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Maternal depression symptomatology and child well-being outcomes: limited evidence for a causal relationship

Javier Escobal
Sara Benites

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ABSTRACT

The paper explores whether or not there is evidence for a causal link between maternal depression symptomatology and child well-being. Considering three rounds of data from the Peruvian Young Lives (PYL) longitudinal study sample, the paper explores this relationship by using the SRQ-20 instrument, which is typically used as a screening tool for common mental disorders, and by collecting information about mothers' socioeconomic characteristics and their children's well-being outcomes. We found a low correlation of SRQ-20 scores across rounds, suggesting that the instrument may be capturing short-term depression or anxiety symptoms rather than chronic mental illness. Furthermore, the SRQ-20 instrument is correlated both with characteristics of the mother and with child well-being indicators, which change over time (nutritional, health, and educational outcomes as well as feelings and attitudes). The study shows that the magnitude of the relationship between the mental health indicator and the child well-being outcomes may be severely biased in a regression that neglects the possible endogeneity of the mental health indicator. Finally, besides maternal age, education, and ethnicity background, socioeconomic shocks are a key determinant of both depression and anxiety symptoms as well as of child well-being outcomes in the first year following birth of the child (PYL round one), where SRQ-20 scores were the highest.

Numerous research studies done in developing countries suggest that poor maternal mental health—maternal depression, in particular—may substantially contribute to negative child well-being. For example, maternal depression may be a risk factor for poor growth in young children. It may also affect parental practices, thus negatively affecting a child's cognitive as well as emotional, behavioral, and psychological development.

Most of these studies are based on simple correlations or—at best—they use a regression framework to control for important child, mother, household, and community characteristics. Some of them use mental health scores gathered in the past, but they seldom recognize that mental health may be determined by multiple factors, or that other unaccounted factors may affect both maternal mental health and child well-being. In this context, it is important to understand the extent to which the correlations found may reflect causal links. Depending on the nature of the causal link that is behind these correlations, different policy recommendations may be considered.

To explore this issue, we take advantage of the fact that the Peruvian Young Lives (PYL) longitudinal study includes the SRQ-20 instrument, a measure of depressive symptomatology used as a screening tool for common mental disorders (WHO, 1994). This instrument involves a survey consisting of 10 yes/no questions regarding mood, thinking capacity, feelings of anxiety, and physical well-being. A yes answer to

questions in any of these domains results in a higher score on the SRQ-20. The PYL study follows a cohort of approximately 2,000 children from birth and currently includes three rounds of surveys at the mean ages of 12, 62, and 95 months, which permits assessment of child and caregiver characteristics within categories as well as over time.

Using the longitudinal record of SRQ-20 scores in the PYL study, we explore the persistence of depressive symptomatology throughout the course of the study. We assess whether the empirical characteristics captured in the SRQ-20 instrument are consistent with chronic mental illness or with short-term depression or anxiety symptoms. Next, we assess the correlation of the SRQ-20 to mother and child well-being indicators, which change over time (nutritional, health, and educational outcomes as well as feelings and attitudes). Finally, we assess whether the magnitude of the parameters of interest are biased by the endogeneity of the mental health indicator in the regression analysis that relates this indicator to child well-being outcomes. In particular, we are interested in the importance of socioeconomic shocks as determinants of both depression and anxiety disorders as well as of child well-being outcomes.

We are interested in exploring whether correlations between proxy indicators of mental health and child well-being outcomes may be spurious. As screening and epidemiologic rather than clinical measures, SRQ-20 scores and other similar measures should not be used to recommend clinical treatment. However, the correlation and causal implications associated with their academic use need to be carefully assessed in order to avoid stigmatizing women and children while still providing reliable information for the discussion of policy recommendations.

Literature review

The body of literature that has analyzed the link between maternal mental health and child well-being is extensive. This literature has focused mainly on three distinct areas: i) health and nutrition; ii) cognitive development; and, iii) emotional, behavioral, and psychological development.

Several studies have shown a negative association between maternal depression and health and nutritional outcomes (Rahman et al., 2004; Turney, 2011). Studies have also considered the link between the occurrence of accidents and injuries and the presence of maternal depression as a risk factor. Three of these studies found negative associations (Howe et al., 2006; Reichenheim & Harpham, 1989; O'Connor et al., 2000). In addition, there is evidence from Young Lives countries that children born to mothers with common mental disorders experience twice the odds of injury compared to infants with healthy caregivers (Howe et al., 2006). By contrast, other studies conclude that there is a null (or marginal) association between maternal depression and child health after controlling for relevant covariates (Turney, 2011; Hazarika, 2010).

A literature review of 17 studies of developing countries during the period of 1996-2010 was completed by Surkan et al. (2011). The authors try to analyze the effect of maternal depressive symptoms on child growth, but their main finding was a null or marginally significant relationship between the variables of interest. When the analysis was restricted to longitudinal studies, this relationship was stronger. Young Lives countries are considered in this systematic review of papers as well (Harpham et al., 2005), which shows an association for India and Vietnam but not for Peru or Ethiopia.

Previous studies done using the first round of Young Lives data have also suggested associations between social capital and mental

health and between mental health and child growth (Harpham et al., 2005; De Silva & Harpham, 2007; De Silva et al., 2007). Some papers based on Young Lives data have gone so far as to claim that their research "provides strong evidence of an association between caregiver mental health and child injury risk" (Howe et al. 2006: p. 1776). The current analysis aims to explore whether there is evidence supporting causal links or mere correlations in the PYL data.

Child cognitive outcomes may also be affected by maternal mental health. (Brennan et al., 2000; Petterson & Albers, 2001; Servili et al., 2010). In addition, evidence of a negative relationship between common maternal mental disorders and child behavior problems is also found in the literature (Brennan et al., 2000; Petterson & Albers, 2001; Kiernan & Huerta, 2008; Oyserman et al., 2002; Kahn et al., 2004; Mustillo et al., 2011). Kiernan & Huerta (2008) conclude that part of the impact that economic deprivation has on children's behavioral problems is mediated by common maternal mental disorders.

There are some common problems in this body of literature that is attempting to find an association between maternal mental health and child well-being outcomes. Based on the methodologies used in their analyses, it is possible to identify three groups of studies: i) part of them are based on correlations exclusively; ii) another group is based on correlations, controlling with basic covariates; and, iii) the last group proposes some form of model that tries to address the potential endogeneity of maternal mental health. Since correlation is not causation, this body of evidence needs to be carefully reviewed to assess the evidence for previously identified causal links.

The majority of the analyses that we will review here can be characterized as part of the second group. The covariates used in the analyses are typically related to: risk factors, income, education, background

history, demographics, gender, feeding practices, mother's anthropo-metrics, area, environment, etc. However, the bulk of the literature includes child, maternal, and household characteristics while neglecting changes in the socioeconomic environment that the mother and children may be facing.

Only a few studies go beyond the simple univariate and multivariate analyses and extend their estimations to structural models. One is the study developed by Kiernan & Huerta (2008), which uses Structural Equation Modeling (SEM) to examine associations between multiple outcomes, and the other one estimates an infant health structural equation by specifying a reduced form of the maternal depression production function to construct an instrumental variable for depression.

The majority of the studies that have linked maternal mental health status with child well-being outcomes have not controlled for covariates that account for differences in the economic and social environments in which the mother and children live. Furthermore, few studies have accounted for the endogeneity of mental health, which may generate a sizable bias in the reported results. Finally, few studies have used longitudinal data on maternal mental health status to assess whether the instrument was capturing short-term stress or depression or a long-term mental condition. In this study we will tackle these shortcomings.

Sample

The information used in this paper comes from the first three rounds of data for Peru from the PYL longitudinal study. Since 2002, Young Lives has been tracking around 2,000 Peruvian children aged between 6 and 17 months at the time of enrollment. A second visit occurred in late 2006 to early 2007, and the third visit occurred in late 2009. A fourth round of data collection was conducted in 2013. Although the study uses a pro-poor rather than a nationally representative sample, the data reflect the diversity of the country's population. As with the other Young Lives samples (those of Ethiopia, India, and Vietnam), the study followed a multistage sampling procedure, whereby 20 sentinel sites were selected, and 100 households within each sentinel site were chosen randomly. In Peru, the sentinel sites were chosen using multistage, cluster-stratified, random sampling. The clusters or sentinel sites were chosen using a Peruvian district-level poverty map. After ranking districts by their poverty level and randomly choosing the first district, the other districts were chosen systematically according to the distribution of poverty (Escobal & Flores, 2008). Overall attrition was 4.4 percent by Round 3 or over the eight-year period, which is very low compared to other international studies (Dercon & Outes-Leon, 2008).

Data description

The Young Lives survey collects comprehensive information about: a) households' economic circumstances, livelihoods, assets, and social capital; b) coping strategies; c) the extent to which children and their parents and caregivers use private and public services (for example healthcare, pre-school care, or education programs). The survey contrasts this information with a large array of well-being indicators for the children, including physical health, nutrition, education, parents' material wealth, as well as maternal psychosocial well-being (mental health, self-esteem, sense of self-efficacy, and sense of receiving discrimination) and similar indicators for the children as they grow up.

The variables used in the analyses are divided into four groups, which are discussed in turn: a) our measure of maternal mental health, the SRQ-20 indicator; b) child, mother, household, and contextual socioeconomic characteristics; c) child well-being outcomes, which include health, nutritional, educational, and cognitive outcomes as well as the child's feelings and attitudes; and, d) potential instrumental variables used to correct the bias caused by the endogeneity of maternal mental health in the child well-being outcome equations. This last group of variables will be discussed when we describe our statistical methods. Basic descriptive statistics for all the variables used in the analyses is provided in Table 1. For all of our analyses, we used the 1,699 mothers for which we have SRQ-20 scores in all three rounds.

a) Maternal mental health

Maternal mental health status was assessed using the WHO-recommended 20-item self-reported questionnaire (SRQ-20). The SRQ was

originally designed to be self-administered, but was also found to be suitable as an interviewer-administered questionnaire (WHO, 1994). It consists of 20 items that try to capture somatic, depressive, anxiety, cognitive, and decreased energy factors. It includes only neurotic items, and ignores psychotic ones. Each of the 20 items is scored as 1 when the symptom is present and 0 on the contrary. For the study we used both the score obtained by adding the yes responses of the 20 questions, and also that from generating alternative dichotomous variables with different cut-off points.

Harpham et al. (2003) recommend the SRQ-20 as a method for measuring mental health in a various countries (Brazil, India, Africa, Pakistan, and Colombia), where the prevalence of this kind of disorders ranges from 18% to 42%. The optimal SRQ-20 threshold found in this review study was 7/8. In addition, the Young Lives sample from Vietnam validates a cut-off point of 7/8, the one most commonly used in developing countries, as it maximizes the sensitivity and specificity of correctly classified cases (Tuan et al., 2004). Given this evidence, for this study a cut-off point of 8 and above was considered to be indicative of psychiatric morbidity.

Table 2 shows the results using the SRQ-20 instrument for all three rounds of data collection. Here we include the individual questions, the SRQ-20 score, and the percentage of mothers that have a high score under alternative cut-off points. Using the 7/8 cut-off point we can see that almost 30% of the mothers in Round one can be considered to have a high SRQ-20 and thus could be considered to "…hav[e] symptoms and problems likely to be present in those with neurotic disorder" (WHO, 1994).

WHO (1994) has recommended that a screening instrument like the SRQ-20 be validated in a variety of settings and with different populations. Even though Peru has not validated this test, other

developing countries with similar characteristics have evaluated it and have examined its reliability. In addition, the instrument was validated in the context of the Young Lives study using data from the Vietnam cohort. In order to assess how well this tool performs and if it measures what it should measure, criterion validation studies have been carried out in many countries, in which the results of the screening test are compared to a "gold standard." As noted by WHO (1994), quoting Goldberg & Williams (1988), a psychiatric assessment by a trained clinician is the most suitable criterion. The correlation between the two methods is analyzed and a higher association between the two is expected.

For the PYL data, internal validation of the SRQ-20 instrument was performed. The SRQ-20 score showed high reliability in all three rounds, as measured by Cronbach's alpha across questions (scale reliability coefficients of 0.84, 0.83, and 0.82, respectively, in each of the three rounds). However, Cronbach's alpha across rounds for each of the 20 items shows a relatively low concordance, with scale reliability coefficients ranging between 0.06 and 0.45, and a simple average of 0.26.

b) Child, mother, household, and socioeconomic context characteristics

Here we include individual child characteristics (whether the child is a boy or girl; age in months at the time of enrollment; relative birth order), as well as maternal characteristics (mother's age, her ethnicity, number of years of education), household characteristics (household size, one- or two-parent family, wealth index, per-capita household income), and community and context characteristics (urban or rural, remoteness).

Ethnicity is proxied by the mother's first language besides Spanish (whether Quechua, Aymara, or another native language), which is considered a marker of ethnicity and typically associated with exclusion in Peru (Trivelli, 2005, Escobal et al., 2012). The relative birth order is calculated as the child's birth number minus 1, divided by the number of siblings. We may expect birth order to be related to child care outcomes. Wealth and income are used to control for household material well-being. The wealth index is a non-weighted average of the following three components: (a) housing quality, which is the average of a scale of rooms per person, floor, roof, and wall quality; (b) access to consumer goods (scale); and (c) access to services, averaged across access to improved water, electricity, improved sanitation, and cooking gas. Remoteness is proxied by the distance in time of the nearest health center and whether the household has experienced at least one shock recently—defined as in the last twelve months for Round one, or since the last visit, in the case of Round two or three.

c) Child well-being outcomes

Health and nutritional outcomes

Here we look at health-related indicators and relative perceptions of well-being (how often the child cries relative to other children; whether the child had a serious illness or accident; and whether the child has a chronic health problem). We also looked at nutritional outcomes including the z-score of height-for-age. This anthropometric indicator is a measure of the long-term nutritional status of the child. Using the World Health Organization (WHO) 2006 reference population, z-scores were computed. Children with a HAZ of less than -2 can

be considered as stunted in growth (i.e., chronically malnourished). Their short stature is related to chronic nutritional deficiency and/or previous acute malnutrition, which affects the child's growth and eventually limits his or her intellectual capacity. Finally, we also explore nutritional problems using the child's average number of meals per day as a complementary indicator.

Educational and cognitive outcomes

For Round three, when the child was already in school, we calculated overage—how many years a child is behind a grade's normative age. We expect this indicator to be strongly correlated with educational achievement. In addition, children's verbal comprehension scores were evaluated at Rounds two and three using the Peabody Picture Vocabulary Test (PPVT). The PPVT is a norm-referenced test of receptive vocabulary. Its main objective is to measure vocabulary acquisition in people from 2.5 years old to adulthood. A detailed analysis of the validation of the PPVT instrument can be found in Cueto et al. (2009).

Child's feelings and attitudes

Finally, we looked at three indicators related to the child's feelings and attitudes. First, we included two direct questions (whether the child feels better than other classmates and whether the child feels that others treat him or her well). In addition, in Round three children were asked for subjective perception of their own well-being. In particular, they were asked to position themselves on a nine-step ladder.

Statistical methods

Descriptive statistics were estimated for all the variables mentioned above for each of the three rounds of data. In addition, these variables were divided into two groups: those from mothers with low SRQ-20 scores (7 and below) and those from mothers with high SRQ-20 scores (8 and above). We tested for the statistical significance of the differences between these two sub-samples. Robustness of these results using alternative cut-off points was confirmed but will not be reported here (it is available upon request).

To further evaluate whether the differences in child well-being outcomes were robust after controlling for confounding factors and taking into account the potential endogeneity of our maternal mental health measure, we used an instrumental variables (IV) regression framework in order to estimate IV regressions for each child well-being outcome in each round.

Possible endogeneity problems in estimating the model may arise from a reverse causality problem, as some child well-being outcomes may induce stress or lead to maternal depression. In addition, some exogenous factors not included in the regressions may be correlated with both child well-being outcomes and maternal mental health measures, thus biasing OLS estimates. To address this estimation problem, we explore the validity of an instrumental variable estimation.

Ideally, instruments should be orthogonal to unobserved determinants of child well-being outcomes. We use two variables as potential instruments and will discuss each one in turn: the presence of physical and verbal violence in the mother's childhood home; and, the incidence of violence in the district where the mother was born. We include these variables to investigate the impact of a history of violence and birth order on child well-being outcomes, and also to

meet the orthogonality requirement in our instrumental variables regression approach.

The validity of instruments can be evaluated in both conceptual and empirical terms. Conceptually, we can expect that a mother's mental health may be affected by a violent environment during her childhood; however, we should not expect this environment to affect her child through a direct causal pathway. Rather, it should affect the child's well-being by means of the effect it had on his or her mother, as long as the family does not still live in the same community. There is also a high risk of verbal violence in the current household if such violence existed in the mother's childhood household. As a proxy for a violent environment, we use the presence of physical and verbal violence in the mother's childhood home when she was a child. To avoid any possibility of a direct effect, we dropped 11 children's cases (based on Round 2 and Round 3 data) from the final instrumental variable estimation. These cases were the only ones in which the mother was affected by physical and verbal violence and the family was living with the maternal grandparents.

The second instrument used was calculated using secondary data from the Peruvian Truth and Reconciliation Commission (CVR, 2003). Although the younger Young Lives cohort was born at a time when terrorist violence in Peru had almost ceased (2000-2001), it is important to recognize that a significant number of children were raised in post-conflict environments. Their parents had suffered effects of the violence and had been compelled to migrate. It is interesting to note that a large proportion of the parents of the younger cohort in Peru had migrated (46%), and that 20% of mothers who had done so were born in areas of the country where a very high number of conflict-related episodes were reported by the Truth and Reconciliation Commission. We expect mothers who were

affected by political violence to be more likely to be affected by mental health problems than mothers that were raised in areas where violence was not prevalent (Instituto Especializado de Salud Mental "Honorio Delgado Hideyo Noguchi," 2003).

Empirically, we tested for exogeneity of the instruments. We computed over-identifying restrictions using Sargan's and Basmann's tests (StataCorp, 2011). In all cases, the tests for over-identifying restrictions showed that the possibility that the instruments were exogenous cannot be rejected. Rejecting their exogeneity is needed to properly correct for potential SRQ-20 endogeneity. Furthermore, we tested for the relevance of the instruments. The betas in the first stage regression were jointly significant at the 95% confidence level, indicating that the instruments were jointly valid. Finally, we looked for exogeneity of the maternal mental health measure using both the Durbin and Wu-Hausman tests. Our test showed that we can reject possible exogeneity of the SRQ-20 and consider it an endogenous variable.

Table 2 shows how the SRQ-20 scores change from round to round under different cut-off points. If we use the 7/8 cut-off points as our benchmark, we can see that the incidence of high SRQ-20 scores drops from almost 30% in Round one (when the children were 6 to 18 months of age) to 13.5% in Round two and 10.8% in Round three (when children were aged 4 to 5 and 7 to 8). This abrupt reduction in the incidence of high SRQ-20 scores could be associated with the presence of postpartum depression in Round one. Although many studies observed postpartum depression during the first 6 months following birth, there is evidence of postpartum depression 12 and even 15 months following birth (Surkan et al., 2012). Table 3 complements this by showing how mothers transition between low and high SRQ-20 scores across rounds. Other contingencies such as a higher incidence of socioeconomic shocks in Round one could also explain this pattern. As we will later show, once we control for the endogeneity of SRQ-20, its significance vanishes, while the importance of shocks as a possible explanation for child well-being outcomes continues to be significant.

Our results suggest that a very small portion of our sample (1.8%) shows high SRQ-20 scores in all three rounds. If we consider those that have high SRQ-20 scores in only at least two consecutive rounds, the incidence rate rises to 7.9%. These rates are low and represent those having at least one instance of high SRQ-20 scores—4.4% and

19.7%, respectively. In other words, 70% of the mothers had only one instance of high SRQ-20 scores and more than 80% had one instance or two non-consecutive instances. Under these circumstances, it is very likely that whatever the SRQ-20 score is capturing cannot be considered a chronic mental illness. Rather, it is more likely that the SRQ-20 is capturing short-term depression or anxiety symptoms.

As we have mentioned, we need to control for key covariates in order to evaluate the relationship between maternal mental health status, as measured by the SRQ-20 score, and child well-being outcomes. These covariates include not only child and mother characteristics but also characteristics of the household and community environment where they live. Table 4 provides basic descriptive statistics, splitting the sample between mothers with high and low SRQ-20 scores. As previously mentioned, the cut-off point is 7/8, although most differences that appear significant continue to be significant if the cut-off point is moved to 6/7 or to 8/9. The results show that the differences are statistically significant across all three rounds only for prevalence of shocks: mothers with a high SRQ-20 score also have a higher likelihood of having faced at least one shock in the previous three years (or previous year if we refer to Round one). The rest of the covariates tend to show a similar pattern in Rounds one and two, but the differences between mothers with high and low SRQ-20 scores vanish in Round 3.

When we explore child well-being outcomes, we find that all health and nutritional outcomes are statistically different between mothers with high and low SRQ-20 scores, with better outcomes associated with low SRQ-20 scores, or better maternal mental health. In Round two all health and nutritional outcomes remain significant, with the exception of whether the child cries more than other children. In this round we have also included the PPVT score to capture

differences in cognitive outcomes. This score also shows significant differences; mothers with high SRQ-20 scores show lower cognitive scores on average. Finally in Round three, many of the differences between the high/low mental health groups vanish. However, children whose mothers have a higher SRQ-20 score are significantly more likely to have a chronic health problem. As the child grew older for Round three, we introduced questions directed to the child to capture his or her feelings and attitudes. In this area, we find that although the perception of how the child is treated by others and the position on the nine step ladder are not different across the high/low mental health grouping, we do find statistically significant differences in how the child feels in comparison to other classmates.

Next we explored whether these statistical differences in child well-being outcomes are still robust once relevant covariates are included, as well as whether or not these partial correlations remain significant if we consider the possibility that maternal mental health may be endogenous or jointly determined alongside the children's well-being indicators. Table 5 shows the parameters of a model that links maternal mental health to child well-being outcomes under alternative specifications. For explanatory purposes only, we used two outcomes in Round one: whether the child has a chronic health problem, and the z-score of height-for-age, as a measure of chronic malnutrition. Here we have three columns for each of the two child well-being outcomes. The first column for each outcome shows the estimated parameter of the regression with the child well-being outcome as the dependent variable and the SRQ-20 score as the only regressor. The second row shows the same regression adding a set of child, mother, household, and context covariates. Finally, the third regression is estimated using instrumental variables to control for the possible endogeneity of maternal mental health.

The results in Table 5 present two cases: one in which the significance of the correlation is robust even when one controls for the exogenous covariates, but it vanishes once we model the endogeneity of the SRQ-20 score; and the other in which the significance of the correlation vanishes when one controls for the exogenous covariates and continues to be not significant once we model the endogeneity of the SRQ-20 score.

Instead of presenting all models for all rounds, we have summarized the results in Table 6. Here we show the four scenarios we found in the data: the first two are similar to the ones depicted in Table 5; in a third scenario, the correlation is not statistically significant and remains insignificant once we add the covariates and we model the endogeneity problem; and in a fourth scenario, the correlation becomes statistically significant after controlling for covariates but vanishes again once we add the covariates and we model the endogeneity. First, our results indicate that in all estimates across all rounds, the significant correlation found between mental health and child outcomes when looking at bivariate relationships is not robust and disappears once we control for relevant covariates or model the potential endogeneity problem. As we mentioned in the methodology section, the validity of the instruments was statistically tested.

Although here we are not presenting the full estimations for all outcomes (they are available upon request), it is interesting to highlight some of the results obtained. In order of importance (measured by the significance and size of the standardized coefficients), the most relevant variables across rounds for most outcomes are as follows: mother's years of education, followed by mother's age and ethnicity. Maternal education is especially relevant as a determinant of low height-for-age scores (chronic malnutrition) and cognitive development. The mother's age is especially relevant in Rounds two and three as a determinant of

health and nutritional outcomes, while ethnicity appears consistently relevant in most outcomes for all rounds. As we have already mentioned, the literature in Peru shows that exclusion based on ethnicity is one of the important channels through which child well-being outcomes are affected. Finally, negative economic shocks appear particularly important in Round one, especially as determinants of a child's serious illness, accidents, or chronic problems.

As we have seen, the literature that links maternal mental health with child well-being outcomes is vast, but a large part of it does not recognize that maternal health and child well-being outcomes may be jointly determined. It is clear that using a value of the maternal mental health scores captured in previous rounds will not be enough to avoid potential biases if there are previously unobserved factors that affect both maternal health and child outcomes.

We used three rounds of data from the PYL longitudinal project study to explore to what extent the correlations found between SRQ-20 scores and child well-being outcomes are spurious. We found that, at least in the case of PYL data, the significance of all of the correlations vanishes, either when one adds relevant exogenous covariates or when one accounts for potential endogeneity of the SRQ-20 scores.

Although more research is needed for policy recommendations, it is clear that other factors that play an important role in affecting child well-being outcomes in Peru may be as important as—if not more important than—maternal mental health. In particular, this analysis suggests that the mother's age and education level, family size, economic shocks, and the presence of at least one negative shock play a more important role in explaining child well-being outcomes across the three rounds of data. In the case of shocks, the evidence suggests that this factor is one of the few indicators that remains robust after controlling for covariates and modeling the endogeneity of the

maternal mental health variable. It also remains to be seen whether interventions aimed to improve maternal mental health result in better outcomes for their children.

There are different ways of measuring mental health. Although there are a variety of psychological instruments, the most common one used in low and middle income countries is the Self-Reporting Questionnaire (SRQ-20). The SRQ-20 was developed by Harding and his colleagues in 1980 and was recommended by the World Health Organization in its 1994 manual. Exactly what the instrument is capturing is difficult to say. According to WHO (1994), the 20-item questionnaire asks respondents about symptoms and problems likely to be present for those with neurotic disorders. Many authors have insisted that this instrument is not a substitute for a clinical diagnosis, as its unique objective is to indicate probable cases of mental disorders (Harpham et al., 2003). Still, as we have shown, it has been widely used to imply a correlation or even a causal link between maternal mental health and child well-being outcomes. The fact that only a small percentage of mothers in our sample show high SRQ-20 scores consistently across the three rounds (less than 2% of the sample, which represents 4% of those having experienced at least one episode of a high SRQ-20 score) highlights the fact that we need to be careful when labeling what the SRQ-20 indicator is capturing. The evidence presented here suggests that our maternal mental health score may be reflecting short-term depression or anxiety symptoms rather than a chronic mental illness.

The SRQ-20 instrument was created as a screening instrument and as the first stage in a multi-stage process, but it is now commonly seen in the literature as a diagnostic tool used to divide the population into those who likely have some kind of neurotic disorder and those who do not. Thus it is considered valid to correlate the SRQ-20 scores

with child, mother, household, and context-specific characteristics to calculate the odds that the mother can be considered to have a mental health problem. Furthermore, the score is used in multiple regression frameworks to associate mental health with a large array of outcomes. The results presented here warn us about the need to carefully assess these empirical regularities.

Finally, one of the most common limitations of many of the studies performed to evaluate the relationship between maternal mental health status and child well-being outcomes is the cross-sectional design, which restricts the "ability to make inferences about causality" (Kahn et al., 2004: p. 727) and confirm the directionality of the associations. A longitudinal analysis could help us solve this problem. Although we have tapped into the longitudinal nature of PYL to evaluate the consistency of this relationship, introducing a dynamic model to explain changes in SRQ-20 scores and changes in child outcomes is still a pending necessary task.

Table 1

Descriptions of principal variables by rounds

Younger Cohort - PYL Survey

	Round 1	Round 2	Round 3
SRQ-20 (Sum of reported illnesses)	**5.60**	**3.63**	**3.26**
Child, mother, household, and socioeconomic context characteristics			
Child's sex: male	50.4%	50.4%	50.4%
Child's age (months)	12.0	63.9	95.4
Relative birth order	0.6	0.5	0.5
Mother's age	27.1	31.4	34.1
Mother's ethnicity: Spanish	68.6%	68.6%	68.6%
Mother's years of education	8.0	7.8	7.8
Household size	5.7	5.5	5.4
One-parent family	13.9%	13.8%	15.2%
Wealth index	0.47	0.48	0.54
Household income (soles)	1278.0	1002.0	1175.7
Location: Urban Area	66.8%	65.7%	70.6%
Remoteness: Time to arrive to nearest health center (minutes)		33.5	
At least one shock since last visit or in prior twelve months (R1)	38.6%	63.4%	61.4%
Good/more or less health during pregnancy	75.0%		
Hard labor	32.5%		
Child well-being outcomes			
Health and nutritional outcomes			
Child cries more than other children	57.6%		
Child had a serious illness or accident	39.8%	25.7%	
Child had an accident	15.7%	7.5%	9.2%
Child has a chronic health problem	14.5%	10.3%	22.5%
Number of meals per day		4.9	4.9
z-score - height for age	-1.283	-1.526	-1.147

SRQ-20 (Sum of reported illnesses)	Round 1 5.60	Round 2 3.63	Round 3 3.26
Educational and cognitive outcomes			
Overage			11.2%
PPVT standard score		86.27	92.48
Child's feelings and attitudes			
Feels better than other classmates			40.4%
Position on the nine-step ladder			7.00
Feels people treat him well			80.3%
Potential instruments			
Physical and verbal violence in mother's parents' house	31.3%		
High incidence of violence in the district of mother's birth	23.2%		

Source: PYL Longitudinal Survey

Table 2
Self-reported questionnaire (20 items) – SRQ-20
Younger Cohort - PYL Survey

	Round 1	Round 2	Round 3
Do you often have headaches?	43.5%	46.3%	37.6%
Is your appetite poor?	22.7%	19.1%	15.6%
Do you sleep badly?	17.2%	18.8%	16.0%
Are you easily frightened?	44.8%	26.6%	21.3%
Do your hands shake?	14.5%	9.5%	7.4%
Do you feel nervous, tense, or worried?	64.4%	62.7%	59.3%
Is your digestion poor?	18.7%	12.7%	9.9%
Do you have trouble thinking clearly?	27.0%	9.5%	7.8%
Do you feel unhappy?	50.1%	40.1%	37.7%
Do you cry more than usual?	26.2%	16.6%	15.1%
Do you find it difficult to enjoy your daily activities?	27.0%	8.4%	7.9%
Do you find it difficult to make decisions?	46.0%	13.5%	17.7%
Is your daily work suffering?	20.5%	6.8%	6.0%
Are you unable to play a useful part in life?	16.5%	5.3%	4.8%
Have you lost interest in things?	14.5%	5.4%	5.0%
Do you feel that you are worthless person?	13.0%	6.0%	3.4%
Has the thought of ending your life been on your mind?	4.6%	4.0%	3.5%
Do you feel tired all the time?	25.9%	13.4%	13.7%
Do you have uncomfortable feelings in your stomach?	27.9%	20.8%	20.5%
Are you easily tired?	34.8%	17.2%	15.8%
SRQ-20 score (sum of reported illnesses)	*5.60*	*3.63*	*3.26*
Percentage of mothers with high SRQ-20 score:			
Cut-off point: 5/6 points	44.7%	23.0%	20.3%
Cut-off point: 6/7 points	36.3%	16.5%	14.9%
Cut-off point: 7/8 points	29.5%	13.5%	10.8%
Cut-off point: 8/9 points	24.0%	8.8%	8.2%
Cut-off point: 9/10 points	18.7%	6.9%	6.1%

Source: PYL Longitudinal Survey

Table 3
Transition of maternal mental problems between rounds
Cut-off point: 8 points
Younger Cohort - PYL Survey

	N	%
Evidence of mental health problems by rounds		
Round one	502	29.5%
Round two	229	13.5%
Round three	184	10.8%
Transitions between rounds		
No evidence of mental health problems	1023	60.2%
Evidence in Round one only	303	17.8%
Evidence in Rounds one and two only	93	5.5%
Evidence in Rounds one and three only	76	4.5%
Evidence in Round two only	96	5.7%
Evidence in Rounds two and three only	10	0.6%
Evidence in Round three only	68	4.0%
Evidence in the three rounds	30	1.8%
Evidence in only one round	467	27.5%
Evidence in at least two rounds	209	12.3%
Evidence in at least two consecutive rounds	133	7.8%

Source: PYL Longitudinal Survey

Table 4

Mean test of principal variables by rounds maternal mental health indicator - cut-off 8 points

Younger Cohort – PYL Survey

	Round 1			Round 2			Round 3		
	SRQ-20<=7	SRQ-20>=8		SRQ-20<=7	SRQ-20>=8		SRQ-20<=7	SRQ-20>=8	
Child, mother, household, and socioeconomic context characteristics									
Child's sex: male	51.8%	49.8%		44.5%	51.3%	*	50.5%	50.4%	
Child's age (months)	12.2	12.0		62.6	64.1	***	95.3	95.4	
Relative birth order	0.7	0.6	***	0.6	0.5	***	0.5	0.5	
Mother's age	28.3	26.6	***	33.7	31.0	***	35.2	34.0	**
Mother's ethnicity: Spanish	64.7%	70.3%	**	56.8%	70.5%	***	71.2%	68.3%	
Mother's years of education	7.0	8.4	***	6.4	8.1	***	7.5	7.8	
Household size	5.9	5.5	***	6.2	5.4	***	5.2	5.4	
One-parent family	16.9%	12.7%	**	15.3%	13.6%	***	20.7%	14.5%	*
Wealth index	0.45	0.48	**	0.41	0.49	***	0.56	0.54	
Household income (soles)	1219.0	1303.0		741.9	1042.0	***	917.6	1207.0	***
Location: urban area	63.8%	68.1%	*	52.0%	67.9%	***	77.7%	69.8%	**
Remoteness: Time to arrive to nearest health center (minutes)	34.3	33.2		42.7	32.1	***	30.7	33.9	
At least one shock since last visit or in prior twelve months (R1)	46.0%	35.5%	***	79.9%	60.9%	***	77.7%	59.4%	***
Good/more or less health during pregnancy	65.1%	79.1%	***						
Hard labor	35.2%	31.4%							

	Round 1			Round 2			Round 3		
	SRQ-20<=7	SRQ-20>=8		SRQ-20<=7	SRQ-20>=8		SRQ-20<=7	SRQ-20>=8	
Child well-being outcomes									
Health and nutritional outcomes									
Child cries more than other children	62.6%	55.6%	***	34.5%	24.3%	***			
Child had a serious illness or accident	50.0%	35.6%	***						
Child had an accident	23.9%	12.2%	***	11.4%	6.9%	**	13.6%	8.7%	*
Child has a chronic health problem	20.1%	12.1%	***	14.4%	9.7%	*	36.4%	20.8%	***
Number of meals per day				4.6	4.9	***	4.9	4.9	
z-score – height-for-age	-1.437	-1.219	***	-1.792	-1.485	***	-1.138	-1.148	
Educational and cognitive outcomes									
Overage							15.3%	10.7%	
PPVT standard score				77.48	87.64	***	90.58	92.71	
Child's feelings and attitudes									
Feels better than other classmates							31.5%	41.5%	***
Position on the nine step ladder							6.79	7.02	
Feels people treat him well							74.5%	81.0%	*
Potential instruments									
Physical and verbal violence in mother's parents' house	38.8%	28.2%	***						
High incidence of violence in the district of mother's birth	24.1%	22.9%							
Number of observations	502	1197		229	1470		184	1515	

Note: Differences are significant at ***1%, **5%, and *10%.

Source: PYL Longitudinal Survey

Table 5

Relationship between maternal mental health
and selected Round one child well-being outcomes
(OLS and probit estimations with and
without controls and IV estimation)

	Child has a chronic health problem			z-score - height for age		
	(1)	(2)	(3)	(1)	(2)	(3)
SRQ-20	0.043***	0.042***	0.026	-0.028***	-0.009	-0.012
	(0.0088)	(0.0094)	(0.0183)	(0.0073)	(0.007)	(0.056)
Child's sex		0.056	0.009		-0.189***	-0.189***
		(0.078)	(0.0172)		(0.0566)	(0.0568)
Mother's age		-0.003	-0.001		-0.003	-0.003
		(0.007)	(0.0018)		(0.0051)	(0.0056)
Mother's years of education		-0.016	-0.001		0.083***	0.082***
		(0.0107)	(0.0038)		(0.0077)	(0.0117)
Mother's ethnicity		0.553***	0.108***		0.400***	0.401***
		(0.1042)	(0.0203)		(0.0701)	(0.0709)
Household size		0.002	0		-0.01	-0.009
		(0.0172)	(0.0039)		(0.0126)	(0.0125)
Negative shocks		0.283***	0.044		0.07	0.073
		(0.0794)	(0.0293)		(0.0593)	(0.0907)
One-parent family		-0.121	-0.046		-0.072	-0.07
		(0.1184)	(0.0299)		(0.0864)	(0.099)
Relative birth order		0.002	-0.004		-0.051	-0.05
		(0.0999)	(0.0232)		(0.073)	(0.0756)

Instrumental variable: Maternal mental health
Exogenous variables: Child's sex, Mother's age, Mother's years of education, Mother's ethnicity, Household size, Negative shocks, One-parent family, Relative birth order
Instruments: Physical and verbal violence in mother's parents' house, high incidence of violence in the district of mother's birth

Notes: Differences are significant at ***1%, **5%, and *10%. Standard errors are in parenthesis.
(1) and (2) are OLS or probit estimates. (3) is an IV estimation
Source: own estimates based on PYL Longitudinal Survey

Table 6

Statistical significance of the relationship between maternal mental health and selected child well-being outcomes for the PYL Sample

Possible scenarios	Round 1	Round 2	Round 3
(I)			
1. Correlation is statistically significant	- Child had a serious accident	- Child had a serious accident	- Child had a serious accident
2. Significance remains after controlling for covariates; and	- Child had a serious illness or accident	- Child had a serious illness or accident	- Child has a chronic health problem
3. Significance vanishes after controlling for covariates and modeling endogeneity	- Child has a chronic health problem	- Child has a chronic health problem	- Overage
		- Number of meals per day	- Child feels people treat him or her well
		- PPVT standard score	
(II)			
1. Correlation is statistically significant	- Child cries more than other children	- z-score - height-for-age	
2. Significance vanishes after controlling for covariates; and	- z-score - height-for-age		
3. Significance vanishes after controlling for covariates and modeling endogeneity			
(III)			
1. Correlation is not statistically significant			- Number of meals per day
2. Relationship continues to be not statistically significant after controlling for covariates; and			- PPVT standard score
3. Significance vanishes after controlling for covariates and modeling endogeneity			- Position on the nine-step ladder

Possible scenarios	Round 1	Round 2	Round 3
(IV)			
1. Correlation is not statistically significant			- z-score - height-for-age
2. Relationship becomes statistically significant after controlling for covariates; and			- Child feels better than other classmates
3. Significance vanishes after controlling for covariates and modeling endogeneity			

Instrumental variable:	Maternal mental health
Exogenous variables:	Child's sex, Mother's age, Mother's years of education, Mother's ethnicity, Household size, Negative shocks, One-parent family, Relative birth order
Instruments:	Physical and verbal violence in maternal parents' house; High incidence of violence in the district of mother's birth

Notes: Differences are significant at ***1%, **5%, and *10%. Standard errors are in parenthesis.
Source: own estimates based on PYL Longitudinal Survey.

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