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Title: Validity and reliability evidence of the nijmegen questionnaire in astma

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Body: Introduction The Nijmegen Questionnaire (NQ) is the most commonly used screening tool for hyperventilation. The validity of the NQ has not been reported for Greek asthma out-patients. Aim Report the validity evidence of the Nijmegen Questionnaire in asthma. Methods 162 Greek asthma out-patients (86 with mild and 76 moderate asthma) participated in the study. Hyperventilation was assessed using NQ and clinical measures such as breath holding time (BHT), respiratory rate (RR) and end-tidal CO₂ (ETCO₂). Construct validity was tested through factor analysis and cross-sectional validity through correlations of the NQ score with BHT, ETCO₂ and RR (Pearson's r correlation coefficient). Results Exploratory factor analysis for the three pre-hypothesized factors of the 16 item NQ showed low factor loadings which led to a principal component analysis (PCA) for NQ. The PCA revealed a one-factor solution with 11 items (Q1, Q2, Q4, Q5, Q6, Q7, Q8, Q9, Q11, Q13, and Q16). The one-factor solution revealed a total of 58.86% of explained variability and a high Cronbach alpha ($\alpha = .92$). These findings were supported by confirmatory factor analysis for the 11 items NQ model [$\chi^2 = 149.90$, df 44, $p < .01$, χ^2 / df ratio = 3.407, CFI = .99, IFI = .99, AGFI = .98, SRMR = .14, RMSEA = .14.]. Cross-sectional validity testing showed moderate correlations of the NQ score with ETCO₂ ($r = -.77$, $p < .001$), RR ($r = .66$, $p < .001$), BHT ($r = -.65$, $p < .001$). Conclusion The NQ was valid and reliable in the present sample with asthma.

Loadings and communalities of the 11 item NQ model

Items	Loadings	Communalities
9	.895	.801

6	.892	.796
11	.889	.790
7	.865	.749
8	.846	.716
13	.826	.683
5	.805	.648
16	.760	.577
4	.565	.320
1	.463	.215
2	.424	.180
Egen Value	6.475	