Dimensionality of the Dermatology Life Quality Index (DLQI): A Commentary

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Sir,

Mazzotti et al. (1) have suggested recently that the Dermatology Life Quality Index (DLQI) is a uni-dimensional assessment of health-related quality of life (HRQL). In developing the DLQI, Finlay and his associates were among the first to recognize and study the impact of skin conditions on patients' lives (2). The content of the measure was developed by asking dermatology patients how their skin disease affected them. Multiple studies employing classical test theory have suggested that it is a valid, reliable and responsive instrument (3).

A fundamental requirement of any outcome scale is that it is uni-dimensional, i.e. that all items in the scale measure the same construct. Only then it is valid to add the items to give a total score. Of the 10 items in the DLQI, 2 assess symptoms (impairment), 6 address functioning (disability) and 2 cover needs that cannot be fulfilled as a result of skin disease (4). As impairments, disability and quality of life (QoL) are different types of outcome, it appears unlikely that the DLQI would prove to be uni-dimensional (5).

Mazzotti et al. (1) employed an exploratory factor analysis (EFA) that identified four dimensions among the 10 items in the DLQI. The face validity of two of these factors was questionable as they consisted of items that did not appear to group logically (factor 1 included items that assessed impairments and disability, and factor 3 combined items measuring disability and QoL). Furthermore, the factors identified generally consisted of too few items (two or less), exhibited item complexity and together explained a rather low proportion of the variance (61%). Also, the absence of the eigenvalues of the factors limits the interpretation of the analyses. As expected with psychological constructs, the EFA factors showed a moderate correlation and, therefore, the authors hypothesized that items on the DLQI were better represented by a higher-order structure such that overall disease *caused* the 4 lower order factors (6). While this has been considered an acceptable method of testing uni-dimensionality it may be considered controversial in this setting due to the limitations of the initial EFA. Furthermore, Wright (7) has asserted that Rasch analysis should replace classical test theory and factor analysis in particular for the measurement of variables in social sciences (7, 8).

In the last decade, the use of more sophisticated statistical techniques (based on item response theory (IRT)) in the development of new patient-reported outcome measures have become accepted and are now considered standard in the psychometric community (9). The implementation of IRT techniques, such as Rasch analyses, help to confirm fundamental measurement issues such as uni-dimensionality, additivity and specific objectivity in the evaluation of patient-based outcomes (10, 11).

If the DLQI were a uni-dimensional instrument it would be expected that the application of Rasch analysis would support the findings by Mazzotti et al. (1). However, application of the DLQI with psoriasis and atopic dermatitis patients in the UK found that the DLQI misfitted the Rasch model (p=0.008 and p=0.018, respectively) indicating that the measure was not uni-dimensional in either disease (12). In addition, the analyses suggested problems with individual items in terms of bias by age and gender and problems with the response format.

In conclusion, the higher-order confirmatory factor analysis conducted by Mazzotti et al. (1), suggesting that the DLQI is uni-dimensional, could not be confirmed by Rasch analyses performed on dermatological patients from the UK. It is clear that the uni-dimensionality of the DLQI is far from established and that further investigations of the measure's scaling properties are required.

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Reply to the Letter by T. Nijsten et al.

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Sir,

We thank Drs Nijsten, Meads and McKenna for their interest in our paper and for providing an opportunity to clarify the issues raised. As they rightly point out, sophisticated statistical techniques based on item response theory (IRT), such as Rasch analysis, have gained ground and are currently considered standard in the psychometric community. Their main concern about our study regards the absence of an IRT-based analysis. However, we did in fact perform an IRT-based analysis, as the MPLUS program (1) that we used implements estimators for ordinal variables (based on weighted least squares estimates) that have been demonstrated (2, 3) as a special case of a two-parameters IRT model, i.e. the so-called Normal Ogive Item Characteristic Curve Model (4, 5).

While Rasch's one-parameter logistic model is an IRT model, it is not the only one. On the one hand, it has some advantages compared with other IRT models, such as the objective specificity and the invariance of comparisons (6). On the other hand, it is often unrealistic with respect to available data. While the Rasch model is a uni-dimensional one-parameter IRT model, a less restrictive model is often more adequate for explaining empirical data. For instance, usually two parameters are needed to explain the probability of endorsing an item; in this case, one should relax the assumption of Rasch model that all items have the same discriminant power.

The approach we use for dimensionality analysis was consistent both with the level of measurement of DLQI items (ordinal scale) and with the assumptions of IRT models, because the MPLUS approach for EFA with categorical variables is a 2-parameter multi-dimensional IRT model. Our solution demonstrated that the set of items of the DLQI does not fit a uni-dimensional model, that the items differ in their level of discrimination, and that a second-order uni-dimensional model fits empirical data. Thus, while the uni-dimensionality of the DLQI is not identifiable at the item level, it can be identified at the level of first-order factors. As noted by Hattie (7), it is quite reasonable to claim for uni-dimensionality when a second-order factor accounts for the correlations between first-order factors.

Nijsten et al. remarked that the uni-dimensionality of the DLQI was not supported by the results of a Rasch analysis performed on patients with psoriasis or atopic dermatitis in the UK (8). In fact, these results do not refute or contradict our findings, because what our study showed is that the uni-dimensionality of the DLQI can be claimed if two assumptions of Rasch model are relaxed, i.e. the presence of only one first-order latent trait, and the presence of only one parameter (i.e. item difficulty).

A minor issue raised by Nijsten et al. regards the proportion of variance explained by the factors, and the absence of the eigenvalues. There is no consensus about how much variance factors should explain. Modern factor analysts are much more concerned with how well the factor model fits the data rather than how much variance it explains, because factor analysis is a tool for explaining what variables have in common, i.e. variable co-variances instead of variables variance (9, 10). This point differentiates factor analysis from principal component analysis (11). Goodness-of-fit indices are thus replacing such obsolete tests as the mineigen (or Kaiser-Guttman) rule and the scree plot of eigenvalues as a method for evaluating the quality of a factorial model (12). While in our study we used goodness-of-fit indices, on request we could provide the eigenvalues of the correlation matrix that was analysed.

Our study was part of a larger research project on psychosocial well-being of patients with psoriasis. While a previous paper documented the ability of the DLQI to detect meaningful changes in health-related quality of life (HRQoL) over time (13), our study on uni-dimensionality supported the hypothesis that there is a higher-order construct of HRQoL that includes both psychosocial and physical effects of skin disease on QoL, at least as far as psoriasis is concerned. This finding has practical implications because it supports the common practice of reporting the results as a summary score. While it should be made clear that in our study we used state-of-the-art methodology, no single study can settle any question, and we agree with Nijsten et al. that further investigations of the measure's scaling properties are warranted.

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