The positive impact of maternal depression intervention on children's emotional and behavioral symptoms in a low-resource setting

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Short title: Children's after maternal depression treatment.

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ABSTRACT

Objective: Children of depressed mothers are at risk of developing mental health problems. We sought to determine whether treatment for maternal depression delivered by community health workers (CHW) would decrease behavioral/emotional symptoms in their child. An intervention treating maternal depressive symptoms in a low-middle-income country can have a high global impact.

Methods: CHW were trained to deliver a psychosocial intervention for mothers with depression in a primary care setting. 49 mothers and 60 children were assessed pre-intervention, post-intervention, and at a 6-months follow-up. Child behavioral/emotional symptoms were evaluated by type of change in maternal depressive symptoms: remission and response.

Results: An overall decrease in maternal depressive symptoms from baseline to post-intervention and 6-month follow-up were found. Remission and response of maternal depression was associated with better outcomes related to child’s behavioral/emotional symptoms at the 6-month follow-up (p = 0.0247, Cohen’s d: 0.76; p = 0.0224, Cohen’s f: 0.44) but not at post-intervention (p = 0.1636, Cohen’s d: 0.48; p = 0.0720, Cohen’s f: 0.33).

Conclusion: Maternal depression improvement was related to their child's decreased behavioral/emotional symptoms. Our results suggest that interventions addressing maternal depression in primary care is a viable strategy to prevent behavioral/emotional symptoms in the next generation.

Key Words: Depressive disorder; Mothers; Child; Mental Health; Developing Countries

Clinical Trial registration information - Interpersonal psychotherapy counseling for depressed children's caregivers; Brazilian Clinical Trials, Number: RBR-5qhmb5; http://www.ensaiosclinicos.gov.br/rg/RBR-5qhmb5/.
INTRODUCTION

Depression in women of child-bearing age is highly prevalent in low-and-middle income countries (LMIC) and high-income countries. [1-3] A mother's experience of depression can interfere with parent-child bonding, which is critical for healthy child development and prevent mothers from establishing a nurturing, consistent and empathic relationship with the child.

The presence of depressive symptoms in mothers is among the most well-replicated risk factor for offspring development. Studies in LMIC have shown strong associations between depressive symptoms in mothers and psychopathology in their children [4-6], and also with infant undernutrition [7-9], low birth weight [7], impaired infant cognitive and motor development [10], disrupted emotion regulation [11], and child mortality [12].

According to a longitudinal study [13], psychiatric disorders in offspring of depressed mothers may vary by age, with disruptive behavior and anxiety disorders commonly occurring in school-age children, depression in adolescents, and substance abuse in young adults. Problems often start before puberty, persisting into adulthood. The morbidity can last for an extended period, impairing social and occupational functioning and increasing the risk of medical problems [14]. Evidence also suggests an earlier onset of depressive disorder in the offspring of depressed parents, and this effect might be transmissible to the next generation [13].

Importantly, studies have also found a positive effect of successfully treating mothers with depression on their children's mental health, whether the treatment with psychological therapies or medication [15-24]. A meta-analysis [6] focused on the impact of psychological treatments for depressed mothers on their children and found that a decrease in levels of maternal depression reduced their children's psychiatric symptoms. A significant limitation of this meta-analysis was that none of the studies included families from LMIC. The short number of studies on LMIC is a
large gap, as LMICs represent more than 80% of the global population but have less than 20% of mental health resources [25].

Maternal depression in LMIC is a public health concern. Access to care is an essential issue posed with any intervention used to improve maternal mental health needs to be integrated into existing services, preferably in primary care settings, as they could reach out more to the population in need. A trial [26] has shown that trained community-based health workers (CHWs) and facility-based primary health care workers could efficiently deliver specific maternal mental health care components in a LMIC setting [27]. In Brazil, where a community-based health program is widely available to low-income mothers [28], relying on CHWs appears the most feasible way to improve coverage and reduce the mental health treatment gap.

Guidelines for the treatment of depression in primary healthcare settings in LMIC published by the World Health Organization's mental health Gap Action Program (MH-GAP) indicated [29] psychosocial approaches as appropriate and brief structured psychological therapies as viable methods for women in LMIC to enhance both mental health and public health impact [30]. Among those interventions, interpersonal psychotherapy (IPT) [32] has been used in the population and is promising. Evidence supports women's preference for psychotherapy over psychopharmacology for mental disorders treatment [31].

The present study is part of a randomized clinical trial (RCT) to evaluate the efficacy of interpersonal counseling (IPC), also an evidence-based intervention [33, 34] to treat depression utilizing a task-shifting approach [35] where IPC was provided by lay professionals (CHWs) trained to treat depressive symptoms in primary care [36]. In this RCT, 86 patients (94.2% women or n=81) with current DSM-IV major depressive disorder or dysthymia recruited from a Family Health Strategy (FHS) clinic were randomized to IPC intervention (n = 43) or enhanced
treatment as usual (E-TAU) (n = 43). E-TAU involved facilitating patients' referral to specialized mental health care within the public health system. In this RCT, although groups did not differ in the intention to treat analysis, the per-protocol analysis showed statistically significant better outcomes (lower Hamilton Rating Scale for Depression (HRSD-17) scores) among patients in the IPC group compared to those in the E-TAU group [37]. Intention-to-treat analysis showed significant improvement in symptoms over two months, without significant differences between groups (IPT or E-TAU).

Our study did not focus on comparing the delivered interventions but rather to show the effect of treating maternal depression in a primary care setting on their children's emotional and behavioral health. Limited studies have been carried out regarding this matter in an LMIC setting. To fill this gap, we built on the RCT of depression described above, restricting the sample to mothers (or grandmothers) responsible for childcare and support, and focusing on the child's emotional and behavioral symptomatology assessed before and after the intervention of maternal depression. We hypothesized that remission of depression or substantial symptom reduction following intervention among depressed mothers would improve the child's emotional and behavioral symptoms.

METHODS

The present study sample was derived from the previous mentioned RCT implemented in a selected Brazilian FHS (primary care setting) in São Paulo, Brazil, called “Unidade Básica de Saúde Iaçapé, Sapopemba.” This RCT sought to treat depressive disorders and evaluate whether IPC and E-TAU would be effective as interventions in a primary care setting. The detailed methodology and the results for the RCT were described elsewhere [36]
Eligible participants included in the analyses were all adult caretakers involved in the RCT, aged 18 to 70 years, with non-psychotic Major Depressive Disorder (MDD), whose HRSD-17 score at baseline was above 7. Maternal exclusion criteria were ongoing treatment with antidepressants or psychotherapy; suicide risk; current or past episodes of mania or hypomania; existing psychotic symptoms; borderline or antisocial personality disorder; and substance use disorder. All eligible caretakers were randomly assigned to IPC or E-TAU treatment, and participation in the study was voluntary without financial compensation. The study protocol was reviewed and approved by The Research Ethics Committee of the Federal University of São Paulo and the Municipal Health Council of São Paulo City. The trial was registered at the Brazilian Clinical Trials, number RBR-5qhmb5 (trial URL: http://www.ensaiosclinicos.gov.br/rg/RBR-5qhmb5/).

For this paper, we selected only mothers or grandmothers as primary caregivers enrolled in the trial, and our analyses focus on the dyad's outcomes, assessing depression in mothers and emotional and behavioral symptoms in their children over time. We do not evaluate the clinical trial results for IPC effectiveness.

**Interpersonal Therapy Counseling (IPC)**

IPC derives from IPT, evidence-based psychotherapy developed by Klerman and Weissman [32]. It is a briefer, structured version of IPT for use primarily in non-mental health settings, such as primary care clinics with community health workers, to treat patients with symptoms of depression [37]. CHWs are agents of the Brazilian public health system, responsible for visiting the assigned households at least once per month to collect data and promote health primary care, irrespective of demand [38]. Forty-two CHWs employed at the Primary Care Clinic with no formal experience in psychotherapy or counseling were trained, and twenty were selected
after a 3-day training, using the IPC Manual [35], by motivation and skills observed by the trainers. They were supervised weekly throughout the trial by the same trainers, who were also available during the entire time. IPC included a one-hour session per week, 3-4 sessions, provided either at the clinic or during household visits.

**Enhanced Treatment as Usual Enhanced Referred (E-TAU)**

Designed by the research team, E-TAU aimed to facilitate mothers' referral to specialized mental health care, increasing access to treatment. Primary care clinics usually have non-mental health professionals employed onsite, and referrals are required. Mothers randomized to E-TAU were followed by off-site research psychologists funded by the study. They would reach out to patients and facilitate their referral to specialized mental health care to receive pharmacological or psychological treatment, increasing clinical attention not present in routine clinical care. This was done by calling the mother at least once per week to check the referral and ensure follow-up.

**Sample**

From the initial sample of 81 women, 49 were mothers (40 mothers and nine grandmothers as primary caregivers, hereafter called mothers), recruited between September 2013 and November 2014 to participate in the trial who had at least one and up to four children aged 6 to 15 years (Mean age: 10.4, SD: 2.29) who screened positive for emotional and behavioral symptoms on the Child Behavior Check List (CBCL). Sixty children were enrolled in the study, and all presented CBCL scores for borderline/clinical impairment (CBCL≥63). Children's exclusion criteria were ongoing psychiatric treatment or psychotherapy and previous psychosis, autism spectrum disorder, or intellectual disabilities. The sample selection is described in detail in Figure 1.
Figure 1. Study Flow Diagram

261 Patients aged 18 to 70y recruited at UBS (Basic Health Unit) to participate in the Clinical Trial

- Woman excluded for not meeting criteria (n=180)
  - In treatment (n=11)
  - Psychotic symptoms or Bipolar disorder (n=6)
  - Suicidal risk (n=1)
  - Insufficient symptoms (n=155)
  - Mans (n=5)
  - Declined to participate (n=2)

81 were woman and screened positive for Depression

- 64 were mothers of 80 children aged 6 to 15y

80 Children screened for screened positive for emotional and behavioral symptoms

- Children excluded for not meeting criteria (n=20)
  - Insufficient symptoms (n=20)

49 mothers had 60 children aged 6 to 15y that screened positive for psychiatric symptoms. All consented and received Baseline Assessment

- 6 mothers had 2 children, 1 mother had 4 children and 1 mother had 3 children included

56 Dyads (45 mothers) completed the Post-intervention assessment

- 4 mothers (total of 4 children) dropped out

53 Dyads (43 mothers) completed the 6 – month follow-up assessment

- 2 mothers (total of 3 children) dropped out
Measures

Mothers were assessed with a battery of instruments that included baseline sociodemographic and psychiatric diagnosis and, at all-time points, depressive symptoms (baseline, post-intervention, and six-month follow-up). Mothers and children were assessed at three different times: at baseline, immediately after (post-intervention (2-months)), and six months after the beginning of the intervention. Children's behavioral/emotional symptoms were assessed at baseline, post-intervention, and 6-month follow-up. Trained mental health professionals, blinded to maternal group status (IPC or E-TAU), collected standard demographic information, and administered all instruments.

Sociodemographic Inventory

An instrument designed for this study assessed mothers' and children's demographic and social data (see Tables 1 and 3 for mothers and children information).

Maternal Assessments

Maternal Depression: Hamilton Rating Scale for Depression - HRSD-17 [39]

The HRSD-17 was used to assess the presence and severity of maternal depressive symptoms. The validated Brazilian version was used in this study [40]. It has excellent reliability and a good correlation with other instruments evaluated by observers. Total scores range from 0 to 52, and the American Psychiatric Association's Handbook of Psychiatric Measures [41] defines its grades of severity as mild depression (8-13), moderate depression (14-18), severe depression (19-22), and very severe depression (≥23). HRSD-17 scores [42] were used in this study as the primary outcome for mothers' presence and severity of symptoms. We defined remission as scores of 7 or less for depressive symptoms and response as a reduction of at least 50% of the baseline score [4,
For analyses, maternal remission was divided into two levels based on the HRSD-17 total scores at the time of evaluation: remission (≤ 7) or no remission (> 7). The maternal response was categorized into three levels based on the percent reduction in baseline HRSD-17 scores: <0% (worsening), reflecting mothers who increased their symptoms, 0 to 50% of reduction in symptoms, and >50% of reduction in symptoms, the last cutoff being the standard and widely used in research to determine response on HRSD-17.

**Maternal Mental Health: Mini International Neuropsychiatric Interview - MINI [45]**

The MINI is a brief standardized diagnostic interview, consistent with the DSM-III-R / IV and ICD-10, intended for clinical practice and primary care research after a short training. The MINI has the same psychometric properties seen in a more complex structured diagnostic interview [46, 47], allowing a reduction of 50% or more of the assessment time. Our study used the Brazilian-Portuguese version [45] of the MINI to evaluate diagnoses of Depression and possible comorbidities. All interviewers were trained before starting the MINI administration.

**Child Assessment**

**Child's behavioral/emotional symptoms: Child Behavior Checklist - CBCL [48, 49]**

The CBCL parent version was used as the primary child mental health outcome. It provides a behavioral profile of the child/adolescent on three scales: overall mental health and behavior problems, internalizing problems (anxiety/depression) and externalizing problems (aggressive, impulsive, opposing, and challenging). The Brazilian translation was used in the study [50].

It consists of 138 items, divided into two blocks. The first block has 20 questions related to social competence. These questions require parents/primary caregivers to compare their children's behaviors with other children of the same age, defining them below, above, or within the mean.
Comparisons requested are relative to time spent on various activities, the degree of participation in groups, quality of family relationships, independence to play or work, and school performance. The second block is composed of eight different scales, for a total of 118 items about emotional and behavioral symptoms, answered by parents/primary caregivers with three alternative answers: false item or absent behavior (score = 0); item partially true or sometimes present behavior (score = 1); and item very true or often present behavior (score = 2). T scores range from 0 to 100 for total externalizing and internalizing problems, while ≥63 are considered clinically impaired. In our analysis, we used CBCL total scores to determine the presence of behavioral/emotional symptoms, and the respondents were mothers participating in the study.

**Statistical Analyses**

Categorical variables were analyzed using frequencies and percentages. Continuous variables were analyzed using means and standard deviations. Mothers who experienced depression remission were compared to those who did not remit using Chi-square, Mann-Whitney, and Kruskal-Wallis tests. Cohen’s d were reported to measure the effect size for the comparison between two means at the maternal remission groups. Alternatively, to compare the three means for the maternal response groups, the effect size were reported by the appropriate Cohen’s f measure. Change in child psychopathology from baseline to 6-month follow-up was evaluated by mother’s remission (HRSD-17 score of ≤7, yes or no) and mother's level of response (percent reduction in baseline HRSD-17 scores: <0%, 0 to 50%, and >50%).

Analyses were adjusted for the child's age and sex and the following control variables: ethnicity, religion, household income, socio-economic status, mother's age, educational level, treatment received (IPC or E-TAU), and psychiatric comorbidity.
To avoid Simpson's paradox, having child's improvement as the dependent variable, all sociodemographic variables were included in multiple linear regression models.

**RESULTS**

The study included sixty dyads, 49 mothers (Mean age: 40.4, SD:10.5; HRSD-17 Mean Score: 17.2, SD: 5.8), where all, accordingly to clinical assessment using the MINI, met diagnostic criteria for depressive disorder, with 60 children (Mean age: 10.4 years, SD: 2.3; 51.7% girls; CBCL Baseline Mean Score: 69, SD: 7.0 ), 56 children (93.3%, CBCL Post-intervention Mean Score: 64.9, SD: 11.5) were evaluated post-intervention, and 53 (88.3% of the initial sample, CBCL 6-month Follow-up Mean Score: 63.8, SD: 9.9) remained in the study at the time of the 6-month follow-up assessment. There were no differences in children's characteristics by mother dropout. Mothers who dropped out before the 6-month follow-up assessment were younger than those that adhered to the protocol (Mean Age: 32.2 years, SD: 5.6 vs. 41.6 years, SD: 10.5; p = 0.0228). There were no differences regarding sociodemographic or clinical variables between mothers that adhered and mothers who dropped out of the study. There were no differences in HRSD-17 scores in both groups, supporting that severity of depression at baseline did not explain dropout 6-months after the end of treatment.

All mothers, randomized to IPC or E-TAU groups, were considered as having received an active intervention. We did not have access to which type of intervention the patients from this group had after referral or even if they received any complete treatment, but we considered that the patients from the E-TAU received active emotional support and care during the contact made by the research psychologists trough phone calls, which had a psychological impact.
Maternal Remission and Changes in Child behavioral/emotional symptoms

Table 1 summarizes the baseline characteristics of mothers and their children by remission of maternal depression at two time-points, post-intervention and at the 6-month follow-up assessment, respectively. Among mothers who received follow-up assessments, 9/45 (20%) at post-intervention and 13/43 (30%) at 6-month follow-up remitted from depression (HRSD-17 Score ≤7). Of the 13 mothers whose remission in depression persisted 6-month after treatment, 6 (46%) received IPC treatment only. Mothers who remitted at post-intervention assessment were more likely to be catholic (67% vs. 19%; \( p = 0.0129 \), see Table 1) compared to protestants or others and had children who lived with both biological parents at that time of evaluation (54% vs. 46%; \( p = 0.0332 \); see Table 1), compared to those living only with biological mother or others.
At the 6-month follow-up, mothers who achieved remission criteria for depression decreased the mean score on HRSD-17 from 16.8 (SD: 4.2) to 3.5 (SD: 1.9). Sociodemographic characteristics did not differ between remitted and non-remitted mothers.
Child CBCL mean scores at both evaluation times (post-intervention and 6-month follow-up) by maternal remission are described in Table 2. The only group of children who achieved asymptomatic mean scores at CBCL (≤60) is shown at a 6-month follow-up in which the mothers remitted from depression (CBCL Mean Score: 58.43, SD: 10.08).

<table>
<thead>
<tr>
<th>Maternal Remission</th>
<th>No Remission</th>
<th>Remission</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>CBCL psychopathology means post-intervention (N=56)</td>
<td>46</td>
<td>65.87</td>
<td>10.96</td>
</tr>
<tr>
<td>CBCL psychopathology means at follow-up (N=53)**</td>
<td>37</td>
<td>65.65</td>
<td>9.16</td>
</tr>
</tbody>
</table>

Abreviation: CBCL, Child Behavior Check-List.

*The scoring range is from 0 to 100. Scores higher or equal to 63 indicate clinical impairment.

**Numbers may vary in each category due to missing data.

There was no evidence that maternal remission was related to lower behavioral/emotional symptoms in children at post-intervention assessment (p = 0.1636, Cohen’s d: 0.48). However, there was a statistically significant effect of time and group (p = 0.0247, Cohen’s d: 0.76), meaning that the reduction in child behavioral/emotional symptoms was higher at 6-month follow-up among children of mothers who remitted from depression.

**Level of Maternal Response and Changes in Child's behavioral/emotional symptoms**

To better understand maternal improvement, we examined change in baseline HRSD-17 scores by maternal response to treatment classified into three levels, as previously described, considering scores from baseline, post-intervention (n=45), and 6-month follow-up (n=43). Table 3 summarizes the baseline characteristics of mothers and their children by maternal response level at two time-points, post-intervention and at the 6-month follow-up assessment, respectively.
Among mothers who received follow-up assessments, 10/45 (22.2%) at post-intervention and 15/43 (34.9%) at 6-month follow-up presented a response >50%. Of the 15 mothers whose
response to treatment was >50% reduction in depressive symptoms according to HRSD-17, at 6-month after treatment, 8 (53%) received IPC treatment only. Mothers who presented >50% of reduction in symptoms at post-intervention assessment were all married (p = 0.0339; see Table 3), and in the same group (>50% of reduction at post-intervention assessment), mothers were more likely to be catholic (70%) compared to protestant or other religions (p = 0.0044; see Table 3).

Child CBCL mean scores at both evaluation times (post-intervention and 6-month follow-up) by maternal response are described in Table 4. The only group of children that achieved asymptomatic mean scores at CBCL (≤60) at both times is the group in which the mother's response reaches the level of >50% of reduction in depressive symptoms (Score: 57.82, SD: 13.81 and 59.65, SD: 10.17, respectively). Therefore, only the children whose mothers had a more remarkable improvement have shown clinical progress, according to CBCL criteria.

<table>
<thead>
<tr>
<th>Maternal Response Level (%)</th>
<th>Worse = &lt;0</th>
<th>0-50</th>
<th>&gt;50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>CBCL psychopathology means* post-intervention (N=56)</td>
<td>17</td>
<td>67.88</td>
<td>9.03</td>
</tr>
<tr>
<td>CBCL psychopathology means* at follow-up (N=53)**</td>
<td>17</td>
<td>69.00</td>
<td>8.87</td>
</tr>
</tbody>
</table>

Abreviation: CBCL, Child Behavior Check-List.
*The scoring range is from 0 to 100. Scores higher or equal to 63 indicate clinical impairment.
**Numbers may vary in each category due to missing data.
‡ p-values are based on Kruskal-Wallis nonparametric tests

Although children achieved asymptomatic scores at CBCL at both times, there was no statistical evidence that maternal response was related to lower behavioral/emotional symptoms in children at post-intervention assessment (p = 0.0720, Cohen’s f: 0.33). However, there was a statistically significant difference (p = 0.0224, Cohen’s f: 0.44) at 6-months follow-up among children of mothers with better response in depressive symptoms after the intervention.

There were no significant differences in proportions of maternal depressive symptoms response or remission based on the type of treatment they received, IPC or E-TAU, either at post-

intervention (response: \( p = 0.0695 \); remission: \( p = 0.6295 \) or 6-month follow-up (response: \( p = 0.4563 \); remission: \( p > 0.999 \)), both compared with baseline HRSD-17 scores.

**DISCUSSION**

Strong evidence shows that mothers’ remission of depressive symptoms positively affects their children [51-53]. This study examined if a brief intervention for maternal depression administered by CHW in a primary care setting improved their children's behavioral/emotional symptoms. Dyads were followed up to six months after treatment, and we found that remission of maternal depression (HRSD-17 score of 7 or lower) was associated with improvement in children's behavioral/emotional symptoms (CBCL below clinical level). We also found improvement in children's symptoms when mothers responded to treatment (particularly with a change of 50% or more in the HRSD-17 score), reducing the severity of depressive symptoms at post-intervention assessment and 6-month follow-up.

In our study, remission and maternal depression response were associated with lower child behavioral/emotional symptoms at 6-month follow-up. Using the percentage of reduction in maternal depression as a continuous variable, we also conducted a multiple linear regression adjusted for possible confounders, including child gender and age, ethnicity, religion, household income, socio-economical class, mother's age, educational level, treatment received, and comorbidity. As a result, only a reduction in maternal depression scores reached statistical significance in lower child CBCL scores (Coefficient: 0.040; SD: 1.797 /\( p = 0.0301 \)). These analyses suggest that the more significant the improvement in maternal depression, the greater the improvement in children's psychopathology (for each point decreased in the HRSD-17 score, 0.04 points decreased in the CBCL score). The same was made for remission, and maternal remission was the only statistically significant (Coefficient: 6.420, SD: 2.286 /\( p = 0.0071 \)) variable related
to the child's improvement at 6-month follow-up. These regressions corroborate with the previous analyses, so we chose to present the results with the previous analyses, facilitating data interpretation.

In a study that evaluated child outcomes after a medication treatment for maternal depression, child psychopathology improvement only occurred within the first 3 to 6 months after their mother's treatment [54]. Another study that evaluated a psychological treatment found that child improvement by the positive maternal response to treatment reached significance only three months later and strengthened association at six months [55].

In our sample, children presented improvement on CBCL scores at post-intervention assessment (related with CBCL baseline scores) associated with maternal response to depression treatment ($p = 0.0441$, Cohen’s $f$: 0.38), but not with maternal remission ($p = 0.2099$, Cohen’s $d$: 0.59). However, at the 6-month follow-up, child symptom levels decreased, in relation to CBCL baseline, for improved maternal response ($p = 0.0229$, Cohen’s $f$: 0.40) and maternal remission ($p = 0.0169$, Cohen’s $d$: 0.86). Changes in children occurring later (after 6-months) could be explained by the fact that the effectiveness of psychotherapy, especially when compared to medication, is frequently observed in the long term as a continuous and persistent effect, suggesting that interventions may have downstream effects, particularly on child functioning. Furthermore, the positive repercussion in children's behavioral/emotional symptoms observed later can be explained by the correlation of maternal depression improvement that leads to changes in mothers' parenting, as well as family functioning (maternal warmth and acceptance, positive maternal behavior, and family functioning), which can affect the relationship of the dyad, and consequently change children's symptoms. This result is consistent with previous findings [52, 56], indicating that children's behavioral/emotional symptoms frequently decrease over time within decreases in
maternal depression, mediated by parenting changes. The mothers in this study were treated with IPC or E-TAU, but the findings reported here would likely apply to any effective treatment for depression, and further studies utilizing time-varying effects model the timing and nature of these associations.

Even with those findings and associations previously reported, the reason why maternal depression remission had a positive impact on children over time is still unclear. In other studies [57, 58], multiple contextual risks relevant to child psychopathology could be positively impacted by decreased maternal depression, including diminished family conflict, perceived stress, parenting hassles, low social support, and fewer family organization resources. Furthermore, children's improvement can positively impact mothers, a reverse causation phenomenon.

From this perspective, those mothers who did not improve or deteriorate with treatment (in our study, part of the 'worsening' maternal depression response group) could be a marker for the severity of maternal depression, which can also be reflected as higher levels of severity in the child. Moreover, and from another perspective, the severity in the child could also be explained by prior causes, such as genetic or earlier environmental elements.

Children of mothers with depression are exposed to cumulative risks that may increase the impact of depression on child outcomes. Epidemiological data [59] suggests that addressing maternal depression and associated risk factors may be the most effective way to prevent adverse outcomes in the offspring. Studies that consider the effect of maternal depression may benefit from also considering other risk factors associated with the mother's mental health.

Robust evidence shows that maternal depression is highly prevalent and potentially harms child mental health. Although the genetic component on a child's psychopathology has a high impact [60], this study supports the strong influence of the environmental factor of remission and
response in maternal depression. It is crucial to find feasible and highly disseminated therapeutical tools for public use, mainly in LAMIC.

A recently published trial [55] comparing nine weekly brief psychotherapy sessions of IPT-MOMS (Interpersonal psychotherapy for mothers) and BSP (Brief supportive psychotherapy) showed improvement over time in depressive symptoms in mothers and psychiatric symptoms in children with no differences between groups of treatment. However, children were also receiving treatment in mental health clinics, which could have masked the benefit and association between maternal depression improvement and child outcomes. Our study did not focus on the differences or efficacy by the type of treatment mothers received, and in our analyses, IPC and E-TAU did not differ in maternal treatment outcomes. As described earlier in “Results,” both of the interventions conducted were considered maternal’ support care, as both approached the management of depression in primary care. A previous study [61] reported that the treatment offered in primary care settings matters when the approach considers building a close relationship with empathic listening and the patient's engagement within the community and other resources.

Our study is the first to assess school-aged children in an LMIC as their mothers underwent non-medication treatment by recruiting depressed mothers seeking treatment. School-age children's moms tend to seek treatment for children who have symptoms and not for themselves, and this could be difficult for them to engage in the treatment if this were proposed [29]. In our study, mothers sought treatment for themselves, which facilitates engagement.

There are some limitations to our study. Although the instrument used to identify symptoms in children and evaluate outcomes in our analysis is widely used in pediatric mental assessment, a diagnostic assessment for children could also have helped us better understand the disorders that those children had developed. Moreover, best practices in assessing psychiatric disorders in
children require both mother and child reports. In our study, we relied only on maternal reports (in our study, children's data was assessed through CBCL administered to caretakers). This is an essential limitation of the study. It is essential to consider that depression in mothers could negatively affect their children's behaviors. However, if depression-related bias had influenced children’s scores, we would expect an association between the severity of maternal depression symptoms and maternal reports. These associations were not found. Future studies should include children’s and, if possible, teacher’s reports across child behavioral assessments and/or assess biomarkers of outcomes in the child to address this point.

Other limitations are that only one primary health unit attended all cases of depressed mothers and the restriction in the sample when we selected only mothers who had children with initially high levels of symptoms as per the CBCL and excluded 20 children without clinical symptoms for behavioral/emotional problems in the CBCL.

Even considering that some mothers increased their symptoms after six months of treatment, most of them achieved good results regarding maternal response (n=26 vs. 17), and mean scores on HRSD-17 decreased in both evaluation, post-intervention, and 6-month follow-up assessment. Furthermore, these results made it more substantial that maternal outcomes are associated with child’s outcomes. For our sample, when mothers improved, children improved, and the opposite was true; when maternal symptoms worsened, the same happened with child symptoms.

Public health approaches must be in place so that the benefit of treating mothers who are depressed can be fully realized. The burden caused by depression on economic and social issues and the consequences of that illness for future generations is enormous. Improving child's mental health by treating their mothers could buffer such impact. Our study's significant strength is that
our findings support that it is possible to improve mother and child's mental health, training and enabling community health workers and scale up care for mental health disorders, especially in a low-resource setting.

Even though our study did not have enough evidence to prevent worse outcomes in later life, a follow-up with qualitative data conducted in Uganda[62] shows that providing treatment for depression in low-resources communities may lead to positive changes in global health and development after years.

According to prospective studies, task sharing[63] in primary care is a promising strategy for addressing the mental health treatment gap, especially in low-and-middle-income countries, and diminishing the burden of depression worldwide [3].

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