

# Sensitivity and specificity of the pictorial Pediatric Symptom Checklist for psychosocial problem detection in a Mexican sample

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## ABSTRACT

Written questionnaires have been developed to assess children's risks of psychosocial problems based on parents' responses. However, the effectiveness of these questionnaires is limited in populations with low literacy rates, which are also among the most in need of improved mental health screening and care. The present study compared the sensitivity and specificity of a version of the Pediatric Symptom Checklist (PSC) –which contained pictorial descriptions in addition to written text– against the “gold standard” Child Behavior Checklist. We retrospectively analyzed 240 sets of questionnaires completed by the mothers or stepmothers of children who visited clinics in a Community Center in Ciudad Juárez, Mexico, between May and December 2007, under the Seguro Popular insurance program provided to Mexicans with the lowest socioeconomic status. Over 95% of the parental participants had less than a high school level of education. The pictorial PSC was a useful tool for screening for psychosocial impairment, with improved sensitivity and specificity in comparison to previous assessments of the written PSC in similar populations within the U.S. Optimal sensitivity and specificity were achieved when the threshold for clinical follow-up was lowered from 28 to 22 points. Questionnaires that include pictorial descriptions may be valuable for improvements of health screening in communities with low education levels.

**Key words.** Pictorials. Detection. Mental health. Sensitivity. Specificity. Psychosocial problems.

## *Sensibilidad y especificidad del cuestionario sobre el comportamiento de niños para la detección de problemas psicosociales en una muestra mexicana*

## RESUMEN

*Se han desarrollado cuestionarios en los que el padre o guardián al responder permite detectar problemas psicosociales y de comportamiento en niños/adolescentes. A pesar de la ventaja que representan estos cuestionarios, su eficacia es limitada en aquellas poblaciones en donde los niveles de alfabetismo funcional son bajos y que son precisamente las que tienen mayor necesidad de detección y tratamiento de este tipo de problemas. Este estudio compara la sensibilidad y especificidad de una adaptación del cuestionario sobre Adaptación Social y Emocional en los Niños –que contiene pictogramas, además de texto en las preguntas– con el Cuestionario Sobre el Comportamiento de Niños(as) (CBCL). Analizamos retrospectivamente 240 cuestionarios que fueron completados por los padres de niños/adolescentes durante la consulta a un centro comunitario en ciudad Juárez, México entre mayo y diciembre del 2007. Los participantes son beneficiarios del Seguro Popular, el cual se le da a mexicanos que se encuentran en los niveles socioeconómicos más bajos. Más de 95% de los participantes indicaron tener un nivel educativo inferior a la preparatoria. El cuestionario usando pictogramas resultó ser una herramienta útil para detectar problemas psicosociales en esta muestra de la misma forma que lo hizo en Estados Unidos con una población similar, presentando una mejor sensibilidad y especificidad al compararla con la versión escrita. La sensibilidad y especificidad óptima se logró al reducir el punto de corte de 28 a 22. Los cuestionarios que incluyen pictogramas pueden ser útiles para mejorar la detección de problemas de salud en comunidades con niveles escolares reducidos.*

**Palabras clave.** Pictogramas. Detección. Salud mental. Sensibilidad. Especificidad. Problemas psicosociales.

## INTRODUCTION

Mental health disorders in children and adolescents are caused by biological and/or environmental factors.<sup>1</sup> Examples of causative biological factors are genetics, chemical imbalances in the body, and damage to the central nervous system, such as a head injury. Many environmental factors, such as exposure to violence, extreme stress, and the loss of an important person, can also affect mental health.<sup>2</sup> The resulting disorders, which include learning and conduct disorders such as depression, anxiety, or attention deficit, range from mild to severe. Children can have more than one disorder. Mental, emotional, and behavioral disorders that occur during childhood and adolescence may seriously impact a child's overall health.

Numerous studies have shown that untreated mental health problems can develop into more severe psychosocial impairments as children move into adolescence, placing them at risk for school dropout, problems with authorities, and antisocial behavior.<sup>3-5</sup> Previous studies suggested that one in five children and adolescents in the U.S. have a mental, emotional, or behavioral disorder that needs to be identified and that requires treatment.<sup>6,7</sup> In Mexico, one out of eleven adolescents is estimated to have a serious mental disorder, one in five a moderate disorder, and one in ten a mild disorder.<sup>8</sup> Studies in both the U.S. and Mexico indicate important barriers to the utilization of existing mental health services, including lack of detection, services, common beliefs, and cultural practices regarding mental health, with particular problems in populations from lower socioeconomic strata.<sup>2,9,10</sup>

During the past decade, early intervention services have proven effective for improving outcomes for children with developmental and mental health problems,<sup>11,12</sup> although cultural and economical constraints have been recognized as difficulties in both the recognition and treatment of children showing a psychosocial impairment, even after it has been detected in the clinical setting.<sup>13-15</sup>

The assessment of mental health problems and subsequent referral to appropriate services rely largely on screening. Primary care physicians often receive information from parents during physical examinations or pediatric sick visits about psychosocial and behavioral problems of their children. Further assessment information may rely also on the use of surveys, screening tools, or verbal questions. In the case of screening tools, it is important to use those that are characterized by validity,

reliability, peer recognition, sensitivity, availability, normative data, ease of use, and cost effectiveness. Such screening tools, completed by parents in the doctor's waiting room, give the health provider a higher probability of detecting mental health problems. Parents and physicians can then use the obtained information to develop a plan for managing problematic behaviors, whether through an educational intervention or a more comprehensive approach, such as counseling.

Most of the current screening tools were developed and tested on populations where barriers of communication were not a major problem. Thus, the accuracy of the screening tools might not be as high as expected when they are used with populations from lower socioeconomic strata or with lower levels of education.<sup>16</sup> Reading written material requires the development of complex skills. Understanding a written paragraph requires the same type of organization and analysis required for the thinking process, which includes learning, reflection, judgment, analysis, synthesis, problem solving, selection, organization, comparison of data, determination of relationships, and critical evaluation of what is being read.<sup>17</sup> In the case of a screening tool, its efficacy depends on the respondents' ability to adequately comprehend questions and respond appropriately, which is directly dependent on the respondent's reading ability.<sup>18,19</sup> Several strategies have been examined for solving the problem of reading deficiencies in parents or caretakers: pictorial descriptions added to the written questions<sup>20</sup> or verbalization of the questions when the parent cannot read and respond to the questionnaire themselves.<sup>21</sup> The success of pictorial descriptions or explanatory illustrations depends on their effectiveness in helping the reader understand the text,<sup>22</sup> and whether they effectively describe or explain procedures by connecting actions and events.<sup>23</sup>

A previous study<sup>24</sup> showed that pictorial descriptions helped parents respond to a widely used screening tool, the Pediatric Symptom Checklist (PSC), which possesses many of the positive attributes mentioned above (validity, reliability, etc.). When used with Mexican-American parents from lower socioeconomic strata (SES) living in the U.S., the Pictorial Pediatric Symptom Checklist (PPSC) led to an improvement in the detection of psychosocial and behavioral problems, compared to the original PSC that contains only written questions.<sup>20</sup> Although there is evidence that the addition of pictorial descriptions to a screening tool can increase parents' ability to read, comprehend, and respond to questions,

the advantages of using descriptive pictorials have not been extensively explored. The present study used the PPSC to gather information about children from lower SES living in Mexico. The sensitivity and specificity of the PPSC were compared with those of the pictorial version of the CBCL (PCBCL).<sup>25</sup> The CBCL is considered to be the “gold standard” for identifying children at risk of psychosocial problems.

## MATERIALS AND METHODS

### Type of study

This study is a retrospective audit of clinical data concerning patients aged 6-16 years old who attended a community center with nine clinics providing non-emergency services in Ciudad Juarez, Chihuahua State, Mexico. The study received the approval of the Texas Tech University Health Sciences Center Institutional Review Board.

### Participants

Participants were the parents of patients between 6 and 16 years old who attended a Mexican government-funded community clinic under the Seguro Popular insurance program, which is provided by the government of Mexico to extend health insurance to cover services including regular and preventive medical care, pharmaceuticals, and health facilities to 50 million uninsured Mexicans in the lowest SES.<sup>26</sup>

The responses to two pictorial adaptations of questionnaires, the PPSC and PCBCL, administered during non-emergency visits from May to December 2007 were retrospectively reviewed. Due to the fact that few questionnaires were completed by a person other than the mother or stepmother, only questionnaires completed by the mother/stepmother were used.

### Measures

- **Pictorial Pediatric Symptom Checklist (PPSC).** The PPSC is an adaptation of the Pediatric Symptom Checklist (PSC) developed by Dr. Michael Jellinek and Dr. Michael Murphy,<sup>27</sup> in which pictorials have been added to the original 35 questions. This brief screening questionnaire is used to screen for psychosocial problems in children aged 6-16 years. It is a reliable indicator of possible problems that require further evaluation due to possible psychological impairment including externalizing (conduct, attention, etc.)

and internalizing (depression, anxiety, etc.) behaviors. Its 35 short statements are designed to evaluate the functioning of the child in several psychosocial areas: feelings, behavior, family, school, and friends. A child's parent/caretaker rates each item for how accurately (to the best of their knowledge) it describes the child, using the following scale: 0 = never; 1 = sometimes; 2 = often. A total score is calculated by adding the individual scores for each item, yielding a range of possible scores from 0 to 70 points. For school-aged children (6-16 years old), a total score of 28 or higher indicates significant psychosocial impairment. Spanish and English language versions of this screening tool are available, and its comparability with the original PSC has been demonstrated.<sup>20</sup>

- **Pictorial Child Behavior Checklist (PCBCL).** The PCBCL is an adaptation of the Child Behavior Checklist (CBCL).<sup>28</sup> It contains 120 behavioral and emotional problem items that are scored on a 3-point scale (0 = not true; 1 = somewhat or sometimes true; 2 = very true or often true). Factor analysis of CBCL items yields eight syndromes, of which three (Anxious/Depressed, Withdrawn Depressed, and Somatic Complaints) load onto the broad-band Internalizing scale and two (Rule-Breaking and Aggressive) load onto the broad-band Externalizing scale. The other three syndromes (Social Problems, Thought Problems, and Attention Problems) do not load differentially on either broad-band scale. A Total Problems score is computed by summing all problem items, and T scores are calculated for each scale. Normative CBCL data for children in Mexico is not available. Therefore, we used the closest available normative culture, which was calculated based on data from Puerto Rican children. High test-retest reliability (e.g., mean  $r = 0.90$  for empirically based scales) and strong internal consistency (e.g.,  $\alpha = 0.97$  for the Total Problems score) have been reported for the CBCL.<sup>24</sup>

### Sample selection

Mothers or stepmothers of the children attending the clinics during this period responded to the two questionnaires. Most mothers/stepmothers who responded to this study had an educational level lower than high school (95.6%), and their socioeconomic status was at the lowest socioeconomic level given the type of health coverage provided to them.

## Area of Study

The population of Ciudad Juarez (CDJ), Chihuahua State, Mexico, reached 1,300,000 people in 2005, of which nearly 106,000 were adolescents. CDJ is a rapidly growing city and currently the 5th largest in Mexico. A large number of immigrants from outside of the State of Chihuahua (32%), mainly from other Mexican cities in central and southern Mexico, come to CDJ searching for work or to try to cross the U.S. border. The economy in CDJ is very much dominated by the offshore assembly and manufacturing industries. The Community Center where the information was collected is funded by the government and serves a large number of families who are not currently working in Mexican companies and who have medical services provided by the social security system.

## Data Analysis

Descriptive analysis was used to describe the characteristics of the sample. Means and standard deviations (SD) were calculated for the scores of the PPSC and PCBCL. The PCBCL was used as the criterion standard to determine sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and likelihood ratio (LR).<sup>20,21,29-31</sup> To determine the most favorable cut-off score for the use of the PPSC in this population of low-SES Mexi-

can children, we used receiver operator characteristic curves (ROC).

## RESULTS

### Demographics

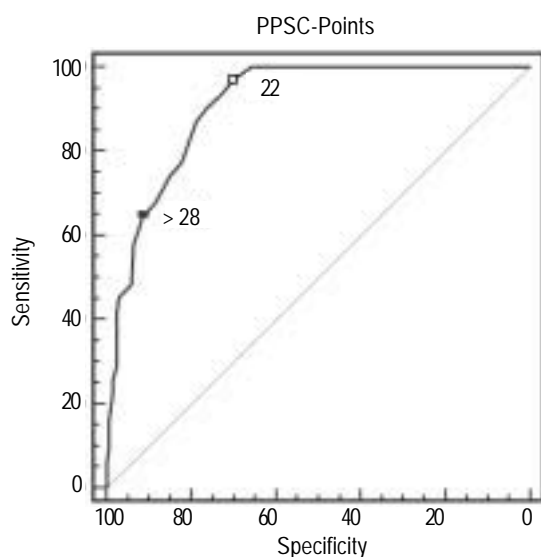
From a total of 240 questionnaires, 233 (97.1%) were completed. The mean age of female patients was 11.1 years (SD = 2.96 years) and that of male patients was 11.2 years (SD = 3.1 years), with a range of 6-16 years. Males comprised 50.6% of the sample group. All participants were insured by the Seguro Popular government program for those in the lowest SES in Mexico. Of all the parents who responded to the questionnaire, 95.6% had not attained a high school level of education.

The means and standard deviations for the PPSC and PCBCL T score scales are presented in table 1 for all children and for girls and boys separately. Boys had a significantly higher mean PPSC score than girls. There was no statistical difference in the scores when calculated for subgroups of ages 6-11 and 12-16 years old; therefore, age was not stratified in the rest of the analysis.

The authors of the PPSC recommend a cut-off score of 28 for children between 6 and 16 years old to determine the need for further assessment. In our cohort, 44 of 233 (18.9%) patients met this criterion. For the PCBCL "gold standard", scores of 60 or higher on the Total, Internalizing or Externalizing scales are considered the threshold for further

**Table 1.** The means and standard deviations of the PPSC and PCBCL T scores for all children and girls and boys separately, as well as respective significance levels.

	All children Total (n = 233) Mean (SD)	Boys (n = 118) Mean (SD)	Girls (n = 115) Mean (SD)	Significance
PPSC	19.4 (9.2)	20.6 (9.2)	18.0 (9.1)	P = 0.03
PCBCL				
Internalizing	47.7 (11.2)	48.1 (11.1)	47.3 (11.3)	NS
Externalizing	50.6 (9.0)	51.2 (8.7)	50.0 (9.8)	NS
Total	49.3 (10.1)	50.0 (9.8)	48.7 (10.4)	NS
Anxious/depressed	53.6 (6.0)	53.8 (6.4)	53.3 (5.5)	NS
Withdrawn/depressed	52.3 (4.4)	52.4 (4.3)	52.3 (4.6)	NS
Somatic complaints	54.7 (6.5)	54.8 (6.4)	54.7 (6.7)	NS
Social	54.5 (5.8)	54.7 (6.1)	54.4 (5.6)	NS
Thought	54.5 (6.2)	54.4 (6.4)	54.6 (6.0)	NS
Attention	52.8 (4.4)	52.8 (4.5)	52.9 (4.4)	NS
Rule-breaking	53.5 (4.5)	53.6 (4.3)	53.3 (4.7)	NS
Aggressive behavior	54.5 (6.0)	55.0 (6.1)	54.1 (6.0)	NS



Sensitivity and specificity for several cut-off points at T score > 60 optimal are marked in bold.

Cut-off	Sensitivity	Specificity
> 28	64.5	91.5
> <b>21</b>	<b>96.8</b>	<b>70.3</b>
> 24	87.1	78.7

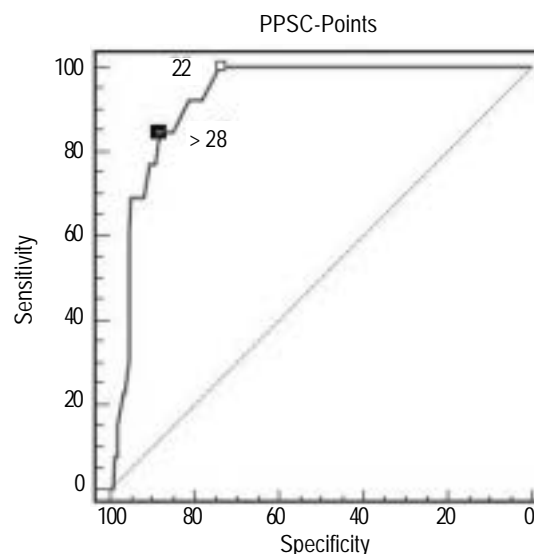
**Figure 1.** Receiver-operator characteristics (ROC) curve for all possible cut-off points of the PPSC using the PCBCL-total problems score (for T value > 60). Sensitivity and specificity of the PPSC using the PCBCL Total scale as a criterion standard for classifying total behavioral problems in Mexican children at T > 60. Area under the ROC curve (AUC) = 0.911; standard error = 0.0358; 95% confidence interval = 0.867-0.944; z statistic = 11.4, significance level P = 0.0001.

assessment. In our cohort, 52 of 233 (22.3%) patients met this criterion.

Sensitivity and specificity were calculated for the PPSC using the PCBCL as a reference. Scores of 60 or higher on the Total, Internalizing or Externalizing scales were considered to be positive. Figures 1 and 2 shows the sensitivity, specificity, PPV, NPV, and LR values determined using the cut-off scores suggested by the questionnaires' authors.

### ROC analysis

To determine the PPSC cut-off score with maximal sensitivity and specificity, ROC<sup>32</sup> analyses were performed using the positive PCBCL Total, Internalizing or Externalizing problem scale results (scores  $\geq 60$ ). A cut-off of 22 most accurately classified children with and without behavioral problems,



Sensitivity and specificity for several cut-off points at T score > 64 optimal are marked in bold.

Cut-off	Sensitivity	Specificity
> 28	84.6	88.2
> 21	100.0	65.0
> <b>24</b>	<b>100.0</b>	<b>74.1</b>

**Figure 2.** Receiver-operator characteristics (ROC) curve for all possible cut-off points of the PPSC using the PCBCL Total problems score (for T value > 64). Sensitivity and specificity of the PPSC using the PCBCL Total score as a criterion standard for classifying total behavioral problems in Mexican children at T > 60. Area under the ROC curve (AUC) = 0.928; standard error = 0.05; 95% confidence interval = 0.887-0.954; z statistic = 8.6, significance level P = 0.0001.

with a sensitivity of 94.5 (95% confidence interval [CI]: 81.8-99.2) and a specificity of 72.0 (95% CI: 65.1-78.1).

### DISCUSSION

The present study used a pictorial adaptation of the Pediatric Symptom Checklist (PSC) a screening tool that has been validated in different populations across the world.<sup>30,31,33,34</sup> The PSC is endorsed by the Bright Futures Mental Health Initiative of the Academy of Pediatrics, a national health promotion initiative launched in 1990 by the Maternal and Child Health Bureau,<sup>35</sup> in the U.S. The PSC has been shown to help primary care physicians screen for psychosocial and behavioral problems among children from diverse settings,<sup>30,36</sup> including deprived backgrounds.<sup>21,24,37,38</sup> However, some pre-

vious studies indicated relatively low prevalence rates for adjustment problems among children living in poverty, and suggested that the PSC cut-off score should be lowered when used on these populations.<sup>21,31,37</sup> The present study compared results of the PPSC to the PCBCL. The PPSC detected 68% of Mexican children from lower SES that were identified by the PCBCL as having psychosocial and behavioral problems. Therefore, using the PPSC it will be possible to detect almost 3 of every 4 children with psychosocial problems. Specificity of the PPSC was 90.3%, which indicates that in almost all cases where psychosocial and behavioral problems are not found, it will most likely be because no problems exist.

When the cut-off score was reduced from 28 to 22 points, specificity was reduced to 72%, but sensitivity increased to 94.5%. This reduction is small relative to the reduction in cut-off score of 28 to 13, which was suggested by a previous study that used the PSC with a comparable population in the U.S.<sup>21</sup>

The ability of primary care pediatricians to recognize and appropriately refer children with behavioral problems would be enhanced by systematically screening all children with a standardized instrument. Attendance at a community clinic presents an opportunity to screen children for possible problems while they receive other services. The results of the present study indicate that the PPSC is a useful screening tool that could aid healthcare providers in Mexico in screening for psychosocial and behavioral problems. Despite the lack of normative data, the PSC and the PPSC could detect at least 65% of children with possible problems and almost 95% if the cut-off score was reduced. The PPSC includes pictorials that have the advantage of communicating large amounts of information at a glance and represent information in a spatially condensed form. Pictorial descriptions have many advantages when used to explain the text since they can be multi-dimensional (i.e., incorporating features such as color, shape, size in various combinations into the basic message). Some people are better at processing pictures than words.<sup>39</sup> In the case of screening tools with both illustrations and text, this feature seemed to help parents with low levels of education understand the questions. The PPSC takes only a few minutes to complete and can be downloaded at no cost from <http://www.dbpeds.org/media/PPSC-spanish2.pdf>.

The present study has some limitations: charts were selected for medical audit without randomization. Instead, all charts were audited during the pe-

riod when the screening tool was used. The patient population belonged only to the lowest SES. In addition, the "gold standard" used for this study was the pictorial version of the CBCL, which has been used in other studies validating the PSC; however, consideration needs to be taken concerning a margin of error when using any type of "gold standard".<sup>40,41</sup> Despite its limitations, the present study provides an important validation of an instrument that could help identify at-risk youths in a geographic area in which a large percentage of the population falls within low SES.

Some clinical and social implications in this study also should be considered. The children included in the sample lived in poor neighborhoods around a community clinic in CJD, which was the most violent city in the world during 2008 and 2009.<sup>42</sup> Although the data were collected from 2007, the mental health conditions of children living in poverty are considered to be at-risk. Their mental health is worsened by exposure to chronic environmental adversity (e.g., community violence)<sup>7</sup> and the impact of family environmental stressors (e.g., joblessness and low levels of education),<sup>43-45</sup> with the risk that these children will respond to such factors by becoming violent.<sup>46,47</sup> Chronic environmental adversity among youth can have short- and long-term effects. Children and adolescents can experience, witness, or hear about violence all at once, in combination or independently several times a day. While the effects of the interlinked exposure can cause children and adolescents greater psychological distress in general,<sup>48</sup> specifically conditions such as Post Traumatic Stress Disorder (PTSD),<sup>49</sup> internalizing and externalizing symptoms,<sup>50</sup> poor school performance,<sup>51</sup> and a higher risk for current substance abuse/dependence<sup>52,53</sup> can occur. In the long term, studies have shown that multiple childhood traumas can be viewed as an independent determinant of chronicity of depression,<sup>54</sup> increased prevalence of sexually-transmitted diseases,<sup>55</sup> school dropouts, delinquency, suicide attempts, and early mortality.<sup>56</sup>

A study conducted in a large metropolitan city in Mexico found that at least 68% of adolescents experienced at least one type of chronic childhood adversity, the most frequent being economic adversity, followed by witnessing domestic violence.<sup>57</sup> Almost 7% of those adolescents experienced four or more adversities, with greater psychosocial and behavioral effects.

Poverty has been well established as a risk factor for mental disorders across all age groups in both low- and high-income countries.<sup>3,58-60</sup> Those who live

in poverty are less educated or lack a stable job, and have an increased risk of suffering from mental disorders. Detection of mental problems in children living in poverty is hindered by the problems embedded in poverty. Their parents frequently have lower levels of education, possess reduced health literacy skills, and must prioritize many other basic needs over the pursuit of treatment for and prevention of mental health problems. Results of the present study indicate that the PPSC, which uses pictorial descriptions, can detect psychosocial problems in the clinical setting and may ultimately improve the care of patients regardless of their social background.

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## NOTA:

En el original de este artículo estaba citada la Tabla 2 pero no teníamos original y no estaban citadas las figuras 1 y 2.

1. Con la Primera corrección del autor(corrector) de la RIC nos enviaron la tabla 2, pero no citaron las figuras.
2. Con la Segunda corrección del autor (corrector) de la RIC citaron las figuras 1 y 2 en el lugar donde se citaba la tabla 2. Por lo que la tabla 2 ya no está citada en el texto.