Health-related quality of life in French adolescents and adults: norms for the DUKE Health Profile

Cédric Baumann1,2, Marie-Line Erpelding2, Christine Perret-Guillaume1,3, Arnaud Gautier4, Stéphanie Réga1, Jean-François Collin1,2, Francis Guillemin1,2 and Serge Briançon1,2*

Abstract
Background: The continual monitoring of population health-related quality of life (HRQoL) with validated instruments helps public health agencies assess, protect, and promote population health. This study aimed to determine norms for the French adolescent and adult general population for the Duke Health Profile (DUKE) questionnaire in a large representative community sample.

Methods: We randomly selected 17,733 French people aged 12 to 75 years old in 2 steps, by households and individuals, from the National Health Barometer 2005, a periodic population study by the French National Institute for Prevention and Health Education. Quality of life and other data were collected by computer-assisted telephone interview.

Results: Normative data for the French population were analyzed by age, gender and self-reported chronic disease. Globally, function scores (best HRQoL=100) for physical, mental, social, and general health, as well as perceived health and self-esteem, were 72.3 (SEM 0.2), 74.6 (0.2), 66.8 (0.1), 71.3 (0.1), 71.3 (0.3), 76.5 (0.1), respectively. Dysfunction scores (worst HRQoL=100) for anxiety, depression, pain and disability domains were 30.9 (0.1), 27.6 (0.2), 34.3 (0.3), 3.1 (0.1), respectively.

Conclusion: The French norms for adolescents and adults for the DUKE could be used as a reference for other studies assessing HRQoL, for specific illnesses, in France and for international comparisons.

Keywords: Health-related quality of life Duke Health Profile, norms, adolescent, adult, French population

Background
Quality of life (QoL) is defined by the World Health Organization (WHO) as “the perception that an individual has of his or her place in life, within the context of the culture and system values in which he or she lives, and in relation to the objectives, expectations, standards and concerns of this individual” [1]. Health-related quality of life (HRQoL) [2,3] can be defined “as an integrative measure of physical and emotional well-being, level of independence, social relationships and their relationship to salient features of their environment” [1]. The conceptualization of HRQoL is both objective and subjective, so its measurement requires reference to varied and complex areas, depending on the perspective. For example, social workers will assess QoL from a different perspective than medical workers. HRQoL measurement can also be very personal because experiences, beliefs, and expectations and perceptions influence how individuals think and behave [4].

HRQoL is a multidimensional concept that relates specifically to a person’s health, to the measure of its functioning, well-being and general health perception in physical, psychological, and social domains [2]. HRQoL measures are used to determine the burden of disease in economic analyses [5,6] and have become an important target in medical care for assessing treatment outcomes in chronic disease and an important outcome criterion in randomised clinical trials, especially oncology [1]. In addition, HRQoL...
instruments can be used in medical practice to improve the physician-patient relationship, in health services evaluation, in research and in policy making.

Many HRQOL instruments, both generic and specific for various illnesses, have been developed to survey the various domains of life that ill health can affect [7].

Most generic instruments are for adults, such as the WHOQOL [8], the Sickness Impact Profile [9], the Nottingham Health Profile [10], the SF-36 [11], and the Duke Health Profile (DUKE) [12-14]. However, whether such generic instruments are suitable for young French people is unknown. To compare the adolescent and adult quality of life, the French Committee for Health Promotion, in 1998, 2000 and in 2005 [15], used a version of the DUKE suited to assess quality of life in the 12-19 age group.

The DUKE is a cross-culturally adapted, valid and useful measure of perceived health in adolescents and adults [12]. One of the obstacles to the success of large surveys is the extensive time needed to complete them (by phone conversations or self-administered). The DUKE is a 17-item short questionnaire, self-administered or interviewer-administered, developed and validated in primary care to measure patient-reported HRQoL, or functional health status, during 1 week [13,14] and may be more suitable than the SF-36 for older inpatients [16-18]. Its feasibility and acceptability were reported to be good for patients with dementia [19]. As well, another study found the DUKE significantly better accepted than the SF-36 by young patients [20]. Finally, the DUKE allows for briefly exploring dimensions of self-perceived health such as self-esteem, anxiety and depression not proposed by other tools [21].

There is an interest in finding a simple short, self-reporting measure of HRQoL in healthy adolescents that is in the French language. The DUKE score has been used primarily for research in the clinical setting, both as a predictor of health-related outcomes and as an outcome [22-24]. The original DUKE was developed in English (United States) and was validated primarily in the United States. Subsequently, the DUKE has been translated into 17 other languages and language variations such as Afrikaans, Chinese, Dutch, Dutch (Belgium), English (UK), French, French (Canada), German, Italian, Korean, Norwegian, Polish, Portuguese, Spanish, Swedish, Thai and Vietnamese. It has been translated in French and used extensively by the Public Health School of Nancy (France) [12,25-29].

Medical and scientific committees need validated instruments to assess HRQoL, but general population norms are lacking, which limits their full use in research and clinical practice. Community norms of HRQoL are important because they provide a base level of HRQoL to compare illness groups or individuals’ HRQoL to expected values. To our knowledge, norms for the DUKE for all countries are lacking.

We aimed to use the DUKE to determine HRQoL norms for French adolescents and adults and analyze these by gender, age and self-reported chronic disease.

**Methods**

**Data source**

Since 1992, the French National Health Barometer, a 5-year periodic study by the French National Institute for Prevention and Health Education (INPES), has surveyed behaviours, attitudes, opinions and knowledge about health (e.g., alcohol consumption, tobacco use, drug consumption, physical activity) and evolution of the health of adolescents and adults in France. The whole questionnaire includes more than 400 questions. Data for the 2005 National Health Barometer were collected between October 14, 2005 and February 12, 2005. This survey was carried out in France by use of a computer-assisted telephone interview (CATI) system with a sample of 30,514 people aged 12 to 75 years who spoke French. Households received a letter in advance to explain the purpose of the survey and to encourage people in the household to take part. The eligible subject within each household whose next birthday was nearest the interview day was selected to answer the questions [30]. All data collected were anonymous and self-reported. Subjects were asked to isolate themselves before the interview began. The mean duration of an interview was about 40 minutes for landline phones.

Young people (younger than 15 years) had to be accompanied by their mother or father to participate. Parents were asked to consent to their child’s participation and that the child could be isolated to speak more freely.

The INPES commissioned the “EA4360 Apemac”, a French research team specialised in HRQoL studies (School of Public Health, Nancy, France), to analyse the data and determine norms [15].

This population-based survey was approved by the French National Institutional Review Board (Commission Nationale Informatique et Liberté).

**Sampling**

Of 30,514 participants in the 2005 Health Barometer survey, 26,672 were contacted by landline phone to answer all questions of the Health Barometer, and 3,842 persons, without a landline phone, were contacted by their mobile phone to answer questions related only to tobacco, alcohol and illegal drug use because by the year 2000, more people had only a mobile phone. When the Barometer started, questioning all participants by mobile phone for more than 20 minutes was difficult (problems with the battery, attention, satellite range). So, the researchers decided to
ask questions about sociodemographic characteristics and tobacco, alcohol, and illegal drug consumption only to limit the duration of the interview.

Among the 26,672 participants contacted by landline phone, 17,783 (two-thirds of the sample) were randomly selected to participate in the QoL survey by the DUKE. Among these, 17,733 responded to the DUKE. The 8,889 participants not randomized responded to another HRQoL questionnaire (WHOQOL-brief) (see figure 1).

Duke Health Profile questionnaire

HRQoL was assessed by use of a French validated version of the DUKE (Table 1), a 17-item generic self-reporting instrument, with question responses according to a 3-point Likert scale, which covers a 1-week time frame [12]. The DUKE includes 10 domains. Six domains are about health function: physical health (items 8-12), mental health (items 1, 4, 5, 13, 14), social health (items 2, 6, 7, 15, 16), general health (aggregation of physical, mental and social health measures to indicate overall well-being) (15 items), perceived health (item 3) and self-esteem (items 1, 2, 4, 6, 7), with high scores indicating better HRQoL; and 4 are about health dysfunction: anxiety (items 2, 5, 7, 10, 12, 14), depression (items 4, 5, 10, 12, 13), pain (item 11) and disability (item 17), with high scores indicating greater dysfunction. The DUKE is suitable for computerised telephone administration by a trained interviewer. It can be completed in a short time and has good acceptability [14,31].

Other data collected

Like many other authors [7,32], we considered age, gender and self-reported chronic disease to determine norms.

Statistical analysis

Questionnaires were coded and calculated according to instructions in the DUKE manual [14]. The score for each dimension is the sum of the scores for the items, standardized from 0 to 100. For the 6 health dimension scores, 100 indicates the best HRQoL, whereas for the 4 dysfunction dimension scores, 100 indicates the greatest dysfunction. Missing dimension scores were imputed if scores were missing for < 50% of items for a dimension, using the mean score of the items completed within that dimension. Scores were analysed for the whole sample and then after stratification by gender, age and self-reported chronic disease.

Norms for the DUKE for French adolescents and adults are presented as means, standard deviation (SD), standard error of the mean (SEM), median (interquartile range), minimum, maximum, and percentage of floor and ceiling effect. In this study, with lack of consensus, floor and ceiling effects were considered present if more than 10% of the respondents achieved the highest or lowest score, and strong effects if more than 30% of the respondents achieved the highest or lowest score.

Qualitative variables were compared by Student’s t test, with Bonferroni correction. Interaction of gender, age groups and self-perceived chronic disease with HRQoL was analyzed by linear regression models. Only strong interactions are presented (p < 0.01).

Data and t test values were weighted by the number of eligible persons in the household and by the French population structure imputed from 1999 INSEE (National Institute for Statistic and Economic surveys) National Census data. In this way, the sample was representative of the French general population between 12 and 75 years old who speak French and have a landline phone.

Internal consistency was assessed by Cronbach’s α, an inter-item correlation statistic ranging from 0-1, except for perceived health, pain and disability domains, which contain only one item. Higher values indicate that items on a domain are correlated and therefore the scale measures an underlying single dimension of the questionnaire. A Cronbach α of ≥ 0.5 is usually considered acceptable [33], but Nunnally recommends values of ≥ 0.7 [34].

Statistical analysis involved use of SAS v9.1 (SAS Inc., Cary, NC).

Results

Description of the sample

Table 2 shows the characteristics of the observed sample and after weighting by gender, age, geographic area and size of community. The response rate to the HRQoL survey was close to 100%. Among 17,783 randomly selected people, completed questionnaires were obtained.
Table 1 Content of the Duke Health Profile questionnaire

| Item (French version) | Dimension * |
|-----------------------|-------------|
| 1. I like who I am    | Mental health, self-esteem, anxiety |
| (Je me trouve bien comme je suis) | |
| 2. I am not an easy person to get along with | Social health |
| (Je ne suis pas quelqu’un de facile à vivre) | |
| 3. I am basically a healthy person | Perceived health |
| (Au fond, je suis bien portant) | |
| 4. I give up too easily | Mental health, self-esteem, depression |
| (Je me découvre trop facilement) | |
| 5. I have difficulty concentrating | Mental health, anxiety, depression |
| (J’ai du mal à me concentrer) | |
| 6. I am happy with my family relationships | Social health, self-esteem |
| (Je suis content de ma vie de famille) | |
| 7. I am comfortable being around people | Social health, anxiety |
| (Je suis à l’aise avec les autres) | |
| 8. Would you have any physical trouble or difficulty : Walking up a flight of stairs | Physical health |
| (Vous auzez du mal à monter un étage) | |
| 9. Would you have any physical trouble or difficulty : Running the length of a football field | Physical health |
| (Vous avez du mal à courir une centaine de mètres) | |
| 10. How much trouble have you had with: sleeping | Physical health, anxiety, depression |
| (Vous avez eu des problèmes de sommeil) | |
| 11. How much trouble have you had with: hurting or aching in any part of your body | Physical health, pain |
| (Vous avez eu des douleurs quelque part) | |
| 12. How much trouble have you had with: getting tired easily | Physical health, anxiety, depression |
| (Vous avez eu l’impression d’être vite fatigué(e) | |
| 13. How much trouble have you had with: feeling depressed or sad | Mental health, depression |
| (Vous avez été triste ou déprimé(e) | |
| 14. How much trouble have you had with: nervousness | Mental health, anxiety |
| (Vous avez été tendu(e) ou nerveux(se) | |
| 15. How often did you: socialize with other people (talk or visit with friends or relatives) | Social health |
| Vous vous êtes retrouvé(e) avec les gens de votre famille qui n’habitent pas chez vous, ou avec des copains en dehors de l’école (posée aux 12-17 ans) Vous avez rencontré des parents ou des amis au cours de conversations ou de visites (posée aux 18 ans et plus) | |
| 16. How often did you: take part in social, religious, or recreation activities (meetings, church, movies, sports, parties) | Social health |
| (Vous avez eu des activités de groupes ou de loisirs) | |
| 17. How often did you: stay in your home, a nursing home, or hospital because of sickness, injury, or other health problem | Disability |
| (Vous avez dû rester chez vous ou faire un séjour en clinique ou à l’hôpital pour raison santé) | |

* The general health dimension consists of all items, except items 3 and 17.

from 17,733 subjects questioned by the CATI system. Participants of the HRQoL survey (n = 17,733) and people not randomly selected (n = 9,539) did not differ in age, gender or self-reported chronic disease. After weighting by the 1999 INSEE National Census data, 49.1% of the sample were males. Adolescents (12-17 years old) represented 10.5% of the sample, young adults (18-24 years old) 11.1% and elderly people (65-75 years old) 12%. Self-reported chronic disease prevalence was 21.7%.

Internal consistency

Internal consistency ranged from poor to good. The Cronbach α was 0.34 for social health, 0.46 for self-esteem, 0.57 for anxiety, 0.61 for depression, 0.62 for physical health, 0.63 for mental health, and 0.71 for general health. The Cronbach α for adolescents was lower than or equal to that for adults for dimensions.

Description of norms by gender, age and self-reported chronic disease

The HRQoL norms globally, by gender and by age are in Table 3. In summary, mean function scores for physical, mental, social, and general health, as well as perceived health and self-esteem, were 72.3 (SEM 0.2), 74.6 (0.2), 66.8 (0.1), 71.3 (0.1), 71.3 (0.3), 76.5 (0.1), respectively. Dysfunction scores for anxiety, depression, pain and disability were 30.9 (0.1), 27.6 (0.2), 34.3 (0.3), 3.1 (0.1), respectively. Scores for men were always higher than those for women, except for social health and disability dimensions.

Mean disability, depression, self-esteem and mental health scores were low for men (2.8 ± 15.6, 21.4 ± 19.5, 78.8 ± 18.4, 78.6 ± 19.6, respectively), and disability, mental health, self-esteem and physical health scores were low for women (3.5 ± 14.9, 74.6 ± 20.2, 74.4 ± 17.2, 72.3 ± 20.3, respectively). The most affected dimension was social health for men (64.4 ± 19.2) and pain for women (38.3 ± 33.4).

Tables 4 and 5 provide the HRQoL norms by gender, age and self-reported chronic disease. Self-reported chronic disease was associated with a mean decrease of 12.5 points in the score for physical health, 4.6 for mental health, 2.3 for social health, 6.5 for general health, 19.3 for perceived health, and 3.2 for self-esteem and a mean increase of 4.8 points in the score for anxiety, 5.1 for depression, 18.4 for pain and 2.5 for disability (for the last 4 dimensions, the interpretation of the score is inverted). All differences were statistically significant (p < 0.001), whatever the gender and age. After adjustment for gender and age, significant interactions were found between self-reported chronic disease and age for perceived health (p < 0.0001) and depression (p < 0.0001):
increase in age had a lower effect on HRQoL score in the group with a self-reported chronic disease. We also observed a significant interaction between gender and self-reported chronic disease, with greater effects for women than men in score for physical health (-14 points and -11 points, respectively, p = 0.003), general health (-7 points and -5.7 points, respectively, p = 0.002), and pain (+23.6 points and 15.9 points, respectively, p = 0.001).

We found a floor effect for anxiety, perceived health and depression scores (6.4, 11.3 and 12.4%, respectively) and a strong floor effect for pain and disability scores (44.6 and 95.4%, respectively) (Table 3). Ceiling effects were moderate for physical health (11.3%), self-esteem (16%) and mental health (16.2%) and strong for perceived health (53.9%).

**Discussion**

The DUKE questionnaire has been used for many years to describe HRQoL in different patient populations but has not been used for a general population. This is the first study presenting norms for the DUKE for French adolescents and adults. These normative data will be useful to researchers who wish to use the DUKE for health assessment and to clinical practitioners in daily practice.

The production of HRQoL community norms is important because they provide expected reference values to evaluate groups or individuals' HRQoL. Norms allow for appreciating the impact of diseases on HRQoL by comparing patients’ HRQoL with normative data. However, some authors have suggested that norm-based interpretation in this situation may be irrelevant [35,36] because the impact of the disease could be underestimated. This situation would be the case mainly in longitudinal studies if patients changed their way of estimating HRQoL over time because of their experience with disease or treatment, the response-shift phenomenon. Humans actively construct meaning from their environment and display a range of cognitive mechanisms to continually adapt to changing circumstances. Response shift refers to a change in the meaning of one’s evaluation of a construct as a result of a change in one’s internal standards of measurement, values or construct definition. Therefore, people might give different answers on patient-reported outcome measures over time, because their HRQoL has changed and because they might have changed their perception on what health or HRQoL means to them [37,38]. However, comparing values between patients and the general population can be problematic with scales that have been developed in a hospital setting, but is not the case for the DUKE.

In public health, the continual monitoring of population HRQoL with validated instruments gives public health agencies data on current health for assessing, protecting, and promoting population health. Tracking population HRQoL over time also helps identify health disparities, evaluate progress on achieving broad health goals, and inform healthy public policy makers. These applications complement those of clinical research and practice, where HRQoL assessment measures patient-reported outcomes from medical, surgical, and behavioural interventions. In epidemiological research, these measures are particularly relevant to the field of chronic disease epidemiology by providing direct evidence of the considerable population burden of long-term health conditions such as disability, arthritis, obesity, asthma or diabetes. As previously mentioned, clinicians and researchers should carefully define their research questions related to patient-reported outcomes before selecting the instrument to use, by structure and content

**Table 2 Characteristics of the sample**

| Age, years | Men | | | Women | | | Total | | |
|------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|            | n observed | % corrected* | n 1999 NCD | n observed | % corrected* | n 1999 NCD | n observed | % corrected* |
| 12-17      | 670   | 11.5 | 2360572 | 737   | 9.6 | 2256154 | 1407   | 10.5 | 4616726 |
| 18-24      | 638   | 11.9 | 2706126 | 810   | 10.4 | 2628525 | 1448   | 11.1 | 5334651 |
| 25-34      | 1400  | 17.8 | 4201394 | 1927  | 18.9 | 4215311 | 3327   | 18.4 | 8416705 |
| 35-44      | 1404  | 17.6 | 4246510 | 1919  | 19.6 | 4337674 | 3323   | 18.6 | 8584184 |
| 45-54      | 1320  | 18.1 | 4081008 | 1776  | 17.5 | 4110160 | 3096   | 17.8 | 8191168 |
| 55-64      | 1125  | 11.2 | 2684944 | 1730  | 12   | 2798797 | 2855   | 11.6 | 5483741 |
| 65-75      | 868   | 11.9 | 2284992 | 1409  | 12.2 | 2859393 | 2277   | 12.1 | 5144385 |

*weighted by number of eligible persons in the household and imputed from 1999 INSEE National Census Data (1999 NCD).
Table 3 HRQoL norms* in French general population from 12 to 75 years old (n = 17,733)

|                  | Men     | Women    | Total   |
|------------------|---------|----------|---------|
|                  | 12-17   | 18-24    | 25-34   | 35-44   | 45-54   | 55-64   | 65-75   | Total   |
| **Physical health** |         |          |         |         |         |         |         |         |
| n                | 670     | 637      | 1396    | 1403    | 1316    | 1121    | 863     | 7406    |
| Mean             | 80.7    | 79.3     | 79.0    | 77.6    | 74.0     | 75.9    | 71.1    | 76.8    |
| Standard deviation | 19.1   | 20.1     | 17.6    | 18.1    | 22.2     | 18.2    | 23.1    | 19.9    |
| Error standard of the mean | 0.6    | 0.4      | 0.5     | 0.6     | 0.6      | 0.7     | 0.2     | 0.7     |
| Percentile 25th  | 70.0    | 70.0     | 70.0    | 60.0    | 70.0     | 60.0    | 70.0    | 60.0    |
| Median           | 80.0    | 80.0     | 80.0    | 80.0    | 80.0     | 70.0    | 80.0    | 70.0    |
| Percentile 75th  | 90.0    | 90.0     | 90.0    | 90.0    | 90.0     | 90.0    | 90.0    | 90.0    |
| Minimum          | 20.0    | 0.0      | 0.0     | 0.0     | 0.0      | 0.0     | 0.0     | 0.0     |
| Maximum          | 100.0   | 100.0    | 100.0   | 100.0   | 100.0    | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.0     | 0.3      | 0.1     | 0.2     | 0.8      | 0.3     | 1.0     | 0.4     |
| Ceiling effect (%) | 18.0  | 15.6     | 17.1    | 14.4    | 17.1     | 14.4    | 17.1    | 14.4    |
| **Mental health** |         |          |         |         |         |         |         |         |
| n                | 668     | 637      | 1398    | 1401    | 1311    | 1123    | 856     | 7394    |
| Mean             | 74.3    | 75.2     | 80.0    | 79.5    | 78.2     | 81.5    | 81.0    | 78.6    |
| Standard deviation | 22.7   | 24.6     | 18.4    | 18.3    | 19.6     | 16.6    | 18.6    | 19.6    |
| Error standard of the mean | 0.7    | 0.5      | 0.5     | 0.5     | 0.5      | 0.6     | 0.2     | 0.7     |
| Percentile 25th  | 60.0    | 60.0     | 70.0    | 70.0    | 70.0     | 50.0    | 50.0    | 60.0    |
| Median           | 80.0    | 80.0     | 80.0    | 80.0    | 80.0     | 70.0    | 80.0    | 70.0    |
| Percentile 75th  | 90.0    | 90.0     | 90.0    | 90.0    | 90.0     | 90.0    | 90.0    | 90.0    |
| Minimum          | 0.0     | 0.0      | 0.0     | 0.0     | 0.0      | 0.0     | 0.0     | 0.0     |
| Maximum          | 100.0   | 100.0    | 100.0   | 100.0   | 100.0    | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.1     | 0.1      | 0.2     | 0.0     | -0.0     | 0.1     | 0.0     | 0.1     |
| Ceiling effect (%) | 12.2  | 15.4     | 21.6    | 20.5    | 19.7     | 27.4    | 25.2    | 20.3    |
| **Social health** |         |          |         |         |         |         |         |         |
| n                | 669     | 634      | 1388    | 1387    | 1296    | 1118    | 841     | 7333    |
| Mean             | 70.3    | 68.1     | 68.7    | 66.4    | 65.7     | 64.9    | 64.4    | 66.9    |
| Standard deviation | 20.2   | 22.8     | 18.2    | 18.1    | 18.9     | 16.7    | 19.2    | 18.9    |
| Error standard of the mean | 0.6    | 0.7      | 0.5     | 0.5     | 0.5      | 0.6     | 0.2     | 0.6     |
| Percentile 25th  | 60.0    | 60.0     | 60.0    | 50.0    | 50.0     | 50.0    | 50.0    | 50.0    |
| Median           | 70.0    | 70.0     | 70.0    | 70.0    | 70.0     | 70.0    | 70.0    | 70.0    |
| Percentile 75th  | 80.0    | 80.0     | 80.0    | 80.0    | 80.0     | 80.0    | 80.0    | 80.0    |
| Minimum          | 20.0    | 0.0      | 0.0     | 0.0     | 0.0      | 0.0     | 0.0     | 0.0     |
| Maximum          | 100.0   | 100.0    | 100.0   | 100.0   | 100.0    | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.0     | 0.0      | 0.2     | 0.0     | 0.2      | 0.1     | 0.1     | 0.2     |
| Ceiling effect (%) | 6.0   | 5.1      | 4.7     | 3.5     | 3.8      | 3.5     | 4.0     | 4.3     |
| **General health** |         |          |         |         |         |         |         |         |
| n                | 667     | 633      | 1384    | 1383    | 1285    | 1113    | 824     | 7289    |
| Mean             | 75.1    | 74.2     | 75.9    | 74.5    | 72.7     | 74.0    | 72.1    | 74.1    |
| Standard deviation | 14.4   | 16.4     | 13.3    | 13.7    | 14.7     | 12.5    | 14.8    | 14.1    |
| Error standard of the mean | 0.5    | 0.5      | 0.3     | 0.4     | 0.4      | 0.4     | 0.5     | 0.2     |

*HRQoL: Health-Related Quality of Life

Baumann et al. BMC Public Health 2011, 11:401
http://www.biomedcentral.com/1471-2458/11/401

Page 6 of 16
Table 3 HRQoL norms* in French general population from 12 to 75 years old (n = 17,733) (Continued)

| Percentile 25 th | 70.0 | 66.7 | 70.0 | 66.7 | 66.3 | 66.7 | 60.0 | 60.0 | 60.0 | 60.0 | 56.7 | 56.7 | 56.7 | 56.7 | 60.0 | 63.3 |
| Median | 76.7 | 76.7 | 76.7 | 76.7 | 73.3 | 76.7 | 70.0 | 70.0 | 73.3 | 70.0 | 66.7 | 70.0 | 70.0 | 73.3 |
| Percentile 75th | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 83.3 | 80.0 | 80.0 | 80.0 | 80.0 | 76.7 | 80.0 | 80.0 | 80.0 |
| Minimum | 26.7 | 23.3 | 20.0 | 16.7 | 13.3 | 16.7 | 26.7 | 13.3 | 20.0 | 20.0 | 16.7 | 10.0 | 6.7 | 0.0 |
| Maximum | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Floor effect (%) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| Ceiling effect (%) | 0.7 | 0.5 | 0.7 | 0.6 | 0.4 | 0.8 | 0.5 | 0.6 | 0.0 | 0.4 | 0.5 | 0.2 | 0.4 | 0.5 |

Perceived health

| n= | 669 | 638 | 1399 | 1403 | 1317 | 1121 | 864 | 7411 | 735 | 810 | 1925 | 1919 | 1770 | 1728 | 1403 | 10290 | 17671 |
| Mean | 71.4 | 75.4 | 78.6 | 76.0 | 69.9 | 67.1 | 64.5 | 72.4 | 69.4 | 72.1 | 74.8 | 73.2 | 69.6 | 67.0 | 61.5 | 70.2 | 71.3 |
| Standard deviation | 43.5 | 44.5 | 33.5 | 34.0 | 37.0 | 31.5 | 37.5 | 36.8 | 39.3 | 38.9 | 32.4 | 32.4 | 31.3 | 27.1 | 29.5 | 32.3 | 34.3 |
| Error standard of the mean | 1.4 | 1.4 | 0.9 | 0.9 | 0.9 | 1.0 | 1.2 | 0.4 | 1.3 | 1.3 | 0.8 | 0.8 | 0.8 | 0.9 | 0.3 | 0.3 |
| Floor effect (%) | 5.6 | 4.3 | 8.0 | 8.0 | 7.5 | 12.7 | 10.5 | 8.0 | 4.4 | 1.5 | 4.0 | 4.1 | 5.2 | 7.8 | 7.4 | 4.9 | 6.4 |
| Ceiling effect (%) | 55.9 | 62.8 | 65.3 | 60.7 | 50.9 | 45.8 | 42.3 | 55.6 | 53.2 | 58.1 | 60.9 | 56.7 | 49.4 | 46.3 | 36.5 | 53.2 | 53.9 |

Self-esteem

| n= | 669 | 1389 | 1387 | 1295 | 1120 | 838 | 7333 | 728 | 807 | 1924 | 1897 | 1754 | 1697 | 1372 | 10179 | 17512 |
| Mean | 77.1 | 76.2 | 80.2 | 79.4 | 79.3 | 78.7 | 79.3 | 78.8 | 68.2 | 70.6 | 75.7 | 75.2 | 74.8 | 75.6 | 77.2 | 74.4 |
| Standard deviation | 206 | 23.7 | 17.7 | 17.8 | 18.0 | 15.8 | 17.7 | 18.4 | 20.0 | 19.7 | 16.4 | 17.4 | 17.6 | 14.6 | 16.2 | 17.2 |
| Error standard of the mean | 0.7 | 0.7 | 0.5 | 0.5 | 0.5 | 0.6 | 0.2 | 0.7 | 0.6 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.2 | 0.1 |
| Floor effect (%) | 1.4 | 1.4 | 0.9 | 0.9 | 0.9 | 1.0 | 1.2 | 0.4 | 1.3 | 1.3 | 0.8 | 0.8 | 0.8 | 0.9 | 0.3 | 0.3 |
| Ceiling effect (%) | 201.1 | 198.4 | 198.3 | 198.1 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 | 198.0 |

Anxiety

| n= | 669 | 1394 | 1395 | 1300 | 1116 | 845 | 7355 | 731 | 808 | 1924 | 1898 | 1756 | 1703 | 1381 | 10201 | 17556 |
| Mean | 29.2 | 32.1 | 28.3 | 28.3 | 28.5 | 24.4 | 24.5 | 28.0 | 35.9 | 37.4 | 34.1 | 33.5 | 34.1 | 31.6 | 30.0 | 33.7 | 30.9 |
| Standard deviation | 225 | 23.1 | 18.9 | 18.8 | 19.6 | 16.2 | 17.5 | 19.4 | 21.0 | 20.0 | 16.9 | 18.2 | 17.7 | 15.3 | 16.5 | 17.7 | 18.6 |
| Error standard of the mean | 0.7 | 0.7 | 0.5 | 0.5 | 0.5 | 0.6 | 0.2 | 0.7 | 0.7 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.2 | 0.1 |
| Floor effect (%) | 1.4 | 1.4 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 |
| Ceiling effect (%) | 152.6 | 150.6 | 206.2 | 200.0 | 194.2 | 192.0 | 205.1 | 189.5 | 5.6 | 7.0 | 13.6 | 14.3 | 14.2 | 15.7 | 18.2 | 13.2 | 16.0 |

Depression

| n= | 670 | 1398 | 1403 | 1313 | 1121 | 856 | 7398 | 736 | 810 | 1926 | 1915 | 1767 | 1721 | 1398 | 10273 | 17671 |
| Mean | 28.6 | 29.1 | 22.2 | 22.0 | 23.1 | 19.5 | 21.4 | 23.5 | 36.3 | 34.3 | 30.6 | 30.6 | 31.7 | 30.2 | 29.5 | 31.5 | 27.6 |
criteria and perhaps according to the availability of normative data.

Methodological considerations
We found relatively low internal consistency and a strong floor effect with the DUKE. Similar limitations were reported in young people [39] and in dementia [16], and in the French validity study of a cohort of 963 people from the general population, in which the Cronbach α varied from 0.63 to 0.81 [12]. However, this limitation should be moderately weighed because the use of the Cronbach α to assess the psychometric qualities of a HRQoL questionnaire might be inappropriate when the construct validity generates dimensions with few items. The Cronbach α is sensitive to the number of items in the dimension; with increasing number of items, the Cronbach α is likely to increase. In addition, the lower the mean inter-item correlation, the lower the Cronbach α.

We also showed some moderate and high floor effects in dysfunction measures (anxiety, depression, pain and disability) of the DUKE, which indicates poor discrimination properties. This finding was not surprising in a sample from a general population, which is, on average, in good health. These dimension scores are probably sensitive to the impact of disease, as we observed in other studies in patient samples [21,40].

| Table 3 HRQoL norms* in French general population from 12 to 75 years old (n = 17,733) (Continued) |
|-----------------------------------------------|
| **Standard deviation** | 24.2 | 24.6 | 19.1 | 18.3 | 20.3 | 16.8 | 19.5 | 20.2 | 23.6 | 22.3 | 19.4 | 20.2 | 20.0 | 17.1 | 18.9 | 19.9 | 20.4 |
| **Error standard of the** | 0.8 | 0.8 | 0.5 | 0.5 | 0.5 | 0.6 | 0.2 | 0.8 | 0.7 | 0.5 | 0.5 | 0.5 | 0.6 | 0.2 | 0.2 | 0.2 |
| **Percentile 25th** | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 200 | 200 | 100 | 100 | 100 | 100 | 100 |
| **Median** | 300 | 300 | 200 | 200 | 200 | 200 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| **Percentile 75th** | 400 | 400 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| **Minimum** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Maximum** | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| **Floor effect (%)** | 9.3 | 8.7 | 15.9 | 15.8 | 17.4 | 23.8 | 18.6 | 15.7 | 7.3 | 8.5 | 9.2 | 9.1 | 11.9 | 12.1 | 9.1 | 12.4 |
| **Ceiling effect (%)** | 0.3 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 | 0.6 | 0.3 | 0.5 | 0.1 | 0.7 | 0.3 | 0.7 | 0.4 |

| Pain |
|---|
| **n=** | 670 | 638 | 1398 | 1404 | 1320 | 1124 | 867 | 742 | 736 | 810 | 1927 | 1919 | 1775 | 1729 | 1406 | 1030 |
| **Mean** | 22.6 | 25.7 | 26.3 | 29.3 | 35.3 | 33.2 | 39.0 | 30.2 | 29.4 | 32.4 | 33.8 | 36.2 | 41.8 | 45.3 | 47.9 | 38.2 |
| **Standard deviation** | 37.4 | 41.5 | 33.2 | 33.3 | 37.3 | 30.5 | 36.9 | 35.6 | 34.0 | 37.2 | 32.8 | 33.4 | 33.8 | 33.8 | 28.9 | 32.3 |
| **Error standard of the mean** | 1.2 | 1.3 | 0.8 | 0.9 | 1.0 | 1.1 | 1.4 | 1.2 | 1.2 | 1.1 | 1.2 | 1.2 | 1.0 | 1.0 | 1.0 | 0.4 |
| **Percentile 25th** | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| **Floor effect (%)** | 61.1 | 57.4 | 54.5 | 47.9 | 42.5 | 43.9 | 36.3 | 49.2 | 48.9 | 48.4 | 45.9 | 42.0 | 35.4 | 31.9 | 28.8 | 40.1 |
| **Ceiling effect (%)** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| Disability |
|---|
| **n=** | 670 | 638 | 1399 | 1403 | 1319 | 1125 | 867 | 742 | 737 | 810 | 1926 | 1919 | 1775 | 1730 | 1407 | 1030 |
| **Mean** | 2.7 | 2.3 | 2.4 | 3.3 | 2.7 | 2.2 | 3.9 | 2.8 | 2.7 | 3.2 | 4.6 | 3.6 | 3.5 | 3.1 | 2.7 | 3.5 |
| **Standard deviation** | 15.6 | 15.9 | 13.8 | 16.4 | 15.8 | 12.2 | 19.5 | 15.6 | 14.2 | 14.4 | 17.0 | 16.0 | 15.8 | 12.3 | 12.5 | 14.9 |
| **Error standard of the mean** | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.2 | 0.1 |
| **Percentile 25th** | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| **Floor effect (%)** | 95.4 | 96.3 | 96.5 | 95.1 | 96.3 | 96.9 | 95.1 | 96.0 | 95.5 | 94.2 | 93.3 | 94.9 | 95.3 | 95.7 | 96.2 | 94.9 |
| **Ceiling effect (%)** | 0.7 | 0.9 | 1.2 | 1.8 | 1.7 | 1.3 | 2.8 | 1.5 | 0.9 | 0.6 | 2.4 | 2.2 | 2.4 | 1.9 | 1.5 | 1.9 |

*Weighted by number of eligible persons in the household and imputed from 1999 INSEE National Census data.

Baumann et al. BMC Public Health 2011, 11:401
http://www.biomedcentral.com/1471-2458/11/401
Page 8 of 16
Table 4 HRQoL norms* in French general population from 12 to 75 years old with self-reported chronic disease (n = 4,153)

| Physical health | Men | Women | Total |
|-----------------|-----|-------|-------|
| n=              |     |       |       |
| Mean            | 62  | 44    | 106   |
| Standard deviation | 74.2 | 72.1 | 73.2 |
| Percentile 25th | 60.0 | 60.0 | 60.0 |
| Median          | 80.0 | 70.0 | 75.0 |
| Percentile 75th | 90.0 | 80.0 | 85.0 |
| Minimum         | 20.0 | 30.0 | 25.0 |
| Maximum         | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0  | 0.5  | 0.3  |
| Ceiling effect (%)| 16.2 | 11.7 | 14.3 |

| Mental health   | Men | Women | Total |
|-----------------|-----|-------|-------|
| n=              |     |       |       |
| Mean            | 62  | 44    | 106   |
| Standard deviation | 67.9 | 72.3 | 70.1 |
| Percentile 25th | 50.0 | 50.0 | 50.0 |
| Median          | 70.0 | 70.0 | 70.0 |
| Percentile 75th | 90.0 | 90.0 | 90.0 |
| Minimum         | 20.0 | 30.0 | 25.0 |
| Maximum         | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0  | 0.5  | 0.3  |
| Ceiling effect (%)| 9.1  | 13.1 | 11.5 |

| Social health   | Men | Women | Total |
|-----------------|-----|-------|-------|
| n=              |     |       |       |
| Mean            | 62  | 44    | 106   |
| Standard deviation | 67.9 | 69.6 | 68.7 |
| Percentile 25th | 60.0 | 60.0 | 60.0 |
| Median          | 70.0 | 70.0 | 70.0 |
| Percentile 75th | 80.0 | 80.0 | 80.0 |
| Minimum         | 20.0 | 30.0 | 25.0 |
| Maximum         | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0  | 0.5  | 0.3  |
| Ceiling effect (%)| 8.9  | 11.7 | 10.3 |

| General health  | Men | Women | Total |
|-----------------|-----|-------|-------|
| n=              |     |       |       |
| Mean            | 62  | 44    | 106   |
| Standard deviation | 70.0 | 71.9 | 71.4 |
| Percentile 25th | 60.0 | 60.0 | 60.0 |
| Median          | 70.0 | 70.0 | 70.0 |
| Percentile 75th | 80.0 | 80.0 | 80.0 |
| Minimum         | 20.0 | 30.0 | 25.0 |
| Maximum         | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0  | 0.5  | 0.3  |
| Ceiling effect (%)| 8.9  | 11.7 | 10.3 |
Table 4 HRQoL norms in French general population from 12 to 75 years old with self-reported chronic disease (n = 4,153) (Continued)

|            | Percentile 25th | Median | Percentile 75th | Minimum | Maximum | Floor effect (%) | Ceiling effect (%) |
|------------|----------------|--------|-----------------|---------|---------|-----------------|-------------------|
| Perceived health |               |        |                 |         |         |                 |                   |
| n          | 62             | 45     | 227             | 330     | 403     | 1614            | 55                |
| Mean       | 70.8           | 80.5   | 66.6            | 59.9    | 53.9    | 51.5            | 52.0              |
| Standard deviation | 40.1    | 34.4   | 39.9            | 38.7    | 37.2    | 36.5            | 37.2              |
| Error standard of the mean | 4.3      | 4.0    | 2.5             | 2.5     | 1.8     | 1.7             | 0.9               |
| Percentile 25th | 50.0          | 50.0   | 50.0            | 50.0    | 50.0    | 50.0            | 50.0              |
| Median      | 1000           | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Percentile 75th | 1000          | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Minimum     | 0               | 0      | 0               | 0       | 0       | 0               | 0                 |
| Maximum     | 1000           | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Floor effect (%) | 10.1           | 2.0    | 11.0            | 20.5    | 22.7    | 22.8            | 20.2              |
| Ceiling effect (%) | 51.6           | 63.0   | 44.2            | 30.4    | 25.8    | 24.3            | 33.1              |

Self-esteem

|            | Percentile 25th | Median | Percentile 75th | Minimum | Maximum | Floor effect (%) | Ceiling effect (%) |
|------------|----------------|--------|-----------------|---------|---------|-----------------|-------------------|
| n          | 62             | 45     | 176             | 217     | 327     | 375             | 391               |
| Mean       | 71.7           | 77.5   | 77.8            | 74.5    | 77.4    | 76.2            | 77.5              |
| Standard deviation | 20.7    | 21.4   | 18.5            | 19.1    | 19.5    | 16.8            | 17.9              |
| Error standard of the mean | 2.2      | 2.5    | 1.4             | 1.2     | 1.0     | 0.9             | 0.8               |
| Percentile 25th | 50.0          | 50.0   | 50.0            | 50.0    | 50.0    | 50.0            | 50.0              |
| Median      | 1000           | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Percentile 75th | 1000          | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Minimum     | 0               | 0      | 0               | 0       | 0       | 0               | 0                 |
| Maximum     | 1000           | 1000   | 1000            | 1000    | 1000    | 1000            | 1000              |
| Floor effect (%) | 0.0            | 0.0    | 0.2             | 0.0     | 0.1     | 0.0             | 0.0               |
| Ceiling effect (%) | 6.4            | 12.4   | 17.2            | 14.2    | 17.8    | 14.7            | 15.0              |

Anxiety

|            | Percentile 25th | Median | Percentile 75th | Minimum | Maximum | Floor effect (%) | Ceiling effect (%) |
|------------|----------------|--------|-----------------|---------|---------|-----------------|-------------------|
| n          | 62             | 44     | 177             | 220     | 328     | 375             | 395               |
| Mean       | 36.2           | 35.7   | 34.5            | 34.2    | 28.2    | 26.5            | 30.9              |
| Standard deviation | 25.3    | 22.7   | 19.9            | 20.5    | 20.2    | 17.3            | 17.1              |
| Error standard of the mean | 2.7      | 2.6    | 1.5             | 1.3     | 1.0     | 1.0             | 0.8               |
| Percentile 25th | 250           | 250    | 250             | 250     | 250     | 250             | 250               |
| Median      | 33.3           | 41.7   | 33.3            | 33.3    | 25.0    | 25.0            | 25.0              |
| Percentile 75th | 500           | 41.7   | 500             | 41.7    | 50.0    | 50.0            | 50.0              |
| Minimum     | 0               | 8.3    | 0               | 0       | 0       | 0               | 0                 |
| Maximum     | 83.3           | 75.0   | 1000            | 91.7    | 91.7    | 83.3            | 1000              |
| Floor effect (%) | 3.3            | 0.0    | 3.1             | 3.9     | 5.6     | 7.1             | 6.7               |
| Ceiling effect (%) | 0.0            | 0.0    | 0.8             | 0.0     | 0.0     | 0.0             | 0.0               |
The response rate of the 2005 Health Barometer telephone survey was about 64% (30,514 participants out of almost 48,000 contacted), which is lower than the response rate of mail surveys. To be representative of French population, data collected from 2005 Health Barometer have been weighted by number of eligible persons in the household (and by the number of landline phones in the household) and imputed from 1999 INSEE National Census data on gender, age, geographic area and size of agglomeration. In this way, the sample used for this study was representative of these criteria of the French population aged 12 to 75 years old, who speak French and have a landline phone. Characteristics of subjects selected (n = 17,733) and not selected (n = 8,889) for the HRQoL group were similar, but despite these precautions and checks, we cannot totally exclude the existence of selection bias.

The rate of depression, pain and disability in the French general population aged 12 to 75 years old with self-reported chronic disease is reported in Table 4. The Table shows the weighted mean, standard deviation, error standard of the mean, and percentiles for depression, pain, and disability. The data are representative of the French population aged 12 to 75 years old, who speak French and have a landline phone. Characteristics of subjects selected (n = 17,733) and not selected (n = 8,889) for the HRQoL group were similar, but despite these precautions and checks, we cannot totally exclude the existence of selection bias.
Table 5 HRQoL norms* in French general population from 12 to 75 years old with no self-reported chronic disease (n = 13559)

|                  | 12-17   | 18-24   | 25-34   | 35-44   | 45-54   | 55-64   | 65-75   | Total   |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|
| **Physical health** |         |         |         |         |         |         |         |         |
| n                | 608     | 593     | 1217    | 985     | 745     | 460     | 5788    | 13509   |
| Mean             | 81.3    | 79.8    | 80.4    | 79.1    | 76.3    | 79.7    | 75.8    | 79.1    |
| Standard deviation | 18.4    | 19.8    | 16.5    | 17.2    | 20.5    | 16.3    | 21.3    | 18.4    |
| Error standard of the mean | 0.6     | 0.6     | 0.4     | 0.5     | 0.6     | 0.9     | 0.2     | 0.7     |
| Percentile 25 th  | 70.0    | 70.0    | 70.0    | 70.0    | 60.0    | 60.0    | 60.0    | 60.0    |
| Median           | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    |
| Percentile 75 th  | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    |
| Minimum          | 200.0   | 100.0   | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| Maximum          | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.0     | 0.3     | 0.0     | 0.1     | 0.6     | 0.2     | 0.4     | 0.2     |
| Ceiling effect (%) | 18.1   | 16.2    | 18.2    | 16.5    | 14.7    | 21.0    | 15.1    | 19.0    |

|                  | 12-17   | 18-24   | 25-34   | 35-44   | 45-54   | 55-64   | 65-75   | Total   |
| **Mental health** |         |         |         |         |         |         |         |         |
| n                | 606     | 593     | 1218    | 1179    | 981     | 745     | 454     | 5776    |
| Mean             | 74.9    | 75.3    | 80.8    | 80.6    | 81.3    | 82.6    | 79.3    | 660     |
| Standard deviation | 22.1    | 24.7    | 17.8    | 17.9    | 18.1    | 17.9    | 18.4    | 23.4    |
| Error standard of the mean | 0.7     | 0.8     | 0.5     | 0.5     | 0.6     | 0.8     | 0.2     | 0.8     |
| Percentile 25 th  | 60.0    | 60.0    | 70.0    | 70.0    | 50.0    | 50.0    | 60.0    | 60.0    |
| Median           | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    |
| Percentile 75 th  | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    | 90.0    |
| Minimum          | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   |
| Maximum          | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.1     | 0.1     | 0.0     | 0.0     | 0.0     | 0.0     | 0.5     | 0.2     |
| Ceiling effect (%) | 12.5   | 15.9    | 22.8    | 22.1    | 0.0     | 0.0     | 0.0     | 0.0     |

|                  | 12-17   | 18-24   | 25-34   | 35-44   | 45-54   | 55-64   | 65-75   | Total   |
| **Social health** |         |         |         |         |         |         |         |         |
| n                | 607     | 589     | 1210    | 1169    | 967     | 742     | 448     | 5732    |
| Mean             | 70.5    | 68.0    | 68.7    | 66.6    | 66.1    | 65.2    | 65.5    | 67.4    |
| Standard deviation | 20.0    | 22.7    | 18.1    | 17.8    | 18.7    | 16.6    | 18.5    | 18.8    |
| Error standard of the mean | 0.7     | 0.7     | 0.5     | 0.5     | 0.5     | 0.7     | 0.8     | 0.2     |
| Percentile 25 th  | 60.0    | 60.0    | 60.0    | 60.0    | 50.0    | 50.0    | 60.0    | 60.0    |
| Median           | 70.0    | 70.0    | 70.0    | 70.0    | 70.0    | 70.0    | 70.0    | 70.0    |
| Percentile 75 th  | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    | 80.0    |
| Minimum          | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   | 200.0   |
| Maximum          | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   | 100.0   |
| Floor effect (%) | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     |
| Ceiling effect (%) | 5.7     | 4.5     | 4.5     | 3.1     | 3.5     | 4.2     | 3.7     | 4.1     |

|                  | 12-17   | 18-24   | 25-34   | 35-44   | 45-54   | 55-64   | 65-75   | Total   |
| **General health** |         |         |         |         |         |         |         |         |
| n                | 605     | 589     | 1207    | 1166    | 960     | 738     | 438     | 5703    |
| Mean             | 75.6    | 74.4    | 76.6    | 75.4    | 74.0    | 76.0    | 74.6    | 75.3    |
| Standard deviation | 13.8    | 16.6    | 12.9    | 13.2    | 13.9    | 11.8    | 14.5    | 13.7    |
| Error standard of the mean | 0.5     | 0.5     | 0.3     | 0.4     | 0.4     | 0.5     | 0.6     | 0.2     |
Table 5 HRQoL norms* in French general population from 12 to 75 years old with no self-reported chronic disease (n = 13559) (Continued)

| Percentile 25th | 70.0 | 66.7 | 70.0 | 66.7 | 66.7 | 66.7 | 66.7 | 60.0 | 60.0 | 63.3 | 63.3 | 60.0 | 60.0 | 63.3 | 60.0 | 63.3 |
| Percentile 75th | 83.3 | 83.3 | 86.7 | 86.7 | 83.3 | 83.3 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 80.0 | 83.3 |
| Minimum         | 26.7 | 23.3 | 26.7 | 16.7 | 30.0 | 13.3 | 20.0 | 20.0 | 23.3 | 20.0 | 16.7 | 0.0  | 100.0 | 0.0  | 0.0  | 0.0  |
| Maximum         | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| Ceiling effect (%)| 0.7   | 0.5   | 0.8   | 0.6   | 0.5   | 1.1   | 0.9   | 0.7   | 0.0   | 0.5   | 0.6   | 0.3   | 0.5   | 0.8   | 0.6   | 0.4   | 0.6   |

**Perceived health**

| Percentile 25th | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 | 50.0 |
| Percentile 75th | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Minimum         | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| Maximum         | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 13.4  | 12.7  | 7.7   | 6.5   | 7.3   | 6.5   | 7.3   | 6.5   | 7.3   | 6.5   | 7.3   | 6.5   | 7.3   | 6.5   | 7.3   | 6.5   |
| Ceiling effect (%)| 56.3  | 62.8  | 68.2  | 64.6  | 65.7  | 56.2  | 58.2  | 61.4  | 53.6  | 60.1  | 63.9  | 61.6  | 56.5  | 57.1  | 48.5  | 58.5  | 60.0  |

**Self-esteem**

| Percentile 25th | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 60.0 | 60.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 | 70.0 |
| Percentile 75th | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Minimum         | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| Maximum         | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 0.0   | 0.0   | 0.1   | 0.1   | 0.0   | 0.0   | 0.0   | 0.2   | 0.2   | 0.1   | 0.1   | 0.1   | 0.1   | 0.0   | 0.1   | 0.0   |
| Ceiling effect (%)| 16.1  | 16.3  | 21.1  | 21.1  | 19.8  | 21.6  | 25.4  | 19.9  | 5.8   | 6.5   | 14.1  | 15.9  | 15.6  | 18.4  | 22.3  | 14.0  | 17.0  |

**Anxiety**

| Percentile 25th | 16.7 | 16.7 | 16.7 | 16.7 | 8.3   | 8.3   | 16.7  | 25.0  | 25.0  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7  | 16.7 |
| Percentile 75th | 41.7 | 41.7 | 41.7 | 41.7 | 33.3  | 33.3  | 41.7  | 50.0  | 50.0  | 41.7  | 41.7  | 41.7  | 41.7  | 41.7  | 41.7  | 41.7 |
| Minimum         | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |
| Maximum         | 83.3 | 91.7 | 91.7 | 91.7 | 83.3  | 75.0  | 91.7  | 91.7  | 83.3  | 91.7  | 91.7  | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Floor effect (%)| 5.8   | 4.6   | 8.7   | 8.8   | 8.1   | 15.7  | 13.9  | 8.7   | 4.4   | 18.4 | 4.4   | 18.4 | 4.4   | 18.4 | 4.4   | 18.4 |
| Ceiling effect (%)| 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   | 0.0   |

Baumann et al. BMC Public Health 2011, 11:401
http://www.biomedcentral.com/1471-2458/11/401
Finally, the “next-birthday” method used in this national survey [30] to select the person to answer the questions can generate a low “self-selection” phenomenon. However, the results of the selection obtained with this method were very close to those expected. We could have used the Kish method, but it requires, before the selection, describing exactly the whole family, more time and more risk of generating refusals than does the next-birthday method.

### Conclusions

We present HRQoL norms for all dimensions of the DUKE for adolescents and adults in France. These norms could be used as a reference for other studies assessing HRQoL, for specific illnesses, and for international comparisons.

### List of abbreviations

- HRQoL: Health-related quality of life
- DUKE: DUKE health profile questionnaire
- INPES: Institut National de Prévention et d’Éducation pour la Santé (French National Institute for Prevention and Health Education)
- * Weighted by number of eligible persons in the household and imputed from 1999 INSEE National Census data.
Acknowledgements

We thank Stéphanie Boini (CHU Nancy) for contributions to the conception of the study. This study was financially supported by the National Institute for Prevention and Health Education, Paris, France, for the collection and the analysis of the data.

Author details

1. Nancy-Université, Université Paul Verlaine Metz, Université Paris Descartes, EA 4360 Apermac, Nancy, France. 2. CHU Nancy, Hôpitaux de Brabois, Épidémiologie et Évaluation Cliniques, Vandœuvre-lès-Nancy, France. 3. CHU Nancy, Hôpitaux de Brabois, service de gériatride, Vandœuvre-lès-Nancy, France. 4. INSERM, département Observation et Analyse des Comportements de Santé, Paris, France.

Authors’ contributions

All authors read and approved the final manuscript. Each author has made substantive intellectual contributions to this multicentre study. CB: statistical analysis, writing manuscript; MLE: statistical analysis, manuscript revision; CPG: manuscript revision; AG: conception of study, manuscript revision; JFC: conception of study, manuscript revision and JS: conception of study manuscript revision and study supervision.

Competing interests

All the authors declare that they have no competing interests.

Received: 30 July 2010 Accepted: 27 May 2011 Published: 27 May 2011

References

1. The WHOQOL Group. Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). Qual Life Res 1993, 2:153-159.
2. Apolone G, Mosconi P. Review of the concept of quality of life assessment and discussion of the present trend in clinical research. Nephrol Dial Transplant 1998, 13(Suppl 1):65-69.
3. Mozes B, Maor Y, Shmueli A. Do we know what global ratings of health-related quality of life measure? Qual Life Res 1999, 8:269-273.
4. Guillen F, Bombardier C, Reato D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Epidemiol 1993, 46:1417-1432.
5. Cooper JK, Kohnmann T, Michael JA, Hafer SC, Stevic M. Health outcomes. New quality measure for Medicare. Int J Qual Health Care 2001, 13:9-16.
6. Gold WR, Muenning P. Measure-dependent variation in burden of disease estimates: implications for policy. Medical care 2002, 40:260-266.
7. Jenkinson C, Coulter A, Wright L. Short form 36 (SF36) health survey questionnaire: normative data for adults of working age. BMJ 1993, 306:1437-1440.
8. The WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. The WHOQOL Group. Psychol Med 1998, 28:551-558.
9. Chwalow AJ, Lune A, Bean K, Parent dCl, Venot A, Dusser D, Douot Y, Strauch G. A French version of the Sickness Impact Profile (SIP): stages in the cross-cultural validation of a generic quality of life scale. Fundam Clin Pharmacol 1992, 6:319-326.
10. Burquet D, Condon S, Ritchie K. The French version of the Nottingham Health Profile. A comparison of items weights with those of the source version. Soc Sci Med 1990, 30:829-835.
11. Gandeck B, Ware JE Jr, Aaronson NK, Alonso J, Apolone G, Bijster J, Brazier J, Bullinger M, Fukuhara S, Kaasa S, Leplege A, Sullivan M. Tests of data quality, scaling assumptions, and reliability of the SF-36 in eleven countries: results from the IQOLA Project. International Quality of Life Assessment. J Clin Epidemiol 1998, 51:1149-1158.
12. Guillen F, Paul-Dauphin A, Virion JM, Bouchet C, Briancion S. [The DUKE health profile: a generic instrument to measure the quality of life tied to health]. Santé Publique 1997, 9:5-44.
13. Parkerson GR Jr, Gehlbach SH, Wagner EH, James SA, Clapp NE, Muhlbaier LH. The Duke-UNC Health Profile: an adult health status instrument for primary care. Medical care 1981, 19:806-828.
14. Parkerson GR Jr, Broadhead WE, Tse CK. The Duke Health Profile. A 17-item measure of health and dysfunction. Medical care 1990, 28:1056-1072.
15. Baromètre santé 2005 : attitudes et comportements de santé Paris: INPES, 2005.
16. Novella J, Ankri J, Morrone I, Guillen F, Jolly D, Jochum C, Potlon L, Blanchard F. Evaluation of the quality of life in dementia with a generic quality of life measure: the Duke Health Profile. Dement Geriat Cogn Disord 2001, 12:158-166.
17. Novella JL, Jochum C, Jolly D, Morrone I, Ankri J, Bureau F, Blanchard F. Agreement between patients’ and proxies’ reports of quality of life in Alzheimer’s disease. Qual Life Res 2001, 10:443-452.
18. Ferret-Guillaume C, Briancion S, Guillen F, Wahl D, Empereur F, Nguyen Thi PL. Which generic health related Quality of Life questionnaire should be used in older inpatients: comparison of the Duke Health Profile and the MOS Short-Form SF-36? J Nutr Health Aging 2010, 14:325-331.
19. Osborne RH, Hawthorne G, Lew EA, Gray LC. Quality of life assessment in the community-dwelling elderly: validation of the Assessment of Quality of Life (AQoL) Instrument and comparison with the SF-36. J Clin Epidemiol 2003, 56:138-147.
20. Chen AL, Broadhead WE, Doe EA, Broyles WK. Patient acceptance of two health status measures: the Medical Outcomes Study Short-form General Health Survey and the Duke Health Profile. Fam Med 1993, 25:536-539.
21. Khlat M, Chau N, Chau N, Guillen F, Ravaud JF, Sanchez J, Guillaume S, Michaely JP, Sierra CO, Legras B, Dazoz A, Choquet M, Mejean L, Tubiana-Ruji N, Meyer JP, Schleret Y, Mur JM. Social disparities in musculoskeletal disorders and associated mental malaise: findings from a population-based survey in France. Scand J Public Health 2010, 38:495-501.
22. Broadhead WE, Gehlbach SH, de Gruy FV, Kaplan BH. The Duke-UNC Functional Social Support Questionnaire. Measurement of social support in family medicine patients. Medical care 1998, 26:709-723.
23. Parkerson GR Jr, Broadhead WE, Tse CK. Health status and severity of illness as predictors of outcomes in primary care. Medical care 1995, 33:53-66.
24. Parkerson GR Jr, Broadhead WE, Tse CK. Perceived family stress as a predictor of health-related outcomes. Arch Fam Med 1995, 4:253-260.
25. Alla F, Briancion S, Guillen F, Balliere Y, Mertes PM, Villemot JP, Zannad F. Self-rating of quality of life provides additional prognostic information in heart failure. Insights into the EPICAL study. Eur J Heart Fail 2002, 4:337-343.
26. Bouchet C, Guillen F, Paul-Dauphin A, Briancion S. Selection of quality-of-life measures for a prevention trial: a psychometric analysis. Control Clin Trials 2000, 21:30-43.
27. Hanh VT, Guillen F, Cong DD, Parkerson GR Jr, Thu PB, Quynh PT, Briancion S. Health related quality of life of adolescents in Vietnam: cross-cultural adaptation and validation of the Adolescent Duke Health Profile. J Adolesc Health 2005, 20:127-146.
28. Loos-Ayyad C, Chau N, Riani C, Guillen F. Functional disability in France and its relationship with health-related quality of life - a population-based prevalence study. Clin Exp Rheumatol 2005, 23:701-708.
29. Vo TX, Guillen F, Deschamps JP. Psychometric properties of the DUK Health Profile-adolescent version (DHP-A): a generic instrument for adolescents. Qual Life Res 2005, 14:2229-2234.
30. Salmon CT. The next-birthday method of respondent selection. Public Opinion Quarterly 1985, 47:270-276.
31. Parkerson GR Jr, (ed). User’s guide for Duke Health Measures 2002.
32. Jenkinson C, Stewart-Brown S, Petersen S, Pace C. Assessment of the SF-36 version 2 in the United Kingdom. J Epidemiol Community Health 1999, 53:46-50.
33. Cronbach L. Coefficient alpha and the internal structure of tests. Psychometrika 1951, 16:297-334.
34. Nunnally J. Psychometric theory. New York: McGraw Hill; 1978.
35. Groenvold M, Fayers PM, Sprangers MA, Bjorner JB, Klee MC, Aaronson NK. General Health Survey and the Duke Health Profile. J Clin Epidemiol 2000, 53:536-539.
36. Parkerson GR Jr, Gehlbach SH, Wagner EH, James SA, Clapp NE, Muhlbaier LH. The Duke-UNC Health Profile: an adult health status instrument for primary care. Medical care 1981, 19:806-828.
37. Bucquet D, Condon S, Ritchie K. The French version of the Nottingham Health Profile. A comparison of items weights with those of the source version. Soc Sci Med 1990, 30:829-835.
38. Cronbach L. Coefficient alpha and the internal structure of tests. Psychometrika 1991, 16:297-334.
39. Nunnally J. Psychometric theory. New York: McGraw Hill; 1978.
40. Groenvold M, Fayers PM, Sprangers MA, Bjorner JB, Klee MC, Aaronson NK, Bech P, Mouridsen HT. Anxiety and depression in breast cancer patients at low risk of recurrence compared with the general population: a valid comparison? J Clin Epidemiol 1999, 52:523-530.
41. Sprangers MA, Schwartz CE. Integrating response shift into health-related quality of life research: a theoretical model. Soc Sci Med 1999, 48:1507-1515.
42. Barclay-Goddard R, Epstein JD, Mayo NE. Response shift: a brief overview and proposed research priorities. Qual Life Res 2009, 18:335-346.
43. Schwartz CE, Bode R, Repucci N, Becker J, Sprangers MA, Fayers PM. The clinical significance of adaptation to changing health: a meta-analysis of response shift. Qual Life Res 2006, 15:1533-1550.
39. Parkerson GR Jr, Broadhead WE, Tse CK: Comparison of the Duke Health Profile and the MOS Short-form in healthy young adults. Medical care 1991, 29:679-683.

40. Perret-Guillaume C, Briancon S, Wahl D, Guillemin F, Empereur F: Quality of Life in elderly inpatients with atrial fibrillation as compared with controlled subjects. J Nutr Health Aging 2010, 14:161-166.

Pre-publication history
The pre-publication history for this paper can be accessed here:
http://www.biomedcentral.com/1471-2458/11/401/prepub

doi:10.1186/1471-2458-11-401
Cite this article as: Baumann et al: Health-related quality of life in French adolescents and adults: norms for the DUKE Health Profile. BMC Public Health 2011 11:401.