



Short Form Version of the Father and Mother Attachment Questionnaire (FMAQ)

Filipa Nunes^{1,2} · Catarina P. Mota^{2,3} · Mónica Costa^{1,2} · Raquel S. Assunção² · Paula M. Matos^{1,2}

Published online: 2 December 2019

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Abstract

Objectives The Father and Mother Attachment Questionnaire (FMAQ) is a 30-item self-report measure developed for assessing adolescents' and young adults' representations of attachment relationships with each parental figure separately, across three dimensions: quality of emotional bond, separation anxiety, and inhibition of exploration and individuality. Five studies were conducted to develop a short-form of FMAQ and to examine whether this new short measure presented with fit psychometric properties.

Method Study 1 involved Item Response Theory (IRT) analyses with 563 Portuguese adolescents and aim to select the best items to include in the short-form of the FMAQ. Studies 2 to 5 aimed to replicate the reliability and factor structure found in Study 1 through confirmatory factor analysis on independent samples of adolescents, young adults and adults.

Results The IRT results suggested including 15-items in the short-form of FMAQ. The results provide support for the adjustment of the short factor structure, internal consistency, and invariance measurement (among gender of participants and parental roles), and predictive validity across different samples.

Conclusions The results obtained in the five studies indicate that the short-form FMAQ is a reliable instrument to assess the quality of attachment to parents in adolescence and emerging adulthood, as well as to evaluate adults' perceptions of their parents as attachment figures during their adolescence. Thus, we suggest this short-form as a promising research tool for researchers quickly to assess attachment to parents in these ages taking into account a three-dimensional approach.

Keywords Parental attachment · Self-report measure · Construct validity · Measurement invariance · Youth

Over the last 30 years, attachment theory has become a central approach in the study of the socioemotional adjustment of individuals. Attachment to parents has been a key variable in understanding mental health, as well as the development of several developmental competences, from

childhood to adulthood (Brenning et al. 2017; Cabral et al. 2012; Nunes and Mota 2017; Ruhl et al. 2015).

Currently, there are many instruments to measure attachment to parents in adolescence (e.g., Inventory of Parent and Peer Attachment, IPPA; Parental Bonding Instrument, PBI; Parental Attachment Questionnaire, PAQ); Adolescent Attachment Questionnaire, AAQ), although, according to literature, they exhibit some limitations (Wilson and Wilkinson 2012). For example, the most frequently used self-report measures do not discriminate attachment to each parental figure. This decision, however, can lead to ambiguous conclusions, as attachment is generally considered dyadic and related to a particular person (e.g., Buist et al. 2008). Some researchers have taken this limitation into account and modified the measures in order to have a version for the mother and another for the father. Nonetheless, these measures do not provide prior evidence of their measurement invariance across parental figures. Furthermore, many of the instruments used to assess attachment to parents in adolescence were originally developed for adults.

Supplementary information The online version of this article (<https://doi.org/10.1007/s10826-019-01672-6>) contains supplementary material, which is available to authorized users.

✉ Paula M. Matos
pmmatos@fpce.up.pt

¹ Faculty of Psychology and Education Sciences, University of Porto. R. Alfredo Allen, 4200-135 Porto, Portugal

² Center for Psychology, University of Porto. R. Alfredo Allen, 4200-135 Porto, Portugal

³ University of Trás-os-Montes and Alto Douro—UTAD, Edifício da Escola de Ciências Humanas e Sociais—Polo I. Quinta dos Prados—UTAD, 5000-801 Vila Real, Portugal

Thus, these instruments may not have the sensitivity to capture the specificities of attachment dynamics in adolescence (Wilson and Wilkinson 2012). Another challenge relates to the length of the measures which can lead to skewed results due to fatigue, especially in extensive protocols. Thus, we consider it important to develop a short measure of attachment to parents that allows to assess father-child and mother-child relationships separately, ensuring measurement invariance across parental figures.

The Father and Mother Attachment Questionnaire (FMAQ), developed by Matos and Costa (2001), is a self-report measure that has been largely used in research with the Portuguese population (e.g., See Gouveia and Matos 2013 for a review). This measure intends to constitute itself as a reliable and valid measure, useful for researching attachment representations. The development of the FMAQ was theoretically driven. A pool of items was generated according to six conceptual dimensions of attachment relationships, namely proximity seeking, safe haven, separation anxiety, fear of loss, admiration, and secure base (Ainsworth 1989; Bowlby 1988). Additionally, items were designed to translate Bartholomew's four attachment patterns: secure, preoccupied, fearful and dismissing (Bartholomew and Horowitz 1991). More specifically, for each conceptual dimension, item formulation attended to how individuals from each prototype would situate themselves. This procedure would guarantee considerable variability across attachment patterns. It should also create a substantive ground for the possibility of using cluster analyses to derive attachment patterns. According to Matos and Costa (2001), the development of FMAQ sought to reconcile a dimensional approach with a prototypical approach to attachment measurement, as opposed to exclusively categorical and typological approaches of attachment. In this way, the FMAQ does not allow access to a total score of parental attachment, but it refers to a three-dimensional approach to the attachment to each parental figure. The use of a dimensional approach of attachment assumes some advantages, namely: greater variability between subjects; does not impose strict boundaries of belonging to groups; requires the conceptual effort to define and operationalize the basic components of the attachment; and makes possible more precise psychometric studies (Fralely and Waller 1998).

This questionnaire consists of 30 items organized in three dimensions: Quality of Emotional Bond (QEB, 10 items), Separation Anxiety (SA, 10 items) and Inhibition of Exploration and Individuality (IEI, 10 items). The response scale ranges from one (Totally Disagree) to six (Totally Agree). QEB refers to the importance given by the individual to the parental figures as attachment figures. SA refers to the individual's perception of experiences of anxiety and fear related to the separation from the attachment figure. It is

important to mention that separation anxiety should not be understood as necessarily negative, given that a secure relationship has in its essence the presence of a certain (not unadjusted) level of fear of losing the attachment figure (Bowlby 1988). Finally, IEI is characterized by the individual's perception of constraints to the expression of his/her individuality and discouragement of the exploratory movement (Matos 2002). Although the FMAQ was initially developed for adolescents and young adults, some studies have already applied this instrument to adults, using a retrospective version (see Gouveia and Matos 2013). In this retrospective version, the items are formulated in the past and they refer to the memory of the relationships with the parental figures during the adolescent period (e.g., Santiago et al. 2017). It should be noted that this version does not evaluate attachment in adults, but the adults' perception of their caregivers as attachment figures during their adolescence.

This questionnaire presents good psychometric properties regarding factorial validity, internal consistency, test-retest reliability, as well as convergent and discriminant validity. In the original psychometric studies, each of the three dimensions of the FMAQ exhibited adequate internal consistency across different samples, as well as good test-retest reliability over 18 months. Correlational analyses testing construct validity evidenced that, with the exception of *separation anxiety*, the subscales correlated moderately to highly (r between 0.50 and 0.76) with dimensions of another widely used attachment measure (IPPA, Armsden and Greenberg 1987), thus providing evidence for concurrent validity. In addition, the FMAQ predicted the separation-individuation process as assessed by the Parental Separation Inventory (PSI, Hoffman 1984). Similarly, to other studies, the emotional independence subscale of the PSI correlated negatively with *quality of emotional bond* ($r = -0.56$ and $r = -0.53$, for fathers and mothers, respectively), suggesting, as pointed out before (e.g., Rice et al. 1995), that it is most likely measuring detachment instead of emotional independence. Finally, and as predicted, discriminant validity was confirmed using subscales of a measure of self-concept (Self-Description Questionnaire III, Marsh 1988). Additionally, results from the FMAQ were compared to data provided by independent judges on a codified semi-structured interview (Family Attachment Interview, Bartholomew and Horowitz 1991). Although only a small convergence between methods was found, in line with results obtained in other studies with older samples (e.g., Shaver et al. 2000), no theoretical inconsistencies have been observed. Since its development, further evidence for convergent and discriminant validity was obtained across different independent studies (see the manual by Gouveia and Matos 2013 for a review of empirical studies).

Measurement invariance has been gathered regarding the parental figures (Assunção et al. 2017). Furthermore, measurement invariance was also tested across a Portuguese sample ($N = 280$) and a German sample ($N = 340$) of late adolescents (16 to 19 years of age). The results provided evidence for the invariance of the original three-factor structure of the questionnaire across both samples at the configural and metric levels (Moura et al. 2010).

Because the FMAQ is long (30 items for the father version and 30 items for the mother version), there is a need for a shorter version based on the more discriminative items, retaining high reliability. Using a restricted pool of items has the advantage of reducing participants' fatigue, frustration, and boredom. Based on the recommendation by Marsh et al. (1998) that a factor should include a minimum of four items, our goal was to select a minimum of fifteen items (i.e., five items for each FMAQ dimension). This is because the selected pool of items must be small enough to allow a quick assessment of the three dimensions of the FMAQ, but large enough to ensure accurate parameter estimates and good reliability (Marsh et al. 1998). The current article was organized into five studies. The first study intended to develop a short-form FMAQ, while studies 2 to 5 aimed to (a) replicate the reliability and factor structure found in Study 1 in independent samples of adolescents, emerging adults, and adults and (b) compare the short and original versions of the FMAQ in terms of construct validity.

The purpose of Study 1 was to select the best items to include in the short form of the FMAQ, evaluate the internal consistency of the QEB, SA and IEI subscales, and examine the factor structure of the short form of this scale through a confirmatory factor analysis. The purposes of Studies 2 to 5 were to replicate the internal consistency and factor structure found in Study 1 in independent samples of adolescents, emerging adults, and adults and compare the short and original versions of the FMAQ in terms of construct validity.

Method

Participants

Study 1

The participants were 563 adolescents with ages ranging from 15 to 18 ($M = 15.99$, $SD = 0.97$), of which 254 (45.1%) were male and 309 (54.9%) were female. As for the participants' education, 224 (37.1%) adolescents were in the 10th grade, 255 (42.2%) in the 11th grade, 110 (18.2%) in the 12th grade, while 15 (2.5%) were in their first year of university.

Study 2

Sample A Sample A of the second study was composed of 625 adolescents with ages ranging from 12 to 18 ($M = 13.50$, $SD = 1.66$), of which 273 (43.7%) were male and 352 (56.3%) were female. Three hundred and seventeen adolescents (50.7%) were between the ages of 12 and 15 years, while 308 (49.3%) had ages ranging from 16 to 18 years. Regarding the participants' education, 51 (8.2%) adolescents were in the 7th grade, 90 (14.4%) in the 8th grade, 63 (10.1%) in the 9th grade, 179 (28.6%) in the 10th grade, 117 (18.7%) in the 11th grade, and 125 (20.0%) were in the 12th grade.

Sample B Sample B was composed of 760 adolescents with ages ranging from 14 to 19 ($M = 15.98$, $SD = 1.08$), of which 351 (46.2%) were male and 409 (53.8%) were female. As for the participants' education ($M = 9.98$, $SD = 1.00$; 1 missing value), 331 (43.6%) adolescents were in the 9th grade, 212 (27.9%) in the 10th grade, 174 (22.9%) in the 11th grade, while 41 (5.4%) were in the 12th grade.

Study 3

The third sample was composed of 555 emerging adults with ages ranging from 18 to 30 ($M = 21.97$, $SD = 3.47$), of which 201 (36.2%) were male and 354 (63.8%) were female. Regarding the qualifications of the participants, 9 (1.6%) had a 9th grade education, 1 (0.1%) had an 11th grade education, 442 (79.6%) had a 12th grade education, 96 (17.3%), had a Bachelor's degree, while 7 (1.3%) had a Master's degree.

Study 4

The fourth sample was composed of 487 adults with ages ranging from 25 to 50 ($M = 34.62$, $SD = 7.83$), of which 150 (30.8%) were male and 337 (69.2%) were female. Regarding the qualifications of the participants, 94 (19.3%) had up to a 9th grade education, 141 (28.9%) had up to a 12th grade education and 252 (51.7%) had a college degree.

Study 5

The fifth sample was composed of 692 emerging adults with ages ranging from 18 to 30 ($M = 23.05$, $SD = 3.36$), of which 520 (75.1%) are female and 172 (24.9%) are male. As for the participants' education, 8 (1.2%) have the 9th grade, 317 (45.8%) have the 12th grade, 363 (52.5%) have a college degree, and 4 (0.6%) have a postgraduate degree.

Procedures

All samples included in this article are part of larger research projects. Initially, a direct contact was made with the authors of those studies, who kindly provided their database and authorized the use of the data for the development and validation of the short-form FMAQ.

In Study 1, before data collection, we arranged meetings with the direction boards of each school to obtain approval. Then, informed consent for adolescents participating in the study was obtained. The protocol of questionnaires was administered to students under the supervision of the teacher and the main researcher, following standardized instructions. Confidentiality and anonymity of the responses were assured, as well as the voluntary character of the adolescents' participation. Participants did not receive any type of compensation for their participation. All protocols were returned to the researcher at the end of the administration. The order of the questionnaires was randomly inverted to avoid biased results since the protocols included other self-report measures beyond the FMAQ. The data included in Study 1 were collected in the scope of a master's project from November to December 2013 in secondary schools.

The samples A and B of Study 2 followed the same procedures as in the previous study. The sample A was collected in the scope of a PhD project from November 2015 to January 2016, in elementary and secondary schools, while the sample B was collected in the scope of PhD project from September to December 2012, in secondary schools. The inclusion of sample B had as its only objective the analysis of the predictive validity of the short version of the FMAQ regarding alienation to peers. Therefore, the results of the remaining analyses for this sample are present as supplementary material.

In the Study 3 we followed the same procedures from Study 1 and the data were collected in the scope of a Master's project from October to December 2016, in higher education institutions.

Regarding to Study 4, the data collection was done through direct contact with the participants and through an online platform, (Google forms). In this study we used the same procedures that Study 1 and the data were collected in the scope of a Master's project from November to December 2013 in companies and institutions. Intercepts invariance was found among of kind of data collect (paper $n = 261$; online $n = 226$) ($\chi^2/df = 2.32/2.13$; $\Delta CFI = -0.001 / 0.002$; $\Delta RMSEA = 0.003/0.003$) in both mother and father versions.

In Study 5, the participants were recruited online (LimeSurvey 3.15[®]) between August and November 2018 in scope of a PhD project. All participants agreed to participate in this study through informed consent and they did not

receive any reward for participation. In this sample, we applied directly the short-form of FMAQ.

Measures

Additional measures were used in the different samples, namely:

Center for Epidemiologic Studies of Depression Scale (CES-D)

The CES-D (Radloff 1977; Portuguese version Gonçalves and Fagulha 2004) was used to evaluate depressive symptomatology. In the present study, we used the dimensions of Negative affect (six items, $\alpha = 0.86$) and Positive affect (five items, $\alpha = 0.72$). The responses are given in a four-point scale from "never" to "very often".

Inventory of Parent and Peer Attachment—revised (IPPA)

The IPPA (Armsden and Greenberg 1987, Portuguese version Ferreira and Costa 1998) was used to evaluate the quality of adolescents' attachment to peers. In the present study, only Alienation to peers (six items, $\alpha = 0.77$) was used. The responses are given in a five-point scale from "never" to "always".

Difficulties in Emotion Regulation Scale (DERS)

The DERS (Gratz and Roemer 2004; Portuguese version Coutinho et al. 2009) was used to evaluate the difficulties of clinically significant emotional regulation. In the present study, the dimensions of Awareness (six items, $\alpha = 0.73$) and Clarity (five items, $\alpha = 0.79$) were analyzed. The responses are given in a five-point scale from "almost never" to "almost always".

COPE—inventory

This inventory (Carver et al. 1989; Portuguese version Cabral and Matos 2010) was used to identify particular, individual and/or preferred coping strategies. In the present study, only the Avoidant dimension (seven items, $\alpha = 0.85$) was used. The responses are given in a six-point scale from "strongly disagree" to "strongly agree".

Échelle de Mesure des Manifestations du Bien-Être Psychologique (ÉMMBEP)

The ÉMMBEP (Massé et al. 1998; Portuguese version Monteiro et al. 2012) was used to evaluate psychological well-being. In the present study, only Self-esteem (four items, $\alpha = 0.83$) was used. The responses are given in a five-point scale from "never" to "almost always".

Brief Symptom Inventory (BSI)

The BSI (Derogatis 1975, Portuguese version by Canavarro 1999) was used to evaluate psychopathological symptomatology. In the present study we used Somatization (seven items, $\alpha = 0.87$), Depression (six items, $\alpha = 0.88$) and Anxiety (six items, $\alpha = 0.91$). The responses are given in a four-point scale from “never” to “too often”.

Visions About Future (VAF)

The VAF (Ginevra et al. 2016, Portuguese version by Nunes et al. 2018) was used to evaluate expectations about the future. This scale evaluates three dimensions, specifically: Optimism (six items, $\alpha = 0.91$); Pessimism (six items, $\alpha = 0.71$); and Hope (seven items, $\alpha = 0.91$). The responses are given in a five-point scale from “it does not describe me at all,” to “it describes me very well”.

Data Analysis

In order to determine which items to include in the short form of the FMAQ, in Study 1 we used two criteria based on Item Response Theory (IRT): discrimination and threshold parameters. IRT analyses were performed in IRTPRO of each item for the three dimensions of the FMAQ (Paek and Han 2013). The analyses were performed using the Graded Response Model (GRM), the most appropriate model for analyzing polytomous data (Likert scales). Analyses were performed using the Maximum Marginal Likelihood estimation (Toland 2014), since, in the GRM, the parameters of the items are estimated by taking into account the marginal distribution of ability (Baker 2001).

Before choosing an IRT model, the dimensionality of the data should be inspected. The appropriate dimensionality is an IRT assumption, which means the model that is used contains the correct number of continuous latent trait variables per person for the data (Toland 2014). It should be noted that the FMAQ is theoretically based and previous research confirmed three latent variables (see Gouveia and Matos 2013, for a review of empirical studies), ensuring appropriate dimensionality of the instrument (Toland 2014). The local independence (LD) is an IRT assumption presupposing that the participants' responses to one item are not statistically related to the responses to other items, even after the latent variable is kept statistically constant. The analysis of the LD values was based on standardized LD χ^2 statistics for each item pair (<10), as proposed by Toland (2014). Item discrimination parameters were examined according to the following guidelines: 0.01 to 0.24 = very low discrimination; 0.25 to 0.64 = low discrimination; 0.65 to 1.34 = moderate discrimination; 1.35 to 1.69 = high discrimination; and more than 1.70 = very high discrimination

(Baker 2001). Threshold parameters were examined according to the guidelines by Toland (2014), in which the ideal threshold should range between -3 and 3 .

Subsequently, in all samples, the Cronbach's alphas were calculated for the three short dimensions of the scale, through *IBM SPSS Statistics 25.0*. The factor structure of the short-form FMAQ was tested using *Amos 25.0*. Maximum Likelihood Estimation was employed to estimate the three-factor model. The CFA was performed according to the method of parceling the items in a random way, as proposed by authors such as Baer et al. (2006). We chose to use this method because one of the advantages of its use is that the parcels are more stable indicators of a latent construct (Taylor et al. 2017).

Each CFA was tested using several fit indices, namely the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA). The CFI and GFI values equal to, or greater than, 0.95 are representative of the acceptable model, and the SRMR and RMSEA values equal to, or lower than, 0.08 correspond to an acceptable fit. The proportion χ^2/df is considered adequate when values range from one to five (Hu and Bentler 1999; Kline 2015). It was also analyzed measurement invariance across gender of participants and parental roles through multigroup analysis.

Results

IRT Analyses for the Mother and Father Versions

In Study 1, analyses were performed separately for the three dimensions of the FMAQ in the mother and father versions, guaranteeing unidimensionality. The results ensure the LD assumption for all items of the three dimensions of the FMAQ in the mother version: QEB (LD χ^2 statistics range from 0.1 to 1.1); SA (LD χ^2 statistics range from 0.1 and 0.3); and IEI (LD χ^2 statistics range from 0.1 to 0.3). Similar results were obtained in the father version: QEB (LD χ^2 statistics range from 0.9 to 7.8); SA (LD χ^2 statistics range from 0.1 and 1.3); and IEI (LD χ^2 statistics range from 0.1 to 0.5). All of the values are relatively small, indicating no evidence of LD, and suggesting that the models fit satisfactorily.

Initially, an IRT analysis was conducted with all items of the three dimensions of the FMAQ. This analysis was done separately for each dimension of the mother and father versions. All items presented moderate to high discrimination in the three dimensions of the mother version: QEB ($\alpha = 1.57$ to $\alpha = 2.92$); SA ($\alpha = 0.84$ to $\alpha = 1.92$) and IEI ($\alpha = 0.77$ to $\alpha = 1.57$). In the father version, all items also exhibited moderate to high discrimination in the three dimensions: QEB ($\alpha = 1.73$ to $\alpha = 2.87$); SA ($\alpha = 0.85$ to

Table 1 Item parameters estimates, standard errors estimates, threshold estimates (Mother’s version)—study 1

		Graded model—item parameter estimates (Mother’s version)—Study 1											
		α^1	SE	β^1	SE	β^2	SE	β^3	SE	β^4	SE	β^5	SE
QEB													
Item 8		1.99	0.18	-3.01	0.25	-2.41	0.18	-1.84	0.13	-1.08	0.09	0.18	0.07
Item 11		2.27	0.21	-2.92	0.24	-2.46	0.18	-1.83	0.13	-1.24	0.09	0.49	0.07
Item 20		2.35	0.23	-3.08	0.26	-2.68	0.21	-2.14	0.15	-1.57	0.11	0.78	0.07
Item 23		1.58	0.15	-3.33	0.31	-2.90	0.25	-2.47	0.20	-1.40	0.12	0.24	0.07
Item 27		2.23	0.19	-2.96	0.24	-2.26	0.16	-1.55	0.11	-0.73	0.07	0.26	0.07
Item 30		3.22	0.32	-2.46	0.17	-2.10	0.14	-1.63	0.10	-0.93	0.07	0.21	0.06
SA													
Item 9		1.74	0.16	-1.38	0.11	0.44	0.07	0.33	0.07	1.10	0.10	2.03	0.16
Item 12		1.33	0.13	-2.82	0.26	-1.95	0.18	-1.97	0.12	0.03	0.08	1.22	0.12
Item 15		1.54	0.15	-2.27	0.20	-1.79	0.16	0.83	0.10	0.05	0.07	0.92	0.10
Item 18		0.81	0.10	-2.34	0.29	-1.11	0.17	0.22	0.11	0.74	0.14	1.98	0.25
Item 24		1.00	0.12	-3.20	0.36	-2.24	0.25	-1.66	0.19	0.91	0.13	0.02	0.10
Item 26		1.57	0.15	-1.36	0.12	0.34	0.08	0.38	0.07	1.01	0.10	1.82	0.15
Item 29		1.45	0.14	-1.45	0.13	0.65	0.09	0.23	0.08	0.92	0.10	1.90	0.16
IEI													
Item 7		1.29	0.13	0.39	0.09	0.62	0.09	1.36	0.13	2.07	0.18	2.85	0.26
Item 10		0.94	0.11	-1.91	0.22	0.79	0.13	0.28	0.11	1.26	0.16	2.20	0.24
Item 13		1.37	0.13	-1.80	0.16	0.68	0.09	0.11	0.08	0.95	0.10	1.77	0.15
Item 16		1.43	0.14	0.64	0.09	0.16	0.08	0.73	0.09	1.31	0.12	2.06	0.17
Item 19		1.53	0.14	0.60	0.09	0.20	0.07	0.80	0.09	1.43	0.12	2.00	0.16
Item 22		1.69	0.16	0.45	0.08	0.51	0.07	1.11	0.10	1.67	0.13	2.48	0.19
Item 25		1.42	0.14	0.05	0.08	0.70	0.09	1.56	0.14	2.03	0.17	2.83	0.25
Item 28		1.19	0.12	-2.31	0.22	-0.33	0.13	0.43	0.09	0.54	0.09	1.51	0.15

The items selected for short-form of the FMAQ are bold

α^1 discrimination parameter, SE standard error, $\beta^{1,2,3,4,5}$ threshold parameter (difficulty parameter), QEB quality of emotional bond, SA separation anxiety, IEI inhibition of exploration and individuality

$\alpha = 2.06$) and IEI ($\alpha = 0.66$ to $\alpha = 1.81$). However, some items showed misfit values in threshold parameters, suggesting they were problematic and should not be included in the short form. The items identified as problematic were: QEB (2, 5, 14, and 17); SA (3, 6, and 21) and IEI (1, 4).

Further IRT analyses were performed without the items initially identified as potentially problematic. The results suggested that the best items to include in the short-form FMAQ for the mother version were: QEB (8, 11, 20, 27, and 30), SA (9, 12, 15, 26, and 29) and IEI (13, 16, 19, 22, and 25) (Table 1). Similar results were obtained for the father version: QEB (8, 11, 20, 27, and 30), SA (9, 12, 15, 26, and 29) and IEI (7, 16, 19, 22, and 25) (Table 2). The following criteria were used to select the items for the short version items that revealed greater discrimination and, simultaneously, presented adjusted values in the threshold parameter. It should be noted that the discrimination parameter reflects the strength of the relationship of each item with the latent trait variable, and the threshold parameter reflects the point at which an individual with a given latent trait has an equal probability of 50% of responding to an item.

One item did not simultaneously correspond to the mother and father short-form versions, namely in the IEI dimension (item seven or 13). Through a semantic analysis of item 7 (*My parents discourage me when I want to try something new*) and of item 13 (*My parents worry too much about me and are always meddling*), we suggest that item seven is better suited for the short-form IEI dimension. This decision was based on the fact that item seven expressed, in a simpler way, Bowlby’s concept of secure base. This concept reflects the function of the attachment figure and the attachment relation to respect, allow and encourage the desire of the individual to engage in exploratory movements beyond the relationship itself (Bowlby 1988). In addition, we tested both models separately, one with item seven and the other with item 13. The results suggested the model that included item seven presented better adjustment indices compared to the model that included item 13.

In addition to IRT analyses, it was also performed a content analysis of items by two area experts who agreed that the items suggested for the short-form preserved the extension of the content of three original factors of FMAQ.

Table 2 Item parameters estimates, standard errors estimates, threshold estimates (Father’s version)—study 1

	Graded model—item parameter estimates (Father’s version)—Study 1											
	α^1	SE	β^1	SE	β^2	SE	β^3	SE	β^4	SE	β^5	SE
QEB												
Item 8	2.48	0.20	-2.37	0.16	-1.84	0.12	-1.23	0.09	0.64	0.07	0.20	0.06
Item 11	3.01	0.25	-2.37	0.15	-1.87	0.11	-1.35	0.09	0.77	0.07	0.13	0.06
Item 20	2.69	0.23	-2.60	0.18	-2.17	0.14	-1.74	0.11	-1.15	0.08	0.48	0.06
Item 23	1.59	0.14	-3.07	0.25	-2.52	0.20	-2.19	0.17	-1.16	0.10	0.00	0.07
Item 27	2.55	0.20	-2.45	0.16	-1.89	0.12	-1.24	0.09	0.53	0.06	0.40	0.06
Item 30	3.17	0.26	-2.13	0.13	-1.68	0.10	-1.22	0.08	0.65	0.06	0.10	0.06
SA												
Item 9	1.87	0.17	-1.16	0.10	0.26	0.07	0.49	0.07	1.29	0.12	2.21	0.17
Item 12	1.40	0.14	-2.56	0.22	-1.71	0.15	0.86	0.10	0.18	0.08	1.30	0.13
Item 15	1.67	0.16	-1.88	0.15	-1.42	0.12	0.63	0.08	0.14	0.07	1.06	0.10
Item 18	0.80	0.10	-2.27	0.28	-1.00	0.16	0.05	0.11	0.93	0.15	2.20	0.27
Item 24	1.13	0.12	-2.68	0.27	-1.93	0.20	-1.38	0.15	0.66	0.11	0.20	0.09
Item 26	1.59	0.15	-1.18	0.11	-0.24	0.07	0.54	0.08	1.18	0.10	2.04	0.16
Item 29	1.51	0.14	-1.25	0.12	-0.41	0.08	0.37	0.07	1.10	0.10	2.02	0.17
IEI												
Item 7	1.09	0.11	-1.86	0.19	0.87	0.12	0.04	0.09	0.89	0.11	1.84	0.18
Item 10	1.07	0.11	-1.86	0.19	0.52	0.10	0.45	0.10	1.59	0.17	2.92	0.29
Item 13	1.57	0.15	0.31	0.08	0.54	0.08	1.10	0.10	0.79	0.14	2.84	0.24
Item 16	1.44	0.14	0.62	0.09	0.19	0.08	0.77	0.09	1.39	0.12	2.18	0.18
Item 19	1.52	0.14	0.71	0.09	0.18	0.07	0.79	0.09	1.46	0.12	2.07	0.17
Item 22	1.99	0.18	0.46	0.07	0.41	0.07	0.98	0.08	1.49	0.11	2.12	0.15
Item 25	1.46	0.14	0.12	0.08	0.60	0.08	1.39	0.12	1.91	0.16	2.81	0.24
Item 28	1.24	0.12	-2.19	0.20	-1.21	0.13	0.40	0.09	0.52	0.09	1.65	0.15

The items selected for short-form of the FMAQ are bold

α^1 discrimination parameter, *SE* standard error, $\beta^{1,2,3,4,5}$ threshold parameter (difficulty parameter), *QEB* quality of emotional bond, *SA* separation anxiety, *IEI* inhibition of exploration and individuality

Descriptive and Item Analyses

Skewness and kurtosis values indicated no severe departures from normality in all studies (Kline 2015; skewness (<3); kurtosis (<8–10)). Skewness ranged from -2.16 to 1.21 (Study 1), from -2.56 to 1.00 (Study 2), from -2.42 to 0.95 (Study 3), from -2.12 to 0.94 (Study 4), and from -2.21 to 1.60 (Study 5) in both mother and father versions. Kurtosis ranged from -1.06 to 7.70 (Study 1), from -1.19 to 7.68 (Study 2), from -0.77 to 6.91 (Study 3), from -1.00 to 4.96 (Study 4), and from -1.08 to 5.09 (Study 5) in both mother and father versions.

Internal Consistency

The Cronbach’s alpha for the three dimensions of the short-form was as acceptable as in the original FMAQ in all samples (Table 3).

Structural Validity

A confirmatory factor analysis (CFA) was performed to confirm the factor structure of the short-form. As shown in Table 4, the short-form FMAQ revealed acceptable adjustment indices in the mother and father versions. The statistic of χ^2 , and associated *p* value, are very sensitive to the sample size, as normally more than 200 is already considered large. Alternatively, the ratio value (χ^2/df) can be used.

Measurement Invariance

Measurement invariance across parental roles and participants’ gender was analyzed using IBM SPSS AMOS 25. In order to test for measurement invariance, the standard steps of measurement invariance were followed: configural invariance, factor loading invariance, intercepts invariance,

residual invariance. Measurement invariance across parental roles was tested by applying the modified version of the correlated uniqueness model (Tagliabue and Lanz 2014), due to the non-independence of observations. In the comparisons across models, the criteria proposed by Cheung and Lau (2012) was used: $\Delta CFI \leq 0.01$ and $\Delta RMSEA < 0.015$ between a more restricted model and the preceding one in the invariance sequence indicate that the invariance hypothesis should not be rejected.

Firstly, the invariance between each dimension of the father and mother versions was tested separately (e.g., QEB father and QEB mother; SA father and SA mother; IEI

father and IEI mother). Invariance between father and mother dimensions was found in all samples. Due to these preliminary results, we tested a model with all three dimensions of the father version and the mother version at the same time, correlating them with each other. Residual invariance was found in all samples: Study 2 ($\chi^2/df = 3.22$; $\Delta CFI = 0.003$; $\Delta RMSEA = -0.001$); Study 3 ($\chi^2/df = 4.13$; $\Delta CFI = 0.006$; $\Delta RMSEA = -0.002$); Study 4 ($\chi^2/df = 3.66$; $\Delta CFI = 0.000$; $\Delta RMSEA = 0.001$); and Study 5 ($\chi^2/df = 2.781$; $\Delta CFI = 0.004$; $\Delta RMSEA = -0.002$). Finally, the measurement invariance of participants' gender was tested in this final model, and residual invariance was found in Study 2 ($\chi^2/df = 2.86$; $\Delta CFI = 0.001$; $\Delta RMSEA = 0.000$), Study 3 ($\chi^2/df = 3.16$; $\Delta CFI = 0.008$; $\Delta RMSEA = -0.002$), and Study 5 ($\chi^2/df = 2.096$; $\Delta CFI = 0.006$; $\Delta RMSEA = -0.003$). Intercepts invariance was found in Study 4 ($\chi^2/df = 3.15$; $\Delta CFI = 0.003$; $\Delta RMSEA = -0.001$) (Table 5).

Table 3 Cronbach's alpha for each sample

FMAQ	Short-form			Original version		
	QEB	SA	IEI	QEB	SA	IEI
Study 1						
Mother	0.85	0.75	0.73	0.88	0.79	0.79
Father	0.89	0.76	0.75	0.93	0.82	0.79
Study 2						
Mother	0.85	0.75	0.85	0.89	0.83	0.80
Father	0.89	0.81	0.70	0.93	0.85	0.79
Study 3						
Mother	0.79	0.74	0.80	0.87	0.79	0.85
Father	0.81	0.76	0.80	0.88	0.81	0.84
Study 4						
Mother	0.88	0.73	0.82	0.90	0.83	0.88
Father	0.90	0.74	0.81	0.92	0.84	0.87
Study 5						
Mother	0.92	0.83	0.82	–	–	–
Father	0.95	0.86	0.83	–	–	–

In study 5, the short form FMAQ was directly applied, therefore no analysis will be presented regarding the original version of this instrument

QEB quality of emotional bond, *SA* separation anxiety, *IEI* inhibition of exploration and individuality

Correlations between Short and Original Dimensions

The correlations between the short-form and the original dimensions of the FMAQ were tested to ensure the representativeness of the proposed short-form scale. Correlations ranged from $r = 0.93$ to $r = 0.96$ for QEB, from $r = 0.90$ to $r = 0.94$ for SA and from $r = 0.89$ to $r = 0.93$ for IEI, in the mother and father versions. In all studies, the intra-scale correlations of the short-form FMAQ in the mother and father versions maintain the same direction and magnitude of those obtained between the original dimensions of the instrument, suggesting the equivalence of the short form.

Predictive Validity

We performed linear regression analyses (considering QEB, SA and IEI dimensions in the same analysis), predicting six

Table 4 Model fit of short-form of the FMAQ in different samples

Study	Version	χ^2 (df), <i>p</i>	χ^2/df	CFI	GFI	SRMR	RMSEA
Study 1	Mother	$\chi^2_{(24)} = 79.37, p = 0.001$	3.31	0.97	0.98	0.04	0.06
	Father	$\chi^2_{(24)} = 76.28, p = 0.001$	3.18	0.98	0.97	0.05	0.06
Study 2	Mother	$\chi^2_{(24)} = 56.51, p = .001$	2.34	0.99	0.98	0.04	0.05
	Father	$\chi^2_{(24)} = 82.43, p = 0.001$	3.44	0.98	0.97	0.06	0.06
Study 3	Mother	$\chi^2_{(24)} = 87.56, p = 0.001$	3.65	0.96	0.97	0.05	0.07
	Father	$\chi^2_{(24)} = 96.99, p = 0.001$	4.04	0.96	0.96	0.06	0.07
Study 4	Mother	$\chi^2_{(24)} = 86.75, p = 0.001$	3.62	0.97	0.96	0.05	0.07
	Father	$\chi^2_{(24)} = 82.06, p = 0.001$	3.42	0.97	0.96	0.06	0.07
Study 5	Mother	$\chi^2_{(24)} = 37.80, p = 0.036$	1.58	1.00	0.98	0.02	0.03
	Father	$\chi^2_{(23)} = 84.70, p = 0.001$	3.68	1.00	0.97	0.04	0.06

χ^2 chi-square, *df* degrees of freedom, *CFI* comparative fit index, *GFI* goodness of fit index, *SRMR* standardized root mean square residual, *RMSEA* root mean square error of approximation

Table 5 Correlated uniqueness model revised: model fit of the invariance steps

Models	Parental role					Gender of participants					
	χ^2/df	CFI	RMSEA	ΔCFI	$\Delta RMSEA$	χ^2/df	CFI	RMSEA	ΔCFI	$\Delta RMSEA$	
Study 2	1—Configural invariance	3.018	0.955	0.057	–	–	2.886	0.910	0.055	–	–
	2—Factor loading invariance	3.539	0.953	0.057	0.002	0.000	2.864	0.907	0.055	0.003	0.000
	3—Intercept invariance	3.178	0.950	0.059	0.002	–0.002	2.872	0.905	0.055	0.002	0.000
	4—Residual invariance	3.216	0.947	0.060	0.003	–0.001	2.864	0.904	0.055	0.001	0.000
Study 3	1—Configural invariance	3.987	0.930	0.072	–	–	3.079	0.896	0.061	–	–
	2—Factor loading invariance	3.932	0.926	0.073	0.004	0.001	3.045	0.894	0.061	0.002	0.000
	3—Intercept invariance	3.969	0.925	0.073	0.001	0.001	3.054	0.892	0.061	0.002	0.000
	4—Residual invariance	4.132	0.918	0.075	0.006	–0.002	3.160	0.884	0.063	0.008	–0.002
Study 4	1—Configural invariance	3.925	0.931	0.078	–	–	3.132	0.897	0.066	–	–
	2—Factor loading invariance	3.752	0.934	0.075	–0.003	0.003	3.133	0.894	0.066	0.003	0.000
	3—Intercept invariance	3.744	0.933	0.075	0.001	0.000	3.146	0.891	0.067	0.003	–0.001
	4—Residual invariance	3.656	0.933	0.074	0.000	0.001	3.392	0.877	0.070	0.014	–0.003
Study 5	1—Configural invariance	2.171	0.987	0.041	–	–	1.968	0.978	0.037	–	–
	2—Factor loading invariance	2.206	0.987	0.042	0.001	0.001	1.944	0.978	0.037	0.000	0.000
	3—Intercept invariance	2.574	0.981	0.048	0.006	–0.006	1.963	0.975	0.037	0.003	0.000
	4—Residual invariance	2.781	0.977	0.051	0.004	–0.002	2.096	0.969	0.040	0.006	–0.003

The misfit values are bold. Δ = change from previous model

criteria: psychopathological symptomatology, alienation to peers, difficulties of emotional regulation, coping strategies, self-esteem, and future expectations.

In all studies, it was found that the short-form FMAQ does not lose the predictive power of the dependent variables compared to the original version. Furthermore, in Study 5, where the short-form FMAQ was applied directly to the participants, the new measure was able to predict theoretically expected variables. In addition, the short dimensions of the FMAQ presented theoretically predictable correlations with the validity criteria. The short dimension of the QEB presented positive correlations with self-esteem, optimism and hope, as well as negative correlations with: negative affect; alienation to peers; difficulties in clarity and emotional awareness; avoidance strategies; and symptomatology of depression, anxiety, somatization, and pessimism. In turn, the short dimension of the SA presented a negative correlation with self-esteem, optimism and hope, as well as positive correlations with: negative affect; alienation to peers; difficulties of clarity and emotional awareness; avoidance strategies; and symptomatology of anxiety, somatization, and pessimism. Lastly, the short dimension of the IEI presented positive correlations with: negative affect; alienation to peers; difficulties of clarity and emotional awareness; avoidance strategies; and symptomatology of depression, anxiety, somatization and pessimism. These results suggest the equivalence of both versions, ensuring the predictive power of the short-form FMAQ relatively to other variables (Table 6).

Discussion

The five studies aimed to develop a short form of the FMAQ, to replicate the short structure and internal consistency in independent samples of adolescents, emerging adults, and adults, and to compare the short and original versions in terms of construct validity. We also intended to analyze the invariance of this new short measure across parental figures and gender of the participants.

The short form has been constructed based on Item Response Theory. The use of this approach allowed the identification/selection of the items for the short version based on the characteristics of each particular item, thus not depending on the total score obtained in each dimension. The construction of this short form was based, therefore, on the attributes (items) within the latent traits (QEB, SA, IEI) that are most important for attachment to parents, in addition to a content analysis by experts which gives strength to the short scale (Paek and Han 2013).

Thus, based on IRT analysis, five items in each of the three dimensions of the original FMAQ were selected. The analyses ensured that all items show a moderate to high level of discrimination (Baker 2001; Toland 2014). This issue is particularly relevant to understanding the SA dimension. According to Matos (2002), it is expected that in close secure relations adolescent and adult individuals develop the capacity to adaptively handle separations, as well as the ability to delay the reencounter for a longer period of time (compared to children), without this causing

Table 6 Standardized regression coefficients from analyses in which FMAQ short-form and original dimensions predicted six validity criteria

Study	Validity criteria	FMAQ—Short-form						FMAQ—Original version									
		Mother			Father			Mother			Father						
		R ²	QEB	SA	IEI	QEB	SA	IEI	R ²	QEB	SA	IEI	R ²	QEB	SA	IEI	
Study 2 CES—Sample A																	
	AF_NEG	0.08	-0.21***	0.18***	0.14**	0.12	-0.34***	0.20***	0.13**	0.07	-0.19***	0.17***	0.13***	0.11	-0.32***	0.19***	0.17***
	AF_POS	0.06	0.21***	-0.14**	-0.10*	0.09	0.30***	-0.15**	-0.11*	0.06	0.21***	-0.16**	-0.10*	0.09	0.32***	-0.18**	-0.12**
	IPPA— Sample B	0.19	-0.28***	0.19***	0.17***	0.16	-0.20***	0.17***	0.20***	0.17	-0.38***	0.23***	0.17***	0.17	-0.30***	0.25***	0.20***
Study 3 DERS																	
	CLA	0.07	-0.12**	0.15**	0.18***	0.09	-0.17**	0.21***	0.16**	0.09	-0.17**	0.22***	0.13**	0.09	-0.26***	0.28***	0.19***
	AWAR	0.04	-0.17**	0.16**	0.03	0.06	-0.20**	0.22***	0.05	0.05	-0.23***	0.19***	0.03	0.06	-0.26***	0.25***	0.02
	COPE	0.15	-0.17**	0.30***	0.20***	0.14	-0.24***	0.35***	0.13**	0.17	-0.11**	0.28***	0.27***	0.15	-0.18**	0.34***	0.16**
	EMMBEP	0.06	0.23***	-0.12*	-0.06	0.07	0.23***	-0.14**	-0.08	0.05	0.22***	-0.15*	-0.04	0.060	0.22***	-0.16**	-0.08
Study 4 BSI																	
	DEP	0.18	-0.20***	0.07	0.29***	0.20	0.06	0.07	0.29***	0.17	-0.15**	0.07	0.33***	0.19	-0.22***	0.06	0.31***
	ANX	0.12	-0.10	0.12	0.28***	0.14	-0.14*	0.10*	0.29***	0.13	0.07	0.12*	0.31***	0.14	-0.14*	0.12*	0.31***
	SOM	0.09	-0.10	0.14**	0.22***	0.08	-0.13*	0.12*	0.21***	0.10	-0.08	0.14**	0.24***	0.09	-0.12*	0.14*	0.24***
	Optimism	0.34	0.36***	-0.22**	-0.04	0.29	0.26***	-0.11**	-0.09								
	Pessimism	0.32	-0.16**	0.17***	0.22***	0.24	-0.18***	0.23***	0.07								
	Hope	0.30	0.31***	-0.23***	-0.01	0.24	0.24***	-0.14***	-0.05								

It is important clarified that DERS assesses difficulties emotion regulation

R² R square, CES center of epidemiologic studies of depression scale, AF_NEG negative affect, AF_POS positive affect, IPPA inventory of parent and peer attachment, AL_P alienation to peers, DERS difficulties in emotion regulation scale, CLA clarity, AWAR awareness, COPE COPE inventory, AVOID avoidant, EMMBEP Échelle de Mesure des Manifestations du Bien-Être Psychologique, SELF_EST self-esteem, BSI brief symptom inventory, DEP depression, ANX anxiety, SOM somatization

*p < 0.05; **p < 0.01; ***p < 0.001

Significant R² values are in bold

exaggerated anxiety. It is worth noting that the SA dimension is not necessarily negative, and it is important that items included in the brief form be sensitive to capturing these anxiety issues, if separated from parents.

This research also provides support for the adjustment of the short factor structure, internal consistency, invariance measurement and predictive validity across different samples. The internal consistency of the short-form FMAQ is good. The values obtained in this study are comparable to those found in previous studies (see Gouveia and Matos 2013, for a review of empirical studies) using the original form. These results suggest that the five items included in the three dimensions of the new short measure converge to reflect the QEB, SA and IEI constructs. A number of findings supported the validity of the short-form. The three-dimensional structure of the FMAQ, proposed by Matos and Costa (2001) and found in several previous studies (e.g., Assunção et al. 2017; Nunes and Mota 2017), was confirmed in this new short form. The presence of good adjustment indices ensures that the items included in the three short dimensions evaluate the constructs proposed in the original version of the FMAQ. These results provide important evidence of the equivalence between the short version and the original version of the FMAQ.

Furthermore, this study establishes important evidence regarding the invariance of the instrument. Although measurement invariance is a prerequisite for conducting cross-group comparisons, it is rarely tested (Cheung and Lau 2012). Thus, the lack of variation in the short FMAQ structure between parental roles, as well as across participants' gender, adds an important evidence for the robustness of this measure. This evidence of invariance guarantees that the comparisons between groups are significant, the instrument evaluates the same construct in both groups, and that differences between groups effectively reflect the differences between them (Cheung and Lau 2012). It should be noted that similar results have been found in previous studies using the original FMAQ (Assunção et al. 2017), and among Portuguese and German adolescents (Moura et al. 2010).

We found that the three dimensions (QEB, SA, and IEI) of the short measure developed in this study were strongly correlated with the three original dimensions of the FMAQ. Furthermore, the intra-scale correlations maintained the same direction and magnitude in both versions (short and original). These results ensure, therefore, the representativeness of the short form proposed. The short dimensions also exhibited explanatory power regarding other variables, as well as theoretically predictable correlations with the validity criteria. As expected, quality relationships with parents were associated with better social-emotional adjustment in individuals, while relationships characterized by higher separation anxiety and inhibition of

individuality were associated with psycho-emotional maladjustment. Moreover, the direct application of this new short measure was able to predict expected theoretical variables. Our findings are consistent with attachment theory (Ainsworth 1989; Bowlby 1988) and previous empirical evidence (e.g., Blomgren et al. 2016; Brenning et al. 2017; Cabral et al. 2012; Paredes et al. 2014). The results obtained in the five studies indicate that the short-form FMAQ is a reliable instrument to assess the quality of emotional attachment to parents in adolescence and emerging adulthood, as well as to evaluate adults' perceptions of the availability of their parents as attachment figures during their adolescence. The results of Study 5 ensured greater robustness of this new short measure since these to show the appropriateness of the abbreviated form through the direct administration of short form FMAQ (Smith et al. 2000). This instrument presented strong psychometric properties and may confidently be used by researchers when a short three-dimensional measure of attachment is required. Thus, we believe our research contributed to attachment research, filling an important gap regarding the development of a theory driven measure that assesses attachment to fathers and mothers separately and presents strong invariance evidence. Again, we want to advise against using a total score due to the content of the dimensions assessed. Insecurity may be expressed both by high (preoccupied attachment) and low levels of separation anxiety (dismissing attachment).

In addition to a number of strengths, the current study has some limitations. All the samples included only cross-sectional data coming from self-report measures. It is important for future studies to test convergent and divergent validity, longitudinal invariance and perform test-retest analyses, in order to further validate the short-form FMAQ and ensure it can be used in longitudinal studies. Moreover, future studies would also benefit from using other assessment methods, such as behavioral observations, daily diaries or interviews to further establish the validity of the short-form FMAQ. Despite the mentioned limitations, we emphasize that the present study indicates the robustness of the short-form FMAQ. Thus, we suggest this short-form as a promising research tool for researchers quickly to assess attachment to parents in these ages.

Acknowledgements We would like to thank the researchers Fátima Silva, Tatiana Ferreira and Patrícia da Costa Claro from the University of Trás-os-Montes and Alto Douro, for kindly making their databases available for this study. This work was funded by the Portuguese Science Foundation (CPUP UID/PSI/00050/2013; FEDER/COMPETE2020 POCI-01-0145-FEDER-007294) and a PhD scholarship (SFRH/BD/133032/2017).

Author Contributions F.N. conceptualized and designed the study, carried out the analyses and drafted the manuscript; C.P.M. conceptualized and designed the study and reviewed the manuscript for

clarity; M.C. contributed to carry out the analyses and the discussion of the results; R.S.A. contributed to carry out the analyses; P.M.M. conceptualized and designed the study, wrote parts of the manuscript, and critically reviewed the manuscript. All authors read and approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This study is in accordance with the ethical standards of the Ethics Committee of the Faculty of Psychology and Education Sciences at the University of Porto (REF^o2017/12-11) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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