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Psychometric properties of the Chinese version of the Parental Bonding Instrument

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Abstract

Background—The Parental Bonding Instrument (PBI) is a widely used assessment tool for measuring parental characteristics that affect parent-child bonds. The measure was developed for and has been most administered in Western populations. Psychometric analyses have yielded discrepant results as to whether the PBI is best represented by a two-factor model (*care* and *overprotection*) or a three-factor model (*care*, *overprotection*, and *autonomy*).

Objectives—Little is known about how the PBI performs in Chinese samples, and there is limited data from Eastern populations as a whole. The purpose of this study is to 1) explore the data and identify the underlying structural model that best fits the Chinese culture, and 2) to further compare the factor structure that emerges in a Chinese sample with that which has emerged in other Eastern cultures (i.e., Japanese) and Western countries.

Methods—The present study investigated the psychometric properties of a Chinese translation of the PBI among a sample ($N = 1417$) of mothers of kindergarten children. Confirmatory factor analysis was used to identify the best-fitting model.

Results—Results supported a four-factor model that included an *indifference* factor ($\chi^2/df < 3.0$; $RMSEA \leq 0.06$; $SRMR < 0.08$). Both the two-factor and three-factor models performed poorly ($\chi^2/df > 5.0$; $RMSEA > 0.08$; $SRMR > 1.0$; $CFI < 0.90$ for both). In this sample, use of a Chinese translated version of the PBI was successful. Support for the four-factor model is consistent with findings from previous studies of Eastern populations and discrepant from those among Western samples.

Conclusions—The *indifference* factor may reflect aspects of parenting specific to Eastern cultures, which tend to value group cohesion over individualization and independence. More research is needed to determine whether these findings are generalizable to all Eastern countries and whether aspects of Chinese culture (e.g., the single-child law) produce unique effects that may impact PBI administration in China.

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Keywords

PBI; Parent Bonding; Construct Validity; Cross-Cultural; Chinese

Introduction

The Parent Bonding Instrument ([PBI] Parker, 1979) is one of the most widely used instruments to measure parent-child bonding. It was designed by Parker to produce a two-factor model that assesses parenting styles in terms of parental caring (e.g., warmth, sensitivity) and overprotection (e.g., control, intrusion). It allows for any parental contribution to disorder to be specified and quantified. The psychometric properties for the PBI are strong and have been well-established (Parker, 1983; Kay and Parker, 1990; Kay et al., 2005; Safford et al., 1997). In addition, the PBI has strong test-retest reliability, long-term reliability, and validity (Parker, 1990; Wilhelm and Parker, 1990; Arrindell et al., 1998).

Poor or unstable parent-child bonding has been significantly associated with a host of negative psychosocial outcomes, including the development of psychopathology during childhood, adolescence, and/or adulthood, criminal behavior, homelessness, substance use, unstable interpersonal relationships, poor school performance, difficulty coping with stress, and low self-esteem (Yoo et al., 2006; Rosenstein and Horowitz, 1996; Rees, 2005; Bell et al., 2000; Canetti et al., 1997; Parker et al., 1999; Enns et al., 2002). Studies examining the PBI specifically have described a relationship between various parental styles and psychosocial dysfunction in community and clinical samples, including depression (Parker et al., 1997), obsessive behavior (Cavedo and Parker, 1994), low self-esteem (Parker, 1993), generalized anxiety (Silove et al., 1991), and recurrence of psychotic episodes in individuals with schizophrenia (Parker and Mater, 1986; Parker et al., 1988). Therefore, understanding aspects of parental attachment through measures such as the PBI may aid in the development of interventions to improve parenting style, bonding, and related outcomes.

The PBI was originally developed by Parker in 1979 and has since been translated into numerous languages, including Spanish, Japanese, French, Italian, and Urdu. Despite the popularity of the measure, there continues to be disagreement as to whether Parker's original two-factor model of "caring" and "overprotection" represents the most valid structure. Other authors (Kendler, 1996; Murphy et al., 1997) have supported a three-factor model wherein "overprotection" is further dimensionalized into two factors. This has varied somewhat by author, and in fact, there have been as many as five different three-factor models proposed (Murphy et al., 1997).

The difficulty in determining the most psychometrically sound factor structure of the PBI is exacerbated by the fact that the PBI has been studied in a variety of English- and non-English-speaking populations with mixed results. Validation in a French sample (Mohr et al., 1998) supported the three factor model, with "overprotection" dimensionalized into "discouragement of behavioral freedom" and "denial of psychological autonomy." This is consistent with previous findings (Murphy et al., 1997) that examined the PBI in adolescents from both the United States and the United Kingdom. Murphy et al. also reported higher ratings of parental caring among the U.K. respondents but greater endorsement of "denial of psychological autonomy" among U.S. respondents. In an Australian sample (Cubis et al., 1989), a three-factor model that dimensionalized protection into personal versus social domains not only provided a better fit for the data, the authors reported evidence of gender differences within the factor structure that presumably would not have emerged in the two-factor model. Specifically, women were more likely than men to rate their fathers higher on

the dimension of denying psychological autonomy and their mothers lower on the dimension of discouraging behavioral freedom. This contradicts findings from another Australian sample (Mackinnon et al., 1989) that supported the two-factor model. Divergent results from the U.S., U.K., and Australian respondents suggest that differences across nationalities cannot be attributed solely to linguistics, as all populations were English-speaking.

Mixed results have also been reported in non-English-speaking samples. Gomez-Beneyto et al. (1993) found support for a three-factor model in a population of Spanish women, which is consistent with a recent study (Terra et al., 2009) of an all-female sample from Brazil. However, among Pakistani women, both the two-factor and the three-factor models were similarly valid (Qadir et al., 2005).

Study of the PBI among Japanese populations has been equally variable. Similar to previous reports (Cubis et al., 1989; Gomez-Beneyto, et al. 1993; Kendler, 1996; Murphy et al., 1997), Sato and colleagues (1999) found Parker's model to be inadequate, but among the various three-factor models examined, the model from Kendler et al. (1996), which dimensionalizes overprotection into protectiveness and authoritarianism, provided a superior fit for the responses. Conversely, an earlier study of Japanese respondents (Kitamura and Suzuki, 1993) found Parker's two-factor model to be psychometrically sound. A more recent examination (Uji et al. 2006) supported a four-factor model that included parental caring, indifference/rejection, autonomy, and overprotection. The authors opine that inclusion of the indifference/rejection factor may reflect a cultural phenomenon ignored by Sato and colleagues' analyses wherein Japanese children may be more prone to feeling rejected and persecuted when those on whom they depend heavily (e.g., parents) do not meet their needs. Further, they point out that, compared to Western cultures, mothers in Japan spend significantly more time with their children (e.g., sleeping and bathing together) and that Japanese cultures value independence and autonomy to a lesser degree than Western societies. Since it was developed originally for use in Western, English-speaking samples, culturally-infused parenting styles must be accounted for when applying the PBI to non-Western cultures. More research is needed in order to better understanding the PBI's applicability to non-Western cultures.

Little is known about how the PBI performs in Chinese populations. In fact, to date, no study examining the PBI in Chinese samples has been printed in an English-based journal. Events in China's recent history, including economic reform during the past two decades, have likely had a great impact on the social structure of Chinese populations, including family dynamics and interpersonal relationships. Therefore, measuring parental bonding in this population is very important both in terms of expanding the literature base as well as understanding modern parenting styles specific to Chinese samples. The purpose of this study is to 1) explore the data and identify the underlying structural model that best fits the Chinese culture, and 2) to further compare the factor structure that emerges in a Chinese sample with that which has emerged in other Eastern cultures (i.e., Japanese) and Western countries.

Method

Subjects

Subjects were the mothers of children who attended 4 area kindergartens already part of a large population-based cohort study (Jintan Child Health Project) in China. The Jintan Child Study consists of a preschool cohort of 1,656 children, including 55.5% boys and 44.5% girls. Both parents of the children consented to participate and were sampled from four area kindergartens. However, fathers did not fill out the questionnaire, only mothers. This was because the questionnaire was completed at the parent-teacher meeting at the end of the

school year, which was attended mostly by mothers. These kindergartens were from urban, suburban, and rural areas of Jintan to obtain a fair representation. We recently published the Jintan Cohort Profile, which contains further information on the subjects, recruitment, and setting (Liu et al., 2009). From these kindergartens, the mothers filled out the questionnaires during their meetings at the kindergarten at the end of the school year. 1417 subjects, all of which gave informed consent, were surveyed for the PBI (Parker et al., 1979). 127 subjects among them missed all 25 items in the inventory. Among the remaining 1290 subjects, 264 subjects had missing values on some items in the inventory. As a result, all 25 items contained at least one missing value. For the 1290 subjects, the mean age of the respondents at the time of the questionnaire was 31.43 years, with a minimum of 23 and a maximum of 48. The standard deviation of the respondent's age was 2.920. On average, the mothers had 10.81 years of education, with a standard deviation of 3.042. 39.8% finished with middle school as the highest level of education, 26.3% finished with high school as the highest level, and 12.6% finished with college as the highest level. The minimum number of years of maternal education was 0 years and the maximum was 22 years. 81.5% of the mothers had only one child. While this questionnaire was self-administered, research assistants were on site to assist mothers' filling out the forms. For those mothers who did not attend the parent meeting, a questionnaire was sent home, and the completed questionnaire was collected in the following week. IRB approval was obtained from the University of Pennsylvania and the ethical committee for research at Jintan Hospital in China.

Instrument Translation

Parker et al. (1979) developed the original PBI using a two-factor model containing 25 items. It was designed to produce a two-factor model that assesses parenting styles in terms of parental caring (e.g., warmth, sensitivity) and overprotection (e.g., control, intrusion) (Parker et al., 1979). It allows for any parental contribution to disorder to be specified and quantified. We received permission from Parker to use the original PBI for translation in this study. The first author, who is fluent in English and Chinese, led a team in the translating process. In total, there were three translators: a psychiatrist, a psychologist, and the first author, all of whom had expertise in translation. Following the standard translation procedure, forward translation of the original instrument into the target language was performed first. This Chinese version was reviewed by a monolingual reviewer for incomprehensible or ambiguous words. It was then back-translated into English and the back-translated version was compared to the original version to assess discrepancies and determine whether attribution is with the forward translation or back-translation. Errors in the forward or back-translation processes required going through the entire process again and if necessary, taking the measure through a second back-translation.

Analysis

We randomly divided the sample into two datasets with equal number of subjects. Then we randomly selected one from these two datasets and conducted an exploratory factor analysis (EFA) on it. Based on this EFA results and previous studies on PBI, we obtained a confirmatory factor model and fitted it into the dataset which is not used in EFA for cross-validation. This confirmatory factor model will be compared with another four models in the literature. These four models are: 2-factor model (Parker et al., 1979), 3-factor model (Cubis et al., 1989), 3-factor model (Murphy et al., 1997) and 4-factor model (Uji et al., 2006). All five fitting models allow a correlated factor structure and were evaluated by several fit indices, including χ^2/df , the Bentler's Comparative Fit Index (CFI, Bentler, 1990), the Root Mean Square Error of Approximation (RMSEA, Steiger and Lind, 1980), and the Standardized Root Mean Square Residual (SRMR, Bentler, 1995). For this study, the following criteria were used to evaluate model fit: $\chi^2/df < 3.0$, CFI > .95, RMSEA < .06 and SRMR < .08 suggests a good fit (e.g., Hu and Bentler, 1999; Kline, 1998), $\chi^2/df < 5.0$, CFI > .

90, RMSEA<.08 and SRMR<.10 suggests an adequate fit (e.g., Schumacker and Lomax, 2004).

In our confirmatory factor analysis, missing values were handled by using techniques with assumption of missing completely at random (e.g., Yuan and Bentler, 2000). Because of the nonnormality of our data, robust standard errors (e.g., Satorra and Bentler, 1994; Yuan and Bentler, 2000) were used to test the significance of unstandardized estimates of fitted models. Our EFA was conducted by using SPSS and the CFA model fitting for this study was conducted by using Mplus.

Results

By the scree test (Cattell, 1966), the scree plot of EFA on the randomly-selected dataset suggests that a 4-factor model may be most suitable in this dataset. These four factors (their eigenvalues are 4.547, 3.315, 1.422 and 1.301 respectively) explained 42.34% (18.19%, 13.26%, 5.69%, and 5.20% by each) of total variance. We then used principal axis factoring to extract a 4-factor model and further rotated the factor loading solution by the oblimin rotation. In this oblique solution (see Table 1), all items except item 13 have only one factor loading greater than .30. Based on this result, we proposed a 4-factor model with a label on each factor and listed it in Table 2 (see the 4-factor model based on EFA). Note that in Table 1, items 8, 9, and 10 have the maximum factor loading on the *indifference* factor in Table 2. By examining these items and based on substantive meaning, we decided to load them on the *over-protection* factor in our model. In addition, item 13 has .438 and -.380 factor loadings on the *care* and *over-protection* factors respectively, according to Table 1. This cross-loading and item-factor relationship become less meaningful or interpretable substantively. As a result, we deleted item 13 from our 4-factor model.

Our EFA results are different from some previous studies on PBI (see specification of those models in Table 2). For example, Parker et al. (1979) proposed a 2-factor model for PBI. Cubis et al. (1989) and Murphy et al. (1997) proposed 3-factor models. Uji et al. (2006) proposed a 4-factor model, which is very similar to the model we obtained from EFA. From Table 2, it is not hard to see that our 4-factor model only differs from the 4 factor model by Uji et al. (2006) on item 13.

We used the dataset which is not used in the first step to cross-validate our 4-factor model obtained from EFA. Other four confirmatory factor models mentioned above were also fit to the same dataset. The fit indices of the five models were presented in Table 3. By this table, we found that the 2-factor and 3-factor models fit our data badly. All three models have $\chi^2/df > 5.0$, CFI<.90, RMSEA>.08 and SRMR>.10. In contrast, two 4-factor models has a $\chi^2/df < 5.0$, RMSEA $\leq$.06 and SRMR<.08 in Table 3 even though CFI<.90 for both of them. When two 4-factor models were compared, we found that our 4-factor model has a better fit than the Uji's 4-factor model by all four fit indices. The modification indices (MI) in the output of the 4-factor model by Uji et al. (2006) also indicated that the chi square value would drop by 98.83 once item 13 was further loaded on the *care* factor. So in addition to the EFA results, the confirmatory analysis of the Uji's 4-factor model also provided strong support to the cross-loading for item 13 which could be a good argument for dropping item 13 from the Uji's 4-factor model. From the output, we also found that the standardized factor loading of item 13 on the *over-protection* factor in this model is only equal to .160, which is less than .20. Based on all of these evidences, we decided to drop item 13 and selected our 4-factor model.

Our 4-factor model has a $\chi^2/df < 3.0$, RMSEA<.06 and SRMR<.08. Even though it has a CFI equal to .856, it still can be considered to have a good model fit by other three indices. Using robust standard errors, we find that all unstandardized factor loading, factor variance,

residual variance and residual covariance estimates of this final model are statistically significant ($p < .05$). Only three of six unstandardized factor covariance estimates are non-significant ($p > .05$). The diagram of this final model with the standardized estimates is given in Figure 1. Note that the variances of all four factors in Figure 1 are equal to 1.0 because of the standardized solution.

Finally, the subjects' scores on 24 items (ranging from 1 to 4 for each item) were averaged within each of four domains. For each domain, the mean and standard deviation (SD) of these averaged scores were calculated across subjects. They are 1.50 (SD=.46) for *care* domain, 3.29 (SD=.58) for *indifference* domain, 3.07 (SD=.53) for *over-protection* domain, and 1.95 (SD=.55) for *autonomy* domain.

Discussion

To our knowledge, this is the first study to report in an English-speaking journal results from psychometric analyses of the PBI in a Chinese population. After comparing several factor structures, results from our confirmatory factor analyses parallel those from Uji et al (2006) that supported a four-factor model in a Japanese sample. Specifically, the two- and three-factor models supported by others (Parker, 1979; Cubis et al., 1989; Gomez-Beneyto et al., 1993; Kendler et al., 1996; Murphy et al., 1997) did not adequately capture Chinese children's perceptions of parental indifference.

Discrepancies in the PBI across Western and Eastern cultures are not necessarily surprising. Child rearing behaviors are a culturally-loaded phenomenon. The PBI was originally developed to examine child rearing practices in Western cultures and therefore reflect those values and behaviors. In Western samples, the three-factor model that includes parental care, overprotection, and autonomy consistently outperforms the two-factor model, including among Spanish-, English- and French-speaking individuals. Uji and colleagues (2006), however, were the first to propose a four-factor model in a Japanese sample by adding an indifference factor. Our replication of their findings suggests that the four-factor model may be superior to the three-factor model across all Eastern cultures, though more research is needed to determine generalizability.

Why might an indifference factor be necessary for Asian samples? Findings from the current study and from Uji et al. (2006) indicate the presence of parenting values and characteristics specific to Eastern cultures – and in particular, differences in how cultures assess parental care. Western cultures traditionally emphasize individuality and privacy, even among parent-child dyads, while Eastern cultures tend to foster collectiveness and view the family as a singular unit (Kim and Wong, 2002). Therefore, Eastern cultures may not necessarily view certain behaviors, such as parental control, as uncaring (Chao, 2001; Rohner and Pettengill, 1985; Tobin et al., 1989), whereas Western populations would likely view this more negatively. Indeed, English- and Spanish-speaking Western samples (Gomez-Beneyto et al., 1993; Murphy et al., 1997) consistently reported an association between low behavioral freedom and depression, and in Parker's (1979) clinical samples of Australian patients with mood disorders, parental overprotection was significantly related to presence of depression. Factors of care and overprotection were also highly negatively correlated among Pakistani women (Qadir et al., 2005). Further, participants in the current study tended to classify items such as "Did not talk with me very much" or "Did not praise me" under indifference, whereas Western cultures have previously classified these as showing a lack of care. It may be that Chinese parents are simply not as verbally expressive as parents from Western cultures, but that their children do not necessarily view this as an unloving behavior (Kim and Wong, 2002).

The autonomy and overprotection factors on the PBI have demonstrated cross-cultural inconsistencies. An item classified as reflecting overprotection in one culture may be interpreted as reflecting care in another (Qadir et al., 2005). In fact, Japanese cultures highly value consideration of others' feelings, which may contradict independence and assertiveness (Uji et al., 2006). Conversely, U.S. and U.K. samples demonstrate a correlation between care and encouragement of behavioral freedom (Murphy et al., 1997). On the other hand, autonomy is not as deeply imbedded a construct in Eastern cultures as it is in Western ones. Lack of autonomy, therefore, may be viewed more neutrally by Eastern children.

Even though Eastern and Western cultural differences clearly exist, there may be factors specific to Chinese populations that could account for our support of the four-factor model. For example, China's only-child policy means that children do not have to compete with siblings to gain attention from caregivers, and caregivers in turn can focus their attention and affection entirely on one child. This is vastly different than most Western households. As a result, Chinese parents may be more highly attached to their children than in other populations. This could partially explain why overprotection or lack of autonomy was not viewed as negatively in our sample. Furthermore, the only-child rule in China may also result in differences in test construction of the PBI. Unlike the sample from Uji and colleagues (2006), which classified the item "Tends to baby me" in the overprotection factor, our model did not include this item. The majority of our sample (81.5%) was single children, and subsequently it was hypothesized that this item could present great ambiguity for our respondents. "Babying" may have been viewed as reflective of caring by some and overprotection by others. Further, this item has previously demonstrated to have a poor fit in Chinese populations, and has been suggested to be problematic in Western cultures as well (Cox et al., 2000).

Despite its important contribution to the literature, our study includes a few limitations. First, our data is from a non-randomized, kindergarten cohort. Second, the questionnaire was only administered to mothers; future studies should incorporate data from fathers as well. Additionally, the region of China in which our study was conducted was well-populated (e.g., 650,000 residents) and included urban, suburban, and rural dwellers, which may limit its generalizability to other regions of the country, for example the minority regions of China. Furthermore, our respondents only provided data on their mothers' behavior; as such, differences in maternal and paternal parenting styles may not be reflected adequately in our findings. However, discrepancies in Chinese parenting styles may be narrowing as of late (Shek, 1998). Finally, because of nonnormality of the data and missing values on all 25 items by 264 subjects, we used the methodology of Yuan & Bentler (2000) for a proper analysis. Although the MCAR assumption for this method is theoretically necessary, Yuan & Bentler (2000) demonstrated that their method can work well in practice when a less restrictive assumption of missing at random (e.g., Yuan & Bentler, 2000) holds in the data. Given their findings, the concern on the over-dependence of our analysis and results on the restrictive assumption can be alleviated.

We conclude that this novel study demonstrates a successful translation of Parker's PBI into Chinese. To date, no study examining the PBI in Chinese samples has been printed in an English-based journal. In recent years, economic growth and reform have likely had a great impact on the social structure of Chinese populations, including family dynamics and interpersonal relationships. Therefore, measuring parental bonding in this population is very important both in terms of expanding the literature base as well as understanding modern parenting styles specific to Chinese samples because nurses play an important role in promoting a strong parent-child relationship. For example, nurses in the birth ward can encourage breastfeeding and skin to skin contact, which can foster parent-child bonding.

Also, Intensive Care Unit (ICU) nurses can support bonding for very ill newborns by encouraging visits and holding of the newborns. Overall, nurses in all units can also promote communication in general between parents and infants. In addition, previous studies have indicated that nursing interventions can assess parent-child relationships, identify potential problems, and even modify parents' behavior to promote stronger relationships (Kim et al., 2008; Wilson et al., 2008). In the evaluation of parent-child bonding, our study suggests that a four-factor model can be used successfully in this population to assess parent-child interactions. Though the three-factor model has gained wide support from studies in Eastern populations, our results indicate a four-factor model that includes an indifference factor is more appropriate for Chinese samples. Cross-cultural differences in parenting styles likely account for this discrepancy and underscore the importance of utilizing a culturally sensitive measure that can be appropriately interpreted in Eastern samples.

The translated, Chinese version of the PBI can be provided upon request to the corresponding author.

What is already known about the topic?

- The Parent Bonding Instrument ([PBI] Parker, 1979) is one of the most widely used instruments to measure parent-child bonding by assessing parenting styles in terms of parental caring (e.g., warmth, sensitivity) and overprotection (e.g., control, intrusion).
- Despite the strong psychometric properties of the measure, there continues to be disagreement as to whether Parker's original two-factor model represents the most valid structure.
- Other authors (Kendler, 1996; Murphy et al., 1997) have supported a three-factor model wherein "overprotection" is further dimensionalized into two factors.
- Since it was developed originally for use in Western, English-speaking samples, culturally-infused parenting styles must be accounted for when applying the PBI to non-Western cultures. More research is needed in order to better understanding the PBI's applicability to non-Western cultures.

What does this paper add?

- This study demonstrates a successful translation of Parker's PBI into Chinese.
- This study proposes that a four-factor model can be used successfully in this Chinese population to assess parent-child bonding and interaction.
- Even though the three-factor model has received support from studies in Eastern populations, our results indicate a four-factor model that includes an indifference factor is more appropriate for samples from China.
- More research is necessary to analyze whether these findings are applicable for all Eastern countries and whether specific aspects of Chinese culture (e.g., the single-child law) produce unique effects that may impact PBI administration in China.
- In addition, this study is particularly relevant for maternal and child health nursing, because nurses in this role can facilitate parent-child bonding. For example, nurses in the birth ward can encourage breastfeeding and skin to skin touching, which helps promote bonding between parents and children. Also,

Intensive Care Unit (ICU) nurses can promote parent-child bonding for very ill newborns by encouraging parental visits and holding of the children. Overall, nurses in both units can also promote talking and communication between parents and newborns.

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References

- Arrindell W, Gerisma C, Vandereycken W, Hageman W, Daeseleire T. Convergent validity of the dimensions underlying the parental bonding instrument (PBI) and the EMBU. *Personality and Individual Differences*. 1998; 24(3):341–350.
- Bell NJ, Forthun LF, Sun SW. Attachment, adolescent competencies, and substance use: developmental considerations in the study of risk behaviors. *Subst Use Misuse*. 2000; 35(9):1177–206. [PubMed: 11349681]
- Bentler PM. Comparative fit indexes in structural models. *Psychological Bulletin*. 1990; 2:238–246. [PubMed: 2320703]
- Bentler, PM. EQS structural equations program manual. Multivariate Software; Encino, CA: 1995.
- Canetti L, Bachar E, Galili-Weisstub E, De-Nour AK, Shalev AY. Parental bonding and mental health in adolescence. *Adolescence*. 1997; 32(126):381–94. [PubMed: 9179334]
- Cattell, RB., editor. *Handbook of multivariate experimental psychology*. Rand McNally; Chicago, IL: 1966.
- Cavedo LC, Parker G. Exploring for links between scores and obsessionality. *Soc Psychiatry Psychiatr Epidemiol*. 1994; 29(2):78–82. [PubMed: 8009323]
- Chao RK. Extending Research on the Consequences of Parenting Style for Chinese Americans and European Americans. *Child Development*. 2001; 72(6):1832–1843. [PubMed: 11768148]
- Cox BJ, Enns MW, Clara IP. The Parental Bonding Instrument: confirmatory evidence for a three-factor model in a psychiatric clinical sample and in the National Comorbidity Survey. *Soc Psychiatry Psychiatr Epidemiol*. 2000; 35(8):353–7. [PubMed: 11037304]
- Cubis J, Lewin T, Dawes F. Australian adolescents' perceptions of their parents. *Aust N Z J Psychiatry*. 1989; 23:35–47. [PubMed: 2930414]
- Enns MW, Cox BJ, Clara I. Parental bonding and adult psychopathology: results from the US National Comorbidity Survey. *Psychol Med*. 2002; 32(6):997–1008. [PubMed: 12214798]
- Gómez-Beneyto M, Pedrós A, Tomás A, Aguilar K, Leal C. Psychometric properties of the parental bonding instrument in a Spanish sample. *Soc Psychiatry Psychiatr Epidemiol*. 1993; 28(5):252–255. [PubMed: 8284739]
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55.
- Kay W, Niven H, Parker G, Hadzi-Pavlovic D. The stability of the Parental Bonding Instrument over a 20-year period. *Psychological medicine*. 2005; 35(3):387–393. [PubMed: 15841874]
- Kay W, Parker G. Reliability of the Parental Bonding Instrument and Intimate Bond Measure Scales. *Aust N Z J Psychiatry*. 1990; 24(2):199–202. [PubMed: 2396963]
- Kendler KS. Parenting: a genetic-epidemiologic perspective. *Am J Psychiatry*. 1996; 153:11–20. [PubMed: 8540566]
- Kim E, Caian K, Webster-Stratton C. The preliminary effect of a parenting program for Korean American mothers: A randomized controlled experimental study. *International Journal of Nursing Studies*. 2008; 45(9):1261–1273. [PubMed: 17996239]
- Kim, SY.; Wong, VY. Assessing Asian and Asian American Parenting: A Reiview of the Literature. In: Kurasaki, K.; Okazaki, S.; Sue, S., editors. *Asian American mental health: Assessment methods and theories* (185-190). Kluwer Academic Publishers; Netherlands: 2002.

- Kitamura T, Suzuki T. A validation study of the Parental Bonding Instrument in a Japanese population. *Jpn J Psychiatry Neurol*. 1993; 47(1):29–36. [PubMed: 8411788]
- Kline, RB. Principles and practice of structural equation modeling. Guilford Press; NY: 1998.
- Liu J, McCauley LA, Zhao Y, Pinto-Martin J, Jintan Cohort Study Group. Cohort Profile: The China Jintan Child Cohort Study. *International Journal of Epidemiology*. 2009; 1:1–7.
- Mackinnon AJ, Henderson AS, Scott R, Duncan-Jones P. The Parental Bonding Instrument (PBI): an epidemiological study in a general population sample. *Psychological Medicine*. 1989; 19:1023–1034. [PubMed: 2594879]
- Murphy E, Brewin CR, Silka L. The assessment of parenting using the Parental Bonding Instrument: two or three factors? *Psychological Medicine*. 1997; 27:333–342. [PubMed: 9089826]
- Parker, G. Parental Overprotection: A Risk Factor in Psychosocial Development. Grune & Stratton; New York: 1983.
- Parker G. The parental bonding instrument. *Social Psychiatry and Psychiatric Epidemiology*. 1990; 25(6):281–282. [PubMed: 2291129]
- Parker G. Parental rearing style: examining for links with personality vulnerability factors for depression. *Soc Psychiatry Psychiatr Epidemiol*. 1993; 28(3):97–100. [PubMed: 8378811]
- Parker G, Johnston P, Hayward L. Prediction of schizophrenic relapse using the parental bonding instrument. *Aust N Z J Psychiatry*. 1988; 22(3):283–92. [PubMed: 3178613]
- Parker G, Mater R. Predicting schizophrenic relapse: a comparison of two measures. *Aust N Z J Psychiatry*. 1986; 20(1):82–6. [PubMed: 3460589]
- Parker G, Roussos J, Hadzi-Pavlovic D, Mitchell P, Wilhelm K, Austin MP. The development of a refined measure of dysfunctional parenting and assessment of its relevance in patients with affective disorders. *Psychol Med*. 1997; 27(5):1193–203. [PubMed: 9300523]
- Parker G, Roy K, Wilhelm K, Mitchell P, Austin MP, Hadzi-Pavlovic D. An exploration of links between early parenting experiences and personality disorder type and disordered personality functioning. *J Pers Disord*. 1999; 13(4):361–74. [PubMed: 10633316]
- Parker G, Tupling H, Brown LB. A parental bonding instrument. *British Journal of Medical Psychology*. 1979; 52:1–10.
- Qadir F, Stewart R, Khan M, Prince M. The validity of the Parental Bonding Instrument as a measure of maternal bonding among young Pakistani women. *Soc Psychiatry Psychiatr Epidemiol*. 2005; 40(4):276–82. [PubMed: 15834778]
- Rees CA. Thinking about children's attachments. *Arch Dis Child*. 2005; 90(10):1058–65. [PubMed: 16177163]
- Rohner RP, Pettengill SM. Perceived parental acceptance-rejection and parental control among Korean adolescents. *Child Dev*. 1985; 56(2):524–8. [PubMed: 3987420]
- Rosenstein DS, Horowitz HA. Adolescent attachment and psychopathology. *J Consult Clin Psychol*. 1996; 64(2):244–53. [PubMed: 8871408]
- Safford SM, Alloy LB, Pieracci AA. Comparison of two measures of parental behavior. *Behavioral Science*. 1997; 16(3):375–384.
- Sato T, Narita T, Hirano S, Kusunoki K, Sakado K, Uehara T. Confirmatory factor analysis of the Parental Bonding Instrument in a Japanese population. *Psychol Med*. 1999; 29(1):127–33. [PubMed: 10077301]
- Satorra, A.; Bentler, PM. Corrections to test statistics and standard errors in covariance structure analysis. In: Von Eye, A.; Clogg, CC., editors. *Latent variables analysis: Applications for developmental research*. Sage; Thousand Oaks, CA: 1994. p. 399-419.
- Schumacker, RE.; Lomax, RG. A beginner's guide to structural equation modeling. Second edition. Lawrence Erlbaum Associates; Mahwah, NJ: 2004.
- Shek DTL. Adolescents' perceptions of paternal and maternal parenting styles in a Chinese context. *The Journal of Psychology*. 1998; 132(5):52.
- Silove D, Parker G, Hadzi-Pavlovic D, Manicavasagar V, Blaszczyński A. Parental representations of patients with panic disorder and generalised anxiety disorder. *Br J Psychiatry*. 1991; 159:835–41. [PubMed: 1790454]

- Steiger, JH.; Lind, JC. Statistically-based tests for the number of common factors; Paper presented at the annual meeting of the Psychometric Society; Iowa City, IA. 1980;
- Terra L, Hauck S, Schestatsky S, Fillipon AP, Sanchez P, Hirakata V, Ceitlin LH. Confirmatory factor analysis of the Parental Bonding Instrument in a Brazilian female population. *Aust N Z J Psychiatry*. 2009; 43(4):348–54. [PubMed: 19296290]
- Tobin, JJ.; Wu, DYH.; Davidson, DH. *Preschool in three cultures*. Yale University Press; New Haven, CT: 1989.
- Uji M, Tanaka N, Shono M, Kitamura T. Factorial structure of the Parental Bonding Instrument (PBI) in Japan: A study of cultural, developmental, and gender influences. *Child Psychiatry and Human Development*. 2006; 37:115–132. [PubMed: 16858638]
- Wilhelm K, Parker G. Reliability of the Parental Bonding Instrument and Intimate Bond Measure Scales. *Australian and New Zealand Journal of Psychiatry*. 1990; 24(2):199–202. [PubMed: 2396963]
- Wilson P, Barbour R, Graham C, Currie M, Puckering C, Minnis H. Health visitors' assessments of parent–child relationships: A focus group study. *International Journal of Nursing Studies*. 2008; 45(8):1137–1147. [PubMed: 17761183]
- Yoo HI, Kim BN, Shin MS, Cho SC, Hong KE. Parental attachment and its impact on the development of psychiatric manifestations in school-aged children. *Psychopathology*. 2006; 39(4):165–74. [PubMed: 16612136]
- Yuan KH, Bentler PM. Three Likelihood-Based Methods for Mean and Covariance Structure Analysis with Nonnormal Missing Data. *Sociological Methodology*. 2000; 30:165–200.

Figure 1.
The diagram of the final model with the standardized estimates

Table 1

Pattern matrix after principal axis analysis and oblimin rotation

Items	Factor 1 (18.19% of total variance)	Factor 2 (13.26% of total variance)	Factor 3 (5.69% of total variance)	Factor 4 (5.20% of total variance)
1. Spoke to me in a warm and friendly voice	0.457	0.030	-0.079	0.084
2. Did not help me as much as I needed	-0.016	0.417	0.071	0.002
3. Let me do those things I liked doing	0.203	-0.082	-0.417	0.028
4. Seemed emotionally cold to me	0.144	0.632	0.088	0.131
5. Appeared to understand my problems and worries	0.663	-0.002	0.057	0.027
6. Was affectionate to me	0.603	0.010	-0.025	-0.109
7. Liked me to make my own decisions	0.274	0.098	-0.406	0.093
8. Did not want me to grow up	-0.015	0.449	-0.049	-0.026
9. Tried to control everything I did	0.007	0.374	-0.033	-0.225
10. Invaded my privacy	0.105	0.573	0.128	-0.026
11. Enjoyed talking things over with me	0.632	0.163	-0.036	0.015
12. Frequently smiled at me	0.651	-0.050	0.006	-0.112
13. Tended to baby me	0.438	-0.120	0.060	-0.380
14. Did not seem to understand what I needed or wanted	-0.008	0.453	0.023	-0.066
15. Let me decide things for myself	0.247	0.032	-0.372	0.155
16. Made me feel I wasn't wanted	0.019	0.565	-0.034	0.090
17. Could make me feel better when I was upset	0.332	-0.195	-0.146	-0.112
18. Did not talk with me very much	-0.082	0.508	-0.157	-0.120
19. Tried to make me feel dependent on her/him	-0.118	0.229	-0.137	-0.360
20. Felt I could not look after myself unless she/he was around	0.029	0.140	-0.006	-0.361
21. Gave me as much freedom as I wanted	0.100	-0.017	-0.737	0.141
22. Let me go out as often as I wanted	-0.088	-0.083	-0.728	-0.006
23. Was overprotective of me	0.133	0.034	0.007	-0.496
24. Did not praise me	-0.123	0.467	-0.154	-0.043
25. Let me dress in any way I pleased	-0.116	0.022	-0.427	-0.210

Table 2

Confirmatory factor models in our study

2-factor model (Parker et al, 1979)	3-factor model (Cubis et al, 1989)	3-factor model (Murphy et al, 1997)	4-factor model (Uji et al., 2006)	4-factor model based on EFA
Care: 1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, 24 Protection: 3, 7, 8, 9, 10, 13, 15, 19, 20, 21, 22, 23, 25	Care: 1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, 24 Protection-Personal Domain: 8, 10, 13, 19, 23 Protection-Social Domain: 3, 7, 9, 15, 20, 21, 22, 25	Care: 1, 2, 4, 5, 6, 11, 12, 14, 16, 17, 18, 24 Denial of psychological autonomy: 8, 9, 13, 19, 20, 23 Encouragement of behavioral freedom: 3, 7, 15, 21, 22, 25	Care: 1, 5, 6, 11, 12, 17 Indifference: 2, 4, 14, 16, 18, 24 Over-protection: 8, 9, 10, 13, 19, 20, 23 Autonomy: 3, 7, 15, 21, 22, 25	Care: 1, 5, 6, 11, 12, 17 Indifference: 2, 4, 14, 16, 18, 24 Over-protection: 8, 9, 10, 19, 20, 23 Autonomy: 3, 7, 15, 21, 22, 25

Table 3

Fit indices of different models

	2-factor model (df=274, Parker et al, 1979)	3-factor model (df=272, Cubis et al, 1989)	3-factor model (df=249, Murphy et al, 1997)	4-factor model (df=269, Uji et al., 2006)	4-factor model based on EFA (df=246)
χ^2/df	6.41	6.25	5.77	3.30	2.71
CFI	0.528	0.545	0.601	0.803	0.856
RMSEA	0.092	0.090	0.086	0.060	0.052
SRMR	0.112	0.116	0.110	0.074	0.059