5 (47.0 for boys) and 70.3 points in grade 9 (61.8 for boys).

2.3 Control variables

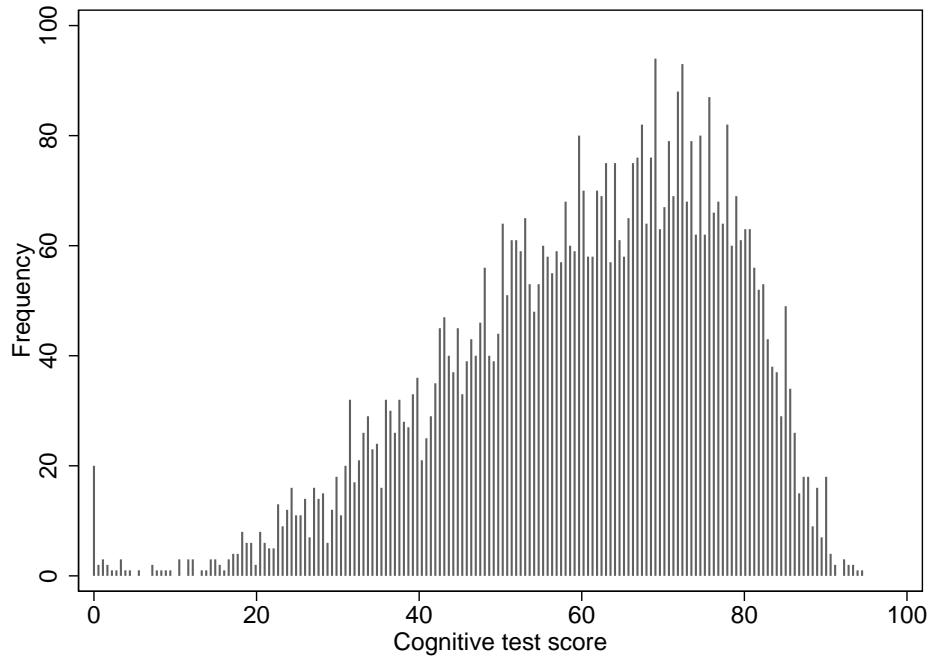
The main empirical problem in studying the effects of mental health on cognitive development is that health and cognitive development may be determined simultaneously by confounders on the individual, family, or community level, such as physical health, parental education and

Table 2: Subtests of the cognitive test

Subtest no. ^a	Subtest name	Source ^b	No. of items	Cronbach's α
Verbal tests				
1.	Verbal classification	CAT (54)	17	.85
3.	Verbal analogies	CAT (54)	18	.84
6.	Vocabulary	Milta (40)	30	.81
9.	Verbal oddities	Milta (19)	13	.77
12.	Sentence completion	Milta (23)	16	.81
Numerical tests				
7.	Number series	Milta (18)	12	.85
11.	Word arithmetic problems	Milta (18)	13	.78
Figural tests				
2.	Figure classification	CAT (45)	15	.75
4.	Figure analogies	CAT, Figure analysis (45)	15	.88
5.	Matrices	SPM, Sets C, D (24)	8	.83
8.	Figure series	CFIT, Series (12)	10	.79
10.	Figural oddities	CFIT, Classifications (14)	14	.63

^a In order of presentation.

^b Original number of items in parentheses.

**Figure 1:** Distribution of cognitive test score

family income or the quality of schools and health care. Our data contain extensive information on a large number of critical covariates. Besides demographic characteristics (age, sex) and household structure we are able to control for a large set of variables characterizing student's socio-economic background. In addition, our data include self- and parent reports on retrospective (e.g., birth weight, infectious diseases) and current physical health, and anthropometric measurements, such as height, weight, waist circumference and hemoglobin levels. The school context is captured by a learning climate index composed of 13 items on disciplinary problems at school (e.g., delay and absence of students and teachers, students bullying and fighting each other as well as the teacher, theft, vandalism) modeled after the TIMSS school principal questionnaire (Cronbach's $\alpha=0.95$). As an alternative to the school climate index we also use school-fixed effects in our regressions. School-fixed effects should capture a range of location-specific unobserved determinants of test scores and mental health. The following detailed list shows the set of covariates we use in our regressions reported in the next section. Table A.1 in the Appendix shows sample averages and proportions of all covariates as well as differences in averages and proportions between students with normal and abnormal mental health scores.

- Demographics: sex, age, month of birth
- Child physical health: low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis
- Household structure and socio-economic status: lives with father, with mother, number of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index (whether household owns a TV, mobile phone, DVD player, air condition, cars, etc.), number of rooms
- School climate: index of principal-reported behavioral problems of student body
- Grade point average in school year 2010/2011

The last item, grade point average, deserves a brief discussion. We know the final grades in school years 2010/11 and 2011/12 as obtained from the school records. To measure the

student's past educational performance we computed the grade point average (GPA) as the sum of grade points in the following subjects taken by all students: Arabic, mathematics, sciences and religious education. In each subject, students are graded on a scale from 0 to 100, with grade points below 50 being a "fail". Academic performance and cognitive ability are strongly correlated, independent of grade or age, respectively (e.g., $r=0.54$ in grade 5, $r=0.51$ in grade 9). Our motivation to use past GPA as control variable rather than outcome is that past GPA should contain a wide range of unobserved influences on cognitive ability up to the point in time GPA was determined. This allows a "value-added" interpretation of our regression estimates and hence a more convincing estimation of causal effects of more recent students' experiences on school performance and cognitive development.

3 Descriptive results

We begin by showing the correlation between measures of mental health and cognitive development. The top left panel (a) of Figure 2 shows a strong negative relationship between parent-reported poor mental health (SDQ) and cognitive test scores. This graph clearly shows a gradient, that is, each additional indicator of internalizing or externalizing problems is related to impaired cognitive development along the entire range of mental health scores. A simple classification into "borderline" or "abnormal" cases thus does not seem appropriate for the purpose of our analysis. The almost linear association shown in Panel (a) is, of course, partly driven by joint determinants – observed and unobserved – of test scores and mental health.

The relationship between children's self-reports of depressive symptoms and test scores is less clear. In the top right panel (b) of Figure 2, test scores first appear to *increase* with additional symptoms, then decrease, and finally increase again. Hence students with very low depression scores have relatively low cognitive test scores, and students with very high depression scores have relatively high cognitive test scores. At this point, we can only speculate about the reasons for this pattern. Possibly very high and very low depression self-ratings are as much due to response patterns as they reflect true underlying mental health. For instance, low ability students might have been less motivated in general to answer our questionnaire truthfully (and reveal symptoms of mental health problems), which is why they are overrepresented on the left

margin of the DSRS distribution. In any case, these results suggest that children's self reports of depressive symptoms may be of limited use and may lead to questionable empirical findings.

Fortunately, most students are in the middle part of the DSRS distribution where the relationship with test scores and poor mental health is negative. This is shown in panels (c) and (d) of Figure 2, where we have excluded the best and worse 10% in terms of self-reported mental health and keep only those who score 6 to 23 points on the SDQ scale or 4 to 17 on the DSRS scale. Now we find similar gradients across different sources of information. Thus in our regression analyses below, when using DSRS as mental health measure, we use this restricted sample.

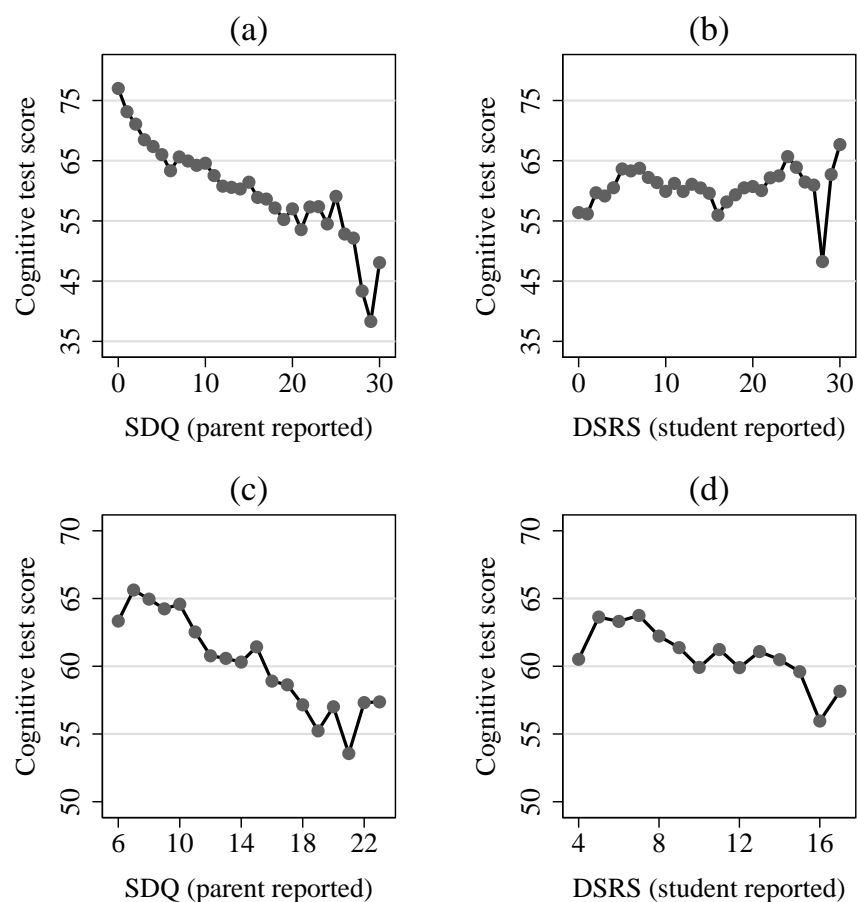


Figure 2: Cognitive test score and mental health measures. Panels (a) and (b): full sample; Panels (c) and (d): best and worse 10% in terms of mental health excluded (DSRS: 4 to 17 score points; SDQ: 6 to 23 score points)

Table 3 reports the results of OLS regressions of cognitive test scores on measures of mental health and varying sets of covariates. Each reported coefficient comes from a sepa-

rate regression model. The association between cognitive ability on the one hand and parent-reported SDQ total scores, SDQ based classifications of borderline or abnormal symptoms, or scores for internalizing and externalizing problems on the other hand, remains statistically significant even when controlling for the full set of covariates. Including household structure and SES substantially reduces the estimated coefficients, which suggests that cognitive ability and mental health are jointly related to household structure, parental education, employment status, and income. Controlling for past academic achievement (GPA 2011) further reduces the regression coefficient by a substantial margin. This makes sense as we believe that GPA 2011 represents the cumulative effect of all unobserved influences on individual, family, and community levels on cognitive test scores, which might as well be related to contemporaneous mental health. Controlling for school climate or school-fixed effects hardly changes the SDQ coefficients. Overall, our regressors are able to account for more than two thirds of the raw correlation. Still, the remainder is significant, although the effect size appears to be moderate. For instance, students diagnosed to have abnormal difficulties score on average about 1.7 points lower on the cognitive test than students classified as "normal". Compared to the average cognitive achievement per grade this difference corresponds to the achievement gap of 1/3 of a grade or school year, respectively.

As discussed above, our regressions for DSRS are limited to the sample that excludes the top and bottom 10% of students in terms of their total score. The results shown in Table 3 show that symptoms of depression reported by the student are significantly linked with cognitive ability only if past GPA is not controlled for. At least two explanations for this finding come to mind. First, parent-reported strengths and difficulties are more reliable measures of mental health problems in general. Second, the SDQ score measures mental health problems that are more relevant for cognitive development than what is measured by the depression self-rating scale.

4 Exposure to conflict, mental health, and cognitive development

In our descriptive OLS regression, we have included observed covariates which account for a large part of the relationship between mental health and cognitive ability. Nonetheless, con-

Table 3: Associations between poor mental health and cognitive test scores: OLS results

Explanatory variable	Dependent variable: cognitive test score					
	(1)	(2)	(3)	(4)	(5)	(6)
SDQ: total score .	-0.570 (0.045)	-0.535 (0.043)	-0.383 (0.042)	-0.178 (0.038)	-0.176 (0.038)	-0.169 (0.035)
SDQ: at least borderline	-5.273 (0.530)	-4.887 (0.517)	-3.567 (0.523)	-1.445 (0.481)	-1.452 (0.478)	-1.354 (0.390)
SDQ: abnormal	-5.692 (0.586)	-5.233 (0.558)	-3.813 (0.592)	-2.043 (0.506)	-2.036 (0.502)	-1.693 (0.441)
SDQ: externalizing score	-0.820 (0.069)	-0.774 (0.070)	-0.622 (0.070)	-0.255 (0.067)	-0.252 (0.067)	-0.227 (0.055)
SDQ: internalizing score	-0.826 (0.083)	-0.758 (0.079)	-0.438 (0.075)	-0.249 (0.063)	-0.244 (0.063)	-0.254 (0.063)
N	4139	4139	4139	4139	4139	4139
DSRS: total score	-0.417 (0.077)	-0.414 (0.077)	-0.225 (0.070)	-0.060 (0.063)	-0.071 (0.064)	-0.073 (0.056)
DSRS: abnormal	-2.723 (0.676)	-2.622 (0.668)	-1.267 (0.644)	-0.153 (0.596)	-0.220 (0.602)	-0.213 (0.489)
N	3530	3530	3530	3530	3530	3530
Demographics	X	X	X	X	X	X
Physical health		X	X	X	X	X
Household structure & SES			X	X	X	X
GPA 2011				X	X	X
School climate					X	
School fixed effects						X

Note: Standard errors clustered on school-level in parentheses. Control variables: sex, age, month of birth, low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis, lives with father, with mother, # of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index, number of rooms, grade point average in school year 2010/2011, school fixed-effects.

cerns about the exogeneity of mental health remain. First, there may still be unobserved potential confounders. For instance, observable disadvantages, such as the absence of mother or father, low income, or unemployment are strongly associated with academic achievement and cognitive development, but also with mental health (see Table A.1 in the Appendix); we find a significantly higher prevalence of depressive, internalizing and externalizing symptoms of students from low-income and low educated families. This suggests that there may be other (unobserved) confounders on the family level, such as good or bad parenting. Second, there may be reverse causation. For instance, low cognitive ability and bad academic performance might affect self-esteem and promote the development of mental health problems. Children might also become victims of bullying in school or maltreatment at home because of their low academic achievement. This in turn can affect mental well-being. Low cognitive ability might also be related to the ability to cope with potentially traumatizing events. The presence of both unobserved heterogeneity and reverse causation would lead to OLS coefficients that overestimate the causal effect of mental health on cognitive development.

As described in the introduction, much of the literature on mental health and educational attainment has used sibling fixed-effects models for identification. Obviously, this strategy does only solve the problem of unobserved (and fixed) confounders on the family level. In the following, we propose an instrumental variables approach that uses exposure to potentially traumatizing events as source of exogenous variation in mental health to identify the causal effect of poor mental health on cognitive ability (see Johnston et al., 2014a). As described above, children and young adolescents in the West Bank grow up amidst war, violence and intrusion of human rights, and have a high probability of experiencing situations which may be potentially traumatizing.

In the context of post-traumatic stress disorder (PTSD), children are said to be at risk of trauma if they have been exposed to a psychosocial adversity or event that would be considered a stressor to most people and that may hinder normal functioning (Betancourt and Khan, 2008). The Diagnostic and Statistical Manual of Mental Disorders (DSM) defines trauma as an event that threatens an individual's life or physical integrity and involves a subjective response of fear, helplessness, or horror (Yehuda, 2004). As part of the health behavior questionnaire, students in

our study completed a Traumatic Events Checklist (TEC; Thabet, 2012), which consists of 27 potentially traumatizing events in the context of the Israeli-Palestinian conflict. The checklist was initially developed for studies in Gaza and has been adapted to the West Bank. To assess exposure to potentially traumatizing events students were explicitly asked to report what they experienced during the preceding 12 months. Exemplary events covered by the TEC are:

- “Have you learned that a family member/friend was killed?”
- “Have you witnessed the arrest of a family member/friend by the Israeli army?”
- “Have you been beaten or humiliated by the Israeli army/by settlers?”
- “Have you witnessed day/night raids by the Israeli army?”
- “Have you you/a family member/a friend been threatened of being killed?”
- “Have you had to wait long hours in front of checkpoints?”

We use these self-reported experiences of students in our sample as an assessment of their exposure to the political conflict in the West Bank. To be used as a valid instrument, exposure to violent and threatening events should affect mental health (instrument relevance), but should not affect cognitive development, educational attainment (e.g., time in school) or parental investments in education directly (exclusion restriction). Among our list of 27 events, not all are plausibly valid. For example, the destruction of the family’s home or the arrest or even loss of a family member may change economic and parental resources and resources invested in the child’s education. Injury or illness experienced by the student him-/herself may affect time in school and learning directly.

In contrast, the experience of threats and humiliations or witnessing or hearing about a friend being shot or arrested should have no direct impact on a child’s cognitive ability, but only an indirect effect through the channel of mental health. When considering behavioral and social problems, direct victimization, e.g., being beaten or humiliated, is expected to be a relevant instrument (Fowler et al., 2009), whereas threats and anxiety caused by sonic bombs, curfews, destruction of the neighbor’s or a friend’s house may especially affect mental health in the domain of emotional problems and depression.

Keeping these issues in mind, we summarized suitable TEC items into four groups and created an indicator variable for each (which equals one if the student reports to have expe-

rienced one of the grouped events and zero otherwise). Our first two instruments summarize potentially traumatizing events where the student him-/herself is directly exposed to physical and/or psychological violence: 'Humiliation' indicates direct victimization in terms of being beaten or humiliated by the Israeli army or by settlers. 'Raids' indicates whether the student has experienced raids by the Israeli army, either by day or by night. The instrument 'Threats' summarizes all reported threats of the student (threatened by shooting, of being killed or being used as a human shield, and threat of a family member of being killed). Finally, "Violence" indicates that the students has witnessed or heard about acts of violence against friends (but not family) or witnessed violence involving strangers. As a possibly more powerful summary instrument we also calculated the sum of these four indicators (normalized to the unit interval).

Table 4: Self-reported Frequencies of potentially traumatizing events

Type of event	Proportion (%)
Humiliation	13.4
Threats	17.6
Raids	20.3
Violence	53.6
Experienced any event	60.0
Av. no. of grouped events experienced	1.0

Table 4 reports the proportion of children in our sample who report to have experienced potentially traumatizing events which we use to instrument mental health. 60% of the students report to have been exposed to at least one the events, with witnessing or hearing about assaults on friends and strangers being the most prevalent. These proportions appear to be quite high, but if compared to numbers collected during more intense periods of the Israeli-Palestinian conflict, they are moderate. For instance, studies conducted during the First Intifada (1987-1993) found that 74% of the children had experienced assaults towards family members, 38% had lost a close person to prison, 88% reported night raids at home and 51% reported having been beaten by Israeli Defense Forces (IDF) soldiers (Abu Hein et al., 1993). During the Second Intifada (2000-2006), 77% of the children had witnessed a killing, 88% experienced night raids at home, and 30% had a family member injured (Qouta et al., 2005).

5 IV regression results

Table 5 shows the results of our IV estimations. In each model, we use the total SDQ score as mental health variable and include the full set of control variables listed in Section 2.3 as well as school fixed-effects.⁶ Since our instruments possibly perform differently and identify causal effects for different subpopulations, we first estimated IV models separately for each instrument (in increasing order of the proportion who experienced a corresponding event) and for the sum of all instruments as another single instrument. Before discussing the instrumental variables coefficients, we comment on both the reduced form and first stage estimates. The reduced form effects of exposure to traumatic events on cognitive test scores are always negative and statistically significant (at least at the 10% level). Events that are more often reported (i.e., which are more common) seem to have smaller reduced form effects.

All instruments have significant first stage effects on SDQ scores. Effects are similar in size, about two thirds of a point on the SDQ scale, with the exception of witnessing or hearing about violence, which is somewhat weaker. The first-stage F-statistics are below 10 for three out of four of our instruments. Thus results using these instruments alone would possibly suffer from a weak instruments problem. Only “raids” are sufficiently strong. Moreover, the sum of all instruments also has a sufficiently strong first stage.

Our instrumental variables estimates of the effect of mental health on cognitive test scores are significantly negative, with the exception of when witnessing or hearing about violence against friends or strangers is used as instrument. The size of the point estimates ranges between minus 1.3 and minus 4.0 percentage points on the cognitive test score per point on the SDQ total score. Our preferred estimate uses the normalized sum of self-reported traumatizing events and amounts to minus 2.2 percentage points, which corresponds to one third of a grade level difference. Compared with the OLS coefficients shown above these are very large effects. This is not an unusual finding when instrumental variables are used to estimate causal effects

⁶Results using DSRS scores as endogenous regressors are shown in Appendix Table A.2. The results are qualitatively similar, but generally stronger in the sense that the IV first stage coefficients of the instruments have much higher F-statistics. In other words, the relationship between our instruments (based on self-reported exposure) and mental health (based on self-reports as well) is much stronger. We currently interpret these results with some caution, because they could be explained by unobserved differences in reporting behavior, such as the general tendency to report “bad things” happening.

but as our a priori guess was that OLS would overestimate the causal effect it deserves some discussion. In the following we offer three possible explanations for this finding.

Table 5: IV estimates of the effect of mental health (SDQ score) on cognitive ability

	Instruments				
	Humiliation	Threats	Raids	Violence	Norm. sum
Reduced form	-2.767 (0.542)	-2.288 (0.509)	-0.815 (0.464)	-0.649 (0.392)	-2.970 (0.651)
First stage	0.716 (0.273)	0.672 (0.248)	0.868 (0.224)	0.482 (0.185)	1.395 (0.335)
F-stat.	6.894	7.355	15.009	6.808	17.358
IV estimate	-4.016 (1.622)	-3.571 (1.338)	-1.158 (0.604)	-1.316 (0.960)	-2.245 (0.670)
N	3,852	3,852	3,852	3,852	3,852

Note: Standard errors clustered on school-level in parentheses. Control variables: sex, age, month of birth low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis, lives with father, with mother, # of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index, number of rooms, grade point average in school year 2010/2011, school fixed-effects.

The first explanation is that mental health is measured with classical measurement error and thus OLS estimates are biased towards zero. Since our endogenous regressor is a continuous variable, we can easily check this by creating a dummy instrument that separates the upper and lower 50% in terms of the SDQ score and use this instrument to compute a Wald estimate. In our case this estimator is minus 0.15 with standard error 0.04, that is, very close (even smaller than) the original OLS estimate. We conclude that classical measurement error is not the reason for our large IV estimates.

Second, our single instrument IV estimates can be interpreted as local average treatment effects, i.e., the effect of poor mental health on cognitive test scores among those whose mental health was affected by the traumatizing events that we use as instruments. In other words, we estimate the effect for the group of non-resilient children, that is, for children who have

difficulties coping with traumatizing events. Therefore it is not implausible to find a large effect.

Third, our instruments may be invalid, for instance because they affect cognitive test scores via other channels than just mental health or because they are correlated with determinants of cognitive test scores that we do not observe. We will address this issue in the next section.

6 Robustness checks

We now address possible concerns regarding the validity of our instruments. We use the last model in Table 5 as baseline model and change this specification according to these concerns.⁷ First, the likelihood of experiencing various traumatic events might be correlated because such events tend to occur simultaneously in the same locations. Thus our instruments might be correlated with other traumatic events that affect cognitive development through various different channels as discussed above, although we already control for local differences in exposure to the Israeli-Palestinian conflict in a very generic way by including school-fixed effects. We therefore now control for *all other* traumatic events recorded in our student questionnaire (see column “All TECs” in Table 6). The main problem with this specification is that the first stage is practically lost, i.e., the effect of the traumatic events we use as instruments on mental health is still positive but insignificant. In other words, they do not contribute much to the explanation of mental health over and above all the other traumatic events. This is no surprise, because we deliberately excluded those events that affected near family, for example. Nevertheless, we note that – also conditional on all other traumatic events – our instrument has a significant reduced form effect on cognitive ability of about the same size as before. As an alternative, we control only for five salient events (in terms of their independent effect on cognitive test scores: hearing of or witnessing the arrest, shooting or killing of a relative, and being forced to leave one’s home). The results are shown in column “5 TECs” of Table 6. Again, the reduced form coefficient remains virtually unchanged compared to the base specification. The first stage now

⁷Results using DSRS as endogenous regressors are again reported in the Appendix. These results are qualitatively similar to those reported for SDQ but, yet again, stronger in the sense of a stronger IV first stage.

becomes significant but the F-statistic does not reach the rule-of-thumb value of 10. Overall, these two robustness checks suggest that the traumatic events we chose as instruments have an effect on cognitive development not only because they are correlated with other traumatic events. In that sense, our exclusion restriction does not seem to be violated.

Table 6: IV estimates of the effect of mental health (SDQ score) on cognitive ability, various robustness checks

	Specification				
	Base	All TECs	5 TECs	Excl. liars	Excl. abnormal
Reduced form	-2.970 (0.651)	-2.844 (1.034)	-2.809 (0.851)	-2.757 (0.887)	-3.432 (0.905)
First stage	1.395 (0.335)	0.595 (0.484)	1.040 (0.426)	1.127 (0.349)	0.647 (0.277)
F-statistic	17.358	1.514	5.958	10.423	5.429
IV	-2.245 (0.670)	-5.957 (4.903)	-3.157 (1.414)	-2.505 (1.007)	-5.309 (2.395)
Nobs	3,852	3,852	3,852	2,861	2,216

Note: Standard errors clustered on school-level in parentheses. Control variables: sex, age, month of birth low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis, lives with father, with mother, # of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index, number of rooms, grade point average in school year 2010/2011, school fixed-effects.

Another concern might be that reporting the experience of traumatic events is not a valid instrument because it lies on the causal path from mental health to cognitive development. For instance, students with poor mental health could be more likely “get into trouble”, i.e., enter specific situations that could be traumatizing. They might also be more likely to report traumatizing events they have experienced because they lack resilience and do not as easily cope with them as others. Finally, they may also be more likely to just report traumatizing events that never happened. Being involved in conflict with the Israeli army or settlers might improve status among peers. If children with mental health problems report events that never happened, this would be part of their behavioral problems. We address these concerns in two different ways.

First we exclude children whose parents stated that their child often lies or steals (“Excl. liars”). This is one of the SDQ items and correlated with the report of traumatic events. For example, when parents say it is “often true” that their child lies or steals, the proportion of children reporting threats is 29%. When parents say it is “never true” that their child lies or steals, the proportion is only 15%. Similar differences can be found for the other events (humiliation: 23% vs. 11%, raids 27% vs 18%, violence 63% vs. 52%, average number of events: 1.4 vs. 1.0). Note that it is not clear whether liars report more traumatic events or whether those exposed are more likely to lie or steal. In any case, when liars are excluded from the regressions (see Table 6), the first stage becomes weaker as expected (but the F-statistic is greater than 10). Since the reduced form coefficient is again hardly affected, the resulting IV estimated even becomes somewhat larger than in the base specification.

Next we exclude children with borderline or abnormal mental health scores, i.e., children which – in a clinical setting – would most likely be classified as mentally ill (“Excl. abnormal”). This should alleviate some of the concerns that our results are due to the fact that mostly mentally ill report traumatic events. On the one hand, their exclusion reduces the strength of the first stage considerably. This was to be expected because we essentially take away a lot of the relevant variation in mental health. Nevertheless the first stage coefficient remains statistically significant (although with an F-statistic of only 5.4). On the other hand, the reduced form coefficient is somewhat larger than in the full sample, so that, despite the weaker first stage, the resulting IV estimator is much larger than in the base specification. We conclude from this finding that mental health effects on cognitive development are possibly stronger in children who are not classified as clinically ill. Actually, this corresponds to the descriptive results in Figure 2, Panel (a), where the steepest decline appears to be at the left hand side among those who score best in terms of mental health. Although our robustness checks cannot ultimately prove that our identification strategy is valid, at least they provide no evidence against its validity.

7 Discussion and conclusion

Identifying long-term causal effects of (early) childhood living conditions has recently become an important research topic in the economics literature. To date, most of this literature focuses

on the effects of poverty and poor physical health. However, poor mental health, also through its conceptual similarity with the lack of non-cognitive skills, may be the most important channel through which adverse early life circumstances translate into later life disadvantages in the labor market and other important areas of life. Perhaps with the exception of diagnosed attention deficits and hyperactivity (ADHD), only little is known about how poor mental health in childhood affects the development of cognitive skills and educational attainment. This paper adds to the literature on the effects of mental health on cognitive development among school-aged children using newly collected data on a sample of about 4,000 students in grades 5 to 9 in the West Bank. One particular strength of our data is that we have very detailed data on cognitive development, mental health, and the family and socio-economic background.

We find that indicators of poor mental health such as depressive symptoms, behavioral problems, inattention, social and emotional problems are significantly linked with low cognitive ability. This association holds even when controlling for a large set of potential confounders at the individual, family and school level. Notably, the relationship can be characterized as a gradient along the entire span of our mental health indices. That is, even for those who are in generally good mental health, small differences in mental health are associated with notable differences in cognitive ability.

To identify the causal effect of poor mental health, we use exposure to (specific) potentially traumatizing events as instruments. Children living in the occupied Palestinian territories are recurrently exposed to the consequences of a continuing violent political conflict, especially to poverty, physical and psychological violence and violation of human rights. Compared to children in Western countries, they have relatively poor mental health, and according to psychiatric assessments, more than one third of Palestinian students possibly meet criteria of post-traumatic stress disorder. Research has documented that exposure to conflict-related traumatic events, like witnessing people being wounded or shot, is associated with changes in behavior, physical health problems, depression and mental distress, which may even result in the long-run development of poor mental health in adulthood.

Our identification strategy requires that the selected traumatizing events affect cognitive development only via mental health. To ensure that our instruments satisfy this exclusion

restriction, we select self-reported exposure to traumatizing events that are likely to affect mental health but that have no direct effect on cognitive development (such as injury) or parental investments into education (such as death, injury or arrest of family member, destruction of homes, etc.). Our selected events include incidents of direct victimization, such as humiliation or threats by the Israeli army and settlers, and witnessing of or hearing about violent events involving friends and strangers. We find that these events are significantly related to poor mental health, also after controlling for our wide range of potential confounders.

Our IV results suggest that effects of mental health on cognitive development are indeed quite strong. In fact, we find IV estimates that are substantially larger than our OLS estimates. This is plausible, because our IV estimator identifies the effect only for those whose exposure to potentially traumatizing events has impaired their mental health (local average treatment effect). We interpret this as the causal effect for the group of non-resilient children. It is beyond the scope of our research to exactly characterize the determinants of resilience, i.e. how students and their families 'successfully' cope with trauma in the context of the Israeli-Palestinian conflict, but we note this is an important direction for future research. This is not only important for public health reasons but also to foster human capital development in the region to ensure a viable economic, social, and cultural development of the West Bank.

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A Appendix: Supplementary figures and tables

Table A.1: Descriptive statistics of selected covariates

	Mean	SD	Diff. abnormal–normal (SDQ) (t in parentheses)		Diff abnormal–normal (DSRS) (t in parentheses)	
Cognitive test score (0-100)	60.4981	16.9904	-6.9417	(12.3834)	-1.9263	(3.7754)
<i>Performance at school</i>						
GPA 2010/11	71.4584	17.1254	-7.2297	(12.4266)	-4.9203	(9.3342)
GPA 2011/12	68.8677	17.1528	-8.4548	(14.6077)	-5.0359	(9.6076)
<i>Demographics</i>						
Boys (%)	0.3302	0.4703	0.0693	(4.5462)	0.0262	(1.8929)
Age (yrs.)	12.8460	1.5188	-0.0324	(0.6183)	0.2502	(5.4207)
<i>Physical health</i>						
Height-for-age (z-score)	-0.1630	1.0559	-0.1502	(4.0670)	0.0058	(0.1754)
Hemoglobin (g/dl)	12.9466	1.3090	-0.0542	(1.1987)	-0.0358	(0.8980)
Low birth weight (<2,500g)	0.1505	0.3576	0.0241	(1.8065)	0.0034	(0.2605)
Not breastfed	0.0723	0.2591	0.0311	(3.6179)	0.0003	(0.0376)
Ever diagnosed chronic diseases:						
Asthma	0.0229	0.1498	0.0073	(1.3224)	0.0058	(1.2728)
Bronchitis	0.0171	0.1296	0.0094	(1.9800)	0.0026	(0.6750)
Diabetes	0.0059	0.0763	0.0074	(2.6631)	0.0035	(1.5698)
Ever diagnosed infectious diseases: Whooping cough						
Measles	0.0291	0.1682	-0.0021	(0.3375)	-0.0084	(1.6298)
Rubella	0.0140	0.1175	0.0075	(1.7869)	0.0028	(0.7902)
Mumps	0.0065	0.0804	0.0027	(0.9397)	-0.0033	(1.3415)
Chicken pox	0.3366	0.4726	0.0056	(0.3389)	-0.0208	(1.4563)
Scarlet fever	0.0055	0.0742	0.0058	(2.2858)	0.0011	(0.5064)
Hepatitis	0.0080	0.0890	0.0107	(3.4646)	0.0027	(0.9999)
<i>Family structure</i>						
Lives with mother	0.1997	0.3998	0.0698	(5.3758)	0.0605	(5.2314)
Lives with father	0.2544	0.4356	0.0760	(5.2841)	0.0651	(5.1170)
No. of siblings	5.1699	2.2670	0.1858	(2.5016)	0.1861	(2.5292)

Table A.1: (continued)

	Mean	SD	Diff. abnormal–normal (SDQ)		Diff. abnormal–normal (DSRS)	
			(t in parentheses)		(t in parentheses)	
<i>Socio-economic and educational background</i>						
Household net monthly income (NIS): <1500	0.3714	0.4832	0.0671	(4.0356)	0.0518	(3.1759)
1500-2499	0.3204	0.4667	-0.0116	(0.7210)	-0.0027	(0.1698)
2500-3999	0.1589	0.3656	-0.0202	(1.5969)	-0.0238	(1.9170)
4000-5000	0.0805	0.2721	-0.0122	(1.3018)	-0.0069	(0.7553)
>5000	0.0688	0.2532	-0.0230	(2.6402)	-0.0183	(2.1808)
Mother's employment status: Empl./self-empl.	0.1219	0.3272	-0.0286	(2.5544)	-0.0114	(1.0492)
unemployed, seeking work	0.0806	0.2722	0.0371	(4.0306)	0.0103	(1.1273)
unemployed, not seeking work	0.0115	0.1067	0.0002	(0.0670)	0.0007	(0.1986)
unable to work/disabled/permanently sick	0.0032	0.0565	0.0020	(1.1116)	0.0002	(0.0838)
homemaker	0.7779	0.4157	-0.0087	(0.6140)	-0.0019	(0.1396)
retired	0.0049	0.0699	-0.0021	(0.8557)	0.0022	(0.9249)
Father's employment status: empl./self-empl.	0.6585	0.4743	-0.0714	(4.2826)	-0.0577	(3.5115)
unemployed, seeking work	0.2262	0.4184	0.0264	(1.7845)	0.0291	(2.0016)
unemployed, not seeking work	0.0351	0.1840	0.0168	(2.6345)	0.0084	(1.3340)
unable to work/disabled/permanently sick	0.0305	0.1721	0.0191	(3.2014)	0.0120	(2.0268)
homemaker	0.0326	0.1776	0.0184	(3.0228)	0.0109	(1.7599)
retired	0.0171	0.1296	-0.0093	(2.0361)	-0.0027	(0.6041)
Living standard	4.2650	1.7986	-0.1722	(2.9810)	-0.1107	(1.8948)
No. of rooms at home	3.4908	1.1566	-0.1513	(3.7220)	-0.0159	(0.4001)
Father's educational level: Below secondary	0.3978	0.4895	0.1220	(7.3281)	0.0437	(2.6736)
Secondary	0.3619	0.4806	-0.0189	(1.1487)	0.0066	(0.4107)
Above secondary	0.2403	0.4273	-0.1031	(7.0697)	-0.0503	(3.5481)
Mother's educational level: Below secondary	0.4311	0.4953	0.0809	(4.7886)	0.0634	(3.8410)
Secondary	0.3798	0.4854	-0.0300	(1.8021)	-0.0321	(1.9746)
Above secondary	0.1891	0.3917	-0.0509	(3.7870)	-0.0314	(2.4170)
Parent's numerical test (sum of correct out of 4)	2.4443	1.1775	-0.2846	(7.4814)	-0.1436	(3.7573)
Books at home: 0-10	0.3719	0.4834	0.1061	(6.2913)	0.0312	(1.8820)
11-25	0.3593	0.4799	-0.0191	(1.1345)	-0.0029	(0.1787)
26-100	0.1888	0.3914	-0.0558	(4.0735)	-0.0047	(0.3485)
101-200	0.0472	0.2120	-0.0224	(3.0403)	-0.0117	(1.6224)
>200	0.0328	0.1780	-0.0088	(1.4120)	-0.0119	(1.9555)
Disciplinary problems at school (factor score)	-0.0012	0.9957	-0.0653	(2.0110)	-0.0103	(0.3449)

Table A.2: IV estimates of the effect of DSRS on cognitive ability

	Instruments				
	Humiliation	Threats	Raids	Violence	Norm. sum
Reduced form	-3.150 (0.636)	-2.902 (0.567)	-0.978 (0.548)	-0.827 (0.404)	-3.662 (0.743)
First stage	1.161 (0.208)	1.586 (0.164)	0.807 (0.148)	0.481 (0.133)	1.967 (0.227)
F-stat.	31.094	93.365	29.651	13.093	74.889
IV estimate	-2.715 (0.713)	-1.830 (0.417)	-1.213 (0.702)	-1.720 (0.847)	-1.862 (0.426)
N	3,321	3,321	3,321	3,321	3,321

Note: Standard errors clustered on school-level in parentheses. Control variables: sex, age, month of birth low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis, lives with father, with mother, # of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index, number of rooms, grade point average in school year 2010/2011, school fixed-effects.

Table A.3: IV estimates of the effect of mental health (DSRS score) on cognitive ability, various robustness checks

	Specification				
	Base	All TECs	5 TECs	Excl. liars	Excl. abnormal
Reduced form	-3.662 (0.743)	-3.452 (1.213)	-3.515 (0.965)	-3.286 (0.967)	-3.776 (0.861)
First stage	1.967 (0.227)	0.763 (0.329)	1.417 (0.301)	1.893 (0.288)	1.176 (0.231)
F-statistic	74.889	5.366	22.212	43.252	25.885
IV	-1.862 (0.426)	-4.526 (2.208)	-2.482 (0.797)	-1.736 (0.540)	-3.212 (0.933)
Nobs	3,321	3,321	3,321	2,381	2,841

Note: Standard errors clustered on school-level in parentheses. Control variables: sex, age, month of birth low birth weight, height-for-age (in quintiles), hemoglobin level, whether breastfed, whether had asthma, bronchitis, anemia, pneumonia, whooping cough, measles, chicken pox, hepatitis, lives with father, with mother, # of siblings, household income, number of books at home, father's education, mother's education, mother's numeracy, father's employment status, mother's employment status, living standards index, number of rooms, grade point average in school year 2010/2011, school fixed-effects.