The Parental Dental Concerns Scale (PDCS): its development and initial psychometric properties


Abstract – Objectives: To assess the validity and reliability of a Parental Dental Concerns Scale (PDCS) to identify parents unable to access preventive dental care for their children. Methods: Two studies were conducted. In Study One, a purposive convenience sample of 399 Scottish parents answered questions on going to the dentist, family life and demographics. Parents were retested eight weeks later. In Study Two, 574 Scottish parents participating in a preventive oral health programme were posted the same questionnaire. Information on child dental attendance was gained from dental records. Data were analysed using exploratory (EFA) and confirmatory (CFA) factor analysis. Internal consistency and test–retest correlations provided reliability estimates. Validity was assessed with confirmatory factor analysis, correlations and independent t-tests. Results: EFA indicated that the PDCS had a four factor structure, supported by a subsequent CFA. The PDCS and its four subscales had good internal consistency, concurrent validity and test–retest reliability. Further work is required to confirm the scale’s predictive validity in discriminating between children and parents who did and did not attend the dental practice. Conclusions: The PDCS is a reliable scale, which demonstrates good construct validity. Further testing is required to confirm its predictive validity.

The Scottish Government introduced the community-based Childsmile Programme to improve the oral health of Scottish preschool and primary school-aged children through the promotion of twice daily fluoride toothpaste use (1, 2), dietary advice (3) and fluoride varnish application (4, 5). The Childsmile Programme is a universal but targeted community-based oral health promotion intervention which consists of three contemporaneous and integrated parts:

1. Childsmile Core: a universal tooth-brushing programme providing children with free fluoride toothpaste and toothbrushes, and daily brushing at nursery and primary school.

2. Childsmile Practice: promotes dental attendance of 0 to 2-year-old children and targets those children assessed as being at risk of dental caries. At-risk children are characterized as residing in areas of high social deprivation, have siblings with dental caries, and parents who attend infrequently for dental care.

3. Childsmile Nursery and School: targets children attending nursery and primary schools in the 20% most deprived areas for twice-yearly fluoride varnish application.

Since its inception, the Childsmile Programme has contributed to a reduction in the incidence of obvious decay experience in 11-year-olds (from a
DMFT of 1.29 in 2005 to 0.70 in 2011) and 5-year-olds (from a dmft of 2.36 in 2004 to 1.52 in 2010) (6). Despite these improvements, oral health inequalities still exist for preschool children who reside in the 20% most deprived areas of Scotland (6, 7). It is estimated that around one-third of Childsmile appointments are not attended, with nonadherence highest in areas of greatest socioeconomic deprivation (8).

Community-based programmes to promote the oral health of children in areas of high social deprivation have been noted to have had varying degrees of success (9–11). Davies et al. (11), for instance, have shown that sizeable numbers of families who experience the greatest deprivation are nonadherent, diluting the effect of community-based oral health intervention programmes. However, there are few investigations into why parents from areas of high social deprivation do not access preventive dental care for their children. Studies from the United States provide some relevant predictors of parents’ nonattendance at dental appointments, which may be grouped into three categories: system-related, demographic and psychosocial predictors. For instance, poor attendance rates among lower income families have been explained by inconvenient appointment times (12–14), negative attitudes and poor communication from dental staff (15–19), poor dental care during parents’ own childhood (15, 20) and lack of transport (16, 17, 21). Demographic predictors include ethnicity (22), low family income (14) and child’s age (23). Lack of social support (24), poor parental mental health, including depression (25, 26), family stress and child dental anxiety (19, 22) have been proposed as significant factors impacting on family participation in preventive dental programmes. For community-based oral health promotion programmes, such as the Childsmile Programme, there is a need for greater understanding of why parents do not engage in preventive dental care for their children. It is likely that different families require different approaches and could benefit from additional support such as motivational techniques (27, 28). As the main purpose of Childsmile Practice is to ensure that vulnerable 0 to 2-year-old children attend for preventive dental care, there is a need to identify those parents and children who have difficulty in accessing dental care in general, and Childsmile Practice in particular.

As part of a wider project investigating parental engagement with Childsmile Practice, the Parental Dental Concerns Scale (PDCS) was developed to identify parents whose concerns impacted upon their ability to access Childsmile Practice for their children (29). Therefore, the aim of this investigation was to conduct an assessment of the validity and reliability of the PDCS. The objectives were to assess its (i) construct, concurrent and predictive validity and (ii) internal consistency and test–retest reliability through the testing of the scale in two studies.

Materials and method

Measures

The questionnaire items emerged from a series of in-depth interviews with 47 Scottish mothers concerning their difficulties in accessing dental care for their children. The data were analysed using grounded theory (GT). Grounded theory was chosen for several reasons. First, because GT is a constant comparative technique, it means that the qualitative data are collected and analysed simultaneously. Second, GT allows the analysis to proceed until the categories are defined and no new features emerge: this ensures that saturation of the categories has occurred. Thirdly, while the aim of any GT study is the creation of theory, it also permits the analysis of qualitative data using open and selective coding, and finally, irrespective of whether the research purpose is to generate theory or analyse data, the goal is to clarify the participants’ main concerns. In this investigation, GT procedures were used to analyse the qualitative data to discover the mothers’ main concerns about taking their children for preventive dental visits (29). Saturation of the categories occurred after interviews with 47 participants.

The concerns that emerged from the data were the difficulties the parents experienced when caring for their children. Parents spoke freely about concerns when taking children on public transport or to buildings which were not ‘child-friendly’; about the instability of living in social housing, disruptive neighbours and people who could be negative towards their children. In addition the women complained of receiving little help, and without emotional support, talked of their low mood and social isolation. Of particular importance was the issue of the parent’s dental anxiety. These parental concerns were exacerbated by living in an environment where health, dental and social services were not designed to address their current life circumstances. All of the parental concerns were used as items in the questionnaire (Table 1).
The questionnaire was written in English. It comprised three main sections, and parents were asked to answer all questions focusing on their youngest child. The first section asked participants about their experience of going to the dentist with their child. Parents were asked to respond on a five-point Likert scale how strongly they disagreed (+1) or agreed (+5) with five statements about attending the dental practice, for example, ‘Dentists are family friendly’. Parental dental anxiety was assessed using the Modified Dental Anxiety Scale (MDAS) (30, 31), and parents were also asked how regularly they attended the dentist. The second section included items on social support, breastfeeding, feeling down, children’s behaviour and satisfaction with health care. Once again, parents were asked how strongly they disagreed (+1) or agreed (+5) with each statement, for example, ‘Some days I feel miserable’. The final section comprised demographic questions including parents’ age, education level, marital status and housing status. The questionnaire was tested for readability

<table>
<thead>
<tr>
<th>PE</th>
<th>BF</th>
<th>NEHC</th>
<th>GD</th>
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<tbody>
<tr>
<td>Mean (SD)</td>
<td>26.3 (6.9)</td>
<td>7.5 (3.1)</td>
<td>8.8 (2.7)</td>
<td>10.8 (3.3)</td>
<td>6.3 (2.8)</td>
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<tr>
<td>Cronbach α</td>
<td>0.83</td>
<td>0.71</td>
<td>0.39</td>
<td>0.65</td>
<td>0.72</td>
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Some days I feel miserable 0.780
I feel down most days 0.671
Since my child was born, I have not felt like my usual self 0.615
I get stressed if my child cries when we are out 0.611
Some days I don’t want to do anything 0.607
I have little time to spend on myself 0.588
All my time is spent on being a parent 0.531
When I look in the mirror, I feel good about the person I see 0.501
Getting out the house with my child is difficult 0.379
People can be unfriendly when I am out with my child 0.341
Breastfeeding is not for me 0.810
Breastfeeding is better than bottlefeeding 0.744
Breastfeeding is difficult 0.725
I felt unprepared when I left hospital with my baby 0.534
I was happy with the care I received during my last pregnancy 0.482
My health visitor knows me well 0.449
I was disappointed with the delivery of my last child 0.341
My family help me by babysitting 0.301
My child is happy for me to care for their teeth and gums 0.301
I feel frightened about going to the dentist with my child 0.360
My partner helps me look after our child 0.800
I feel settled in my home 0.929
I am happy where I am currently living 0.926
My neighbours can be difficult 0.542
My child eats the foods I want them to eat 0.728
My child drinks what I want them to drink 0.673
My child sleeps well at night 0.339
I have someone close to me I can speak to about my problems 0.336

PE, Parental Exclusion; GD, Going to the Dentist; BF, Bottlefeeding; HD, Housing Dissatisfaction; NEHC, Negative Experiences of Healthcare; LPC, Lack of Parental Control.
by examining the number of words per sentence and number of syllables per word (32). It had an 84% reading ease score, and a Flesch-Kincaid grade of 4.3, indicating that the language was easy to understand for the average 10-year-olds. The questionnaire was piloted on six parents attending a local parents’ support group to check comprehension of item wording, layout and ease of use. Full question wording can be found in Table 1, and a copy of the questionnaire is available on request from the first author. In Study Two, additional information on attendance at a Childsmile practice was collected from children’s dental records.

**Study One**

Study One investigated the construct and concurrent validity, internal consistency and test–retest reliability of the PDCS. The data were gathered in areas where Childsmile Practice was not yet introduced.

**Construct and concurrent validity and internal consistency.** A nonprobability convenience sample of parents of preschool children was recruited through local organizations working with families and baby clinics. An attempt was made to recruit parents living in areas of high deprivation, as these parents were known to be less likely to attend preventive dental appointments for their children (8). The first author and health promotion staff introduced the study to parents, provided information sheets and gained informed consent. All parents could speak and understand English. Twenty parents requested that the interviewer read the questionnaire out to them, rather than completing it on their own. Expressed explanations given for this included reading difficulties, such as dyslexia. Parents were accommodated in this request at all times, and to ensure that responses were not biased by this administration method, questionnaires were read as written. All parents were reassured before completing the questionnaire that they were free to skip any question they did not wish to answer.

**Test–retest reliability.** Each parent was asked whether they were willing to complete a second administration of the questionnaire eight weeks later. The second administration determined the test–retest reliability of the PDCS over a moderate time period. At eight weeks, parents were contacted, and asked whether they still wished to take part. If so, questionnaires were posted to parents’ home addresses. Parents had the option of returning the questionnaire using a Freepost envelope, or completing the questionnaire with the first author by telephone.

**Study Two**

Study Two investigated the validity of the scale among families that were registered with Childsmile Practice.

**Further construct validity and predictive validity.** Parents (n = 574) participating in Childsmile Practice within a Scottish health board were posted a copy of the questionnaire along with an information sheet and contact details for the research team. Parents had initially signed-up to Childsmile through their child’s public health nurse, or when visiting their dental clinic. Parents were asked to return their questionnaire using an enclosed Freepost envelope. Parents who had not returned a questionnaire after three weeks were telephoned to remind them about the study.

**Ethical issues**

Ethical approval was obtained from the NHS Fife and Forth Valley Research Ethics Committee (REC ref: 10/S0501/11). Parents were provided with a participant information sheet, and informed consent was gained from each participant before questionnaires were distributed. The information sheet explained that the study was interested in parents’ experiences of attending the dental practice with a young child, and family life more generally, with the aim of improving children’s dental services within Scotland.

**Data analysis**

SPSS Statistics version 19.0 (Armonk, NY, United States) was used for descriptive, exploratory and bivariate data analysis. Confirmatory factor analysis (CFA) was carried out using SPSS AMOS version 19.0. Relevant items were reverse scored to ensure that high scores represented greater parental dental concerns.

**Construct validity.** The construct validity of the new measure was examined using Exploratory Principal Components Analysis (PCA). The number of components to be retained in the PCA was determined using parallel analysis. Parallel analysis compares the sample component structure with that of a random population component structure and retains components with eigenvalues greater
than those obtained from random numbers (33). This reduces the ambiguity associated with component retention from eigenvalues >1 or scree plots (33). CFA allowed the adequacy of the measurement model to be tested (34). The variance of the first indicator of each latent variable was set to 1.0 for first-order latent variables. The variance of the second-order latent variable was also set to 1.0, as well as error terms attached to indicators. This reduced the number of model parameters to be estimated ensuring model identification (35). Bootstrapping was applied to determine the significance of path coefficients, with 2000 bootstrapping samples selected to ensure the stability of probability estimates. A number of conventional fit indices were employed to determine model adequacy including: Comparative Fit Index (CFI) of >0.90, Root Mean Square Error of Approximation (RMSEA) of <0.06 (36), and chi-square/degrees of freedom ratio of <2. The similarity of the measurement model was tested across housing type (bought home/other housing), with the equivalence of a constrained versus unconstrained model assessed via the significance of the change in chi-square statistic between the two models. Housing type was chosen as it provided a good indicator of social status in this sample, and additionally provided a similar number of respondents in each category.

Concurrent validity. Concurrent validity was established using bivariate Pearson correlation analysis of the new measure with the established MDAS (30, 31). Within our grounded theory study, participants with the greatest concerns were also those who stated they had high dental anxiety.

Test–retest reliability and internal consistency. Cronbach’s alpha coefficients were calculated to assess the internal consistency of each subscale and the total measure. Test–retest reliability was assessed by paired t-tests and intra-class correlation coefficients (37).

Predictive validity. The PDCS’s ability to discriminate between parents adhering and not adhering with Childsmile Practice was determined using independent samples t-tests.

Results
Study One (construct validity, internal consistency, test–retest reliability)

Descriptive analysis. Figure 1 provides an overview of the number of parents taking part in each stage of Study One. The majority of parents were mothers (n = 378), with the remainder fathers or care givers. Parents’ mean age was 30 years (SD = 6.96), and the mean number of children living with parents was 1.8 (SD = 0.96). Just under half of parents were married (44%), working (45%), and living in a bought home (49%). Sixty per cent of parents were educated to school or college level, with the remainder educated to university level. Around two-thirds (67%) of parents had attended the dentist for themselves in the last six months.

Fig. 1. Flow diagram of participant involvement and response rates for Studies One and Two.
Construct validity. Only fully completed questionnaires were included in the analysis of the scale’s construct validity \( (n = 319) \). Thirty-two items were included in the PCA (Table 1). The first PCA was run unrotated. Ten components had eigenvalues greater than one; however, the results of a parallel analysis indicated that only six components should be retained. A second PCA was run specifying six components, with direct oblimin rotation to improve interpretability of components. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was high \( (0.79) \), and Bartlett’s test of sphericity significant \( (\chi^2 = 2790, \ df = 496, P < 0.001) \), indicating that the relationship between the variables was strong and that PCA was appropriate. The six components explained 46% of the variance in the correlation matrix.

Component loadings of >0.3 were used to determine onto which component each item loaded. All but two items (‘I have little time to spend on myself’ and ‘All my time is spent on being a parent’) loaded onto a single component. Where items cross-loaded, assignment was to the component onto which they loaded most highly. The six components represented the following subscales: Parental Exclusion, Bottlefeeding, Negative Healthcare Experiences, Going to the Dentist, Housing Dissatisfaction and Lack of Parental Control. Items within each component were summed to construct subscales. Four subscales had acceptable internal consistency (Table 1); therefore, Negative Healthcare Experiences and Lack of Parental Control were excluded from subsequent analysis. All 21 items belonging to these four subscales were combined to provide a single PDCS. The mean score of the PDCS was 50.9 \( (SD = 11.1, \) possible range \( 21–105) \), and Cronbach \( \alpha = 0.83 \).

A four factor model was fitted with the PDCS subscales, with an overarching second-order Parental Dental Concerns latent construct (Fig. 2). Table 2 shows that the four factor model with uncorrelated errors was a reasonable fit, with fit indices within the range specified for adequacy. The model was improved, however, with the inclusion of two correlated pairs of error terms, identified from high Legrange indices. Both correlations were not theoretically meaningful and were retained in further analyses. Subscales were labelled as before. Standardized regression coefficients were all significant at the \( P = 0.01 \) level or less.

To determine the similarity of the measurement model across housing type, two additional models were compared, split by parents living in a bought home and parents living in other housing. In the first model, indicators were unconstrained, that is, the parameters were allowed to be calculated freely. In the second model, a constrained model was tested, with parameters fixed between the first-order latent subscales and observed variables, and between correlated errors, across housing type. The key relationships between the constructs were close to identical across groups, with a non-significant change in chi-square score \( (\Delta \chi^2 = 29.57, df 19, P > 0.05) \), which confirmed that the measurement model was virtually identical across housing groups.

Concurrent validity. The PDCS was correlated with the MDAS. Parents reporting greater concerns were more likely to report high dental anxiety within our grounded theory study. Pearson correlations indicated that the PDCS and its subscales were significantly correlated with the MDAS (Table 3).

Test–retest reliability and internal consistency. The reliability of the PDCS, and each subscale, was assessed comparing parents’ test and retest scores, as well as Cronbach’s \( \alpha \) scores from Table 1. Paired \( t \)-tests indicated that there were no significant differences between the PDCS or subscales means at time 1 and time 2 (Parental Exclusion \( \text{M1} = 26.8 \ [SD1 = 6.9], \text{M2} = 27.1 \ [SD2 = 7.3] \), \( t(84) = -0.46, P = 0.65 \); Bottlefeeding \( \text{M1} = 7.1 \ [SD1 = 3.1], \text{M2} = 7.2 \ [SD2 = 3.0] \), \( t(84) = -0.54, P = 0.59 \); Going to the Dentist \( \text{M1} = 10.0 \ [SD1 = 3.0], \text{M2} = 10.4 \ [SD2 = 2.7] \), \( t(84) = -1.33, P = 0.19 \); Housing Dissatisfaction \( \text{M1} = 6.0 \ [SD1 = 3.1], \text{M2} = 6.2 \ [SD2 = 2.7] \), \( t(84) = -0.54, P = 0.59 \); PDCS \( \text{M1} = 50.0 \ [SD1 = 10.9], \text{M2} = 50.8 \ [SD2 = 10.9] \), \( t(84) = -1.01, P = 0.31 \). Intra-class correlations were high, which indicated that not only were participants’ responses consistent, but that there was also strong absolute agreement between time 1 and time 2 (Parental Exclusion ICC = 0.77, \( P < 0.000 \); Bottlefeeding ICC = 0.86, \( P < 0.000 \); Going to the Dentist ICC = 0.68, \( P < 0.000 \); Housing Dissatisfaction ICC = 0.65, \( P < 0.000 \); PDCS ICC = 0.77, \( P < 0.000 \)).

Study Two – construct and predictive validity

Descriptive analysis. In Study Two, 172 parents returned questionnaires (further information on
participation and response rates for Study Two can be found in Fig. 1). Respondents and nonrespondents were compared in relation to deprivation level, urban/rural location, and child’s age, to determine whether significant differences existed between the two groups. Deprivation levels were determined by linking postcode information to the Scottish Index of Multiple Deprivation. Chi-square tests suggested that there were significant differences in relation to deprivation level, $\chi^2 = 10.07$, df 1, $P = 0.002$, but not urban/rural location, $\chi^2 = 3.03$, df 1, $P = 0.082$. A significantly greater proportion of parents living in areas of low deprivation (the lowest three quintiles) responded to the survey, compared with parents living in areas of high deprivation (the highest two quintiles). Respondents and nonrespondents did not differ significantly (at the 5% level) by their youngest child’s age, $t(572) = 1.96$, $P = 0.050$.

Parents’ mean age was 30 years (SD = 6.1). Around half of participants were working (51%), and married (52%). Sixty-nine per cent of parents were educated to school or college level, and 57% lived in a bought home. Thirty-eight per cent of parents were living in areas of high deprivation (quintiles 1 and 2), and 82% lived in rural areas. Around 82% of parents had attended the dentist in the last six months, with 57% reporting that they attend at least every six months. Information from child dental records showed that 70% of parents had attended for a Childsmile appointment during the previous 2 years.

Further construct validity – testing the measurement model in a second sample. To investigate further the adequacy of the measurement model fitted in Study One, a CFA was carried out on respondents who had fully completed each item of the PDCS ($n = 168$). Results indicated that with no uncorrelated errors, the model was outside the range considered adequate for good model fit, with a $\chi^2$/DF ratio = 1.61 as the single adequate goodness-of-fit measure ($\chi^2 = 297.56$, df 185, $P < 0.001$, RMSEA = 0.060, CFI = 0.866). With the addition of five

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**Fig. 2.** Path diagram of standardised solution of second order confirmatory factor analysis.
correlated errors, the adequacy of the model was confirmed from three of the four goodness-of-fit measures (χ² = 235.07, df 180, P = 0.004; χ²/DF = 1.306; CFI = 0.934; RMSEA = 0.043, 90% LCI = 0.025 90% UCI = 0.057).

**Predictive validity.** There were no significant differences in mean scores between parents who adhered and did not adhere with Childsmile in relation to the PDCS, and its subscales at the 5% level (Did not attend (n = 52) M = 51.3, SD = 9.1; Attended (n = 116) M = 48.7, SD = 8.7, P = 0.077). There was, however, a tendency towards significance for the PDCS, with parents who had not attended a Childsmile appointment more likely to report higher concerns.

**Discussion**

This study is the first to assess the psychometric properties of a measure of parental concerns in relation to attending the dental practice with young children, in particular, its validity and reliability. The purpose of such a measure is to identify families that are unlikely to attend for preventive care, to provide additional and appropriate support to enable dental attendance.

The PDCS demonstrated good construct validity. Principal Components Analysis and analysis of internal consistency suggested that there were four subscales within the PDCS relating to four unambiguous constructs. Confirmatory Factor Analysis in both studies demonstrated the adequacy of a four factor, second-order model, with each of the latent subscales loading on an overall Parental Dental Concerns measure. The measures were also invariant across housing type, an indicator of parental social status.

Concurrent validity was also good, with a significant and moderate correlation with the MDAS. The MDAS has shown acceptable validity and reliability previously (30, 31), and it was expected that parents suffering from high dental anxiety, would also have a greater number of reported dental concerns.

There was limited evidence of the ability of the PDCS’s subscales to discriminate between parents who adhered with Childsmile Practice, and those who did not at the 5% level. There was a tendency towards significance, however, with parents who were nonadherent with Childsmile reporting greater concerns in relation to taking their child to the dentist. Future work should be carried out with a larger sample of parents who do not attend to establish the predictive validity of the PDCS.

Internal consistency was acceptable for four of the six subscales identified in the exploratory PCA, and very good for the full PDCS. Test–retest reliability of the PDCS, and its subscales, was excellent over a two-month period, suggesting that the scale could be particularly valuable for use...
within a long-term programme such as Childsmile Practice.

The results of this study reaffirm the complexity that has been identified previously in relation to parental attendance at preventive dental appointments for their children. Subscales of the PDCS were correlated with each other, indicating that parental concerns over a number of areas are inter-related. Of particular note is that the Parental Exclusion and Housing Dissatisfaction subscales correlated with the Going to the Dentist subscale, in line with previous work that has identified housing (23), social support (24) and depressive symptoms (25, 26) as predictors of nonattendance. The children of parents with poor mental health are twice as likely to have unmet dental needs (25, 26) and are twice as likely to brush their teeth less than twice per day (26). The PDCS is the first scale to be developed that recognizes the above issues. Its use facilitates the provision of additional support to parents reporting greater dental concerns to enable them to access preventive dental care for their children.

Limitations
Recruitment was positive in Study One, where a nonprobability convenience sample was employed with parents keen to participate. Study Two had a lower response rate, most likely due to the use of a postal administration method. Ethical restrictions on approaching families limited opportunities to contact parents by other means in this study. Evidence of response bias was, therefore, unsurprising, with parents living in areas of high deprivation less likely to return questionnaires. This is in line with established knowledge that individuals with lower socio-economic status are less likely to take part in research (38). Results from Study Two, therefore, must be treated with caution, with future work focused on parents who are living in particularly hard to reach areas.

Conclusion
Studies One and Two have demonstrated that the PDCS has good construct validity and reliability. It has provided the first example of a tool suitable for assessing families who have concerns about participating fully in preventive programmes to improve their children’s oral health. Motivational interviewing is successful in improving children’s oral health (28, 39). Such an approach could be utilized among parents identified as having high parental dental concerns. In the interim, further work is required to better understand the relationship between concerns and additional barriers to health, and to establish the predictive validity of the PDCS. We believe that with this information, the PDCS can be utilized within the community dental setting to identify families requiring additional assistance to access preventive dental care for their children.

Acknowledgements
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References