

# Benchmarking the burden of 100 diseases: results of a nationwide representative survey within general practices

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## ABSTRACT

**Objective:** To assess the burden of diseases and quality of life (QOL) of patients for a large variety of diseases within general practice.

**Design:** In a representative nationwide cross-sectional study, a total of 825 general practitioners (GPs) were randomly selected from across France. Independent investigators recruited 8559 patients attending the GPs' practices. Data on QOL (12-Item Short Form questionnaire) and other individual characteristics were documented by the independent investigators for all participants in the waiting room. Medical information was recorded by GPs. Sampling was calibrated to national standards using the CALMAR (CALage sur MARges) weighting procedure. Associations of lower scores (ie, below vs above the first quartile) of physical and mental component scores (physical component summary score (PCS) and mental component summary score (MCS), respectively) with main diseases and patients characteristics were estimated using multivariate logistic regression. Weighted morbidity rates, PCS and MCS were computed for 100 diagnoses using the International Classification of Diseases (9th version).

**Results:** Overall mental impairment was observed among patients in primary care with an average MCS of 41.5 (SD 8.6), ranging from 33.0 for depressive disorders to 45.3 for patients exhibiting fractures or sprains. Musculoskeletal diseases were found to have the most pronounced effect on impaired physical health (OR=2.31; 95% CI 2.08 to 2.57) with the lowest PCS (45.6 (SD 8.8)) and ranked first (29.0%) among main diagnoses experienced by patients followed by cardiovascular diseases (26.7%) and psychological disorders (22.0%). When combining both prevalence and QOL, musculoskeletal diseases represented the heaviest burden in general practice.

**Conclusions:** Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3) is the first study to provide reference figures for burden of disease in general practice across a wide range of morbidities, particularly valuable for health-economics and healthcare-system evaluation.

## ARTICLE SUMMARY

### Article focus

- The impact of diseases on quality of life (QOL) in general practice has been assessed among selected samples of patients, usually from studies including a limited number of medical practices and/or focusing mainly on chronic conditions.
- There is a clear need for more data on QOL of patients in primary care; the aim of the Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3) survey was to provide reference figures for disease burden in this setting.

### Key messages

- The EPI3 study was a cross-sectional survey combining unique data from patients and general practitioners (GPs), and allowed provision of reference figures for the vast majority of diseases encountered in primary care for a large number of patients.
- The study highlighted the burden of musculoskeletal and psychological disorders, experienced by more than half the patients.
- Although social and medical determinants of patients' QOL were somewhat similar than those found in previous studies in primary care, the EPI3 survey showed more pronounced mental impairment in French patients.

## INTRODUCTION

Assessing and measuring the burden of a disease in medical practice is undoubtedly important for the evaluation of medicines and healthcare.<sup>1</sup> To assess such burden quantitatively, both the prevalence of diseases and their impact on health status and on the quality of life (QOL) of patients need to be taken into account.<sup>2</sup>

In primary care, the prevalence of morbidities has been shown to be remarkably

ARTICLE SUMMARY

Strengths and limitations of this study

- No nationwide study on burden of disease combining both prevalence measures and QOL assessment has been conducted to date, addressing such a large variety of diseases in general practice.
- On-site selection and recruitment by an independent investigator limited the possibility of selection bias among patients, and the participation of physicians added high specificity to medical data collection.
- A study design providing a high specificity in data collection led to a relatively low response rate from GPs. However, stratified recruitment phases and sample sizes from both GPs and patients highly representative of national standards ensured the strong external validity of the results.
- Home consultations, which are common among GPs in France, were not surveyed which could have led to an underestimation of the burden of disease.

similar across different industrialised countries.<sup>3–5</sup> However, their effect upon QOL is only partially known.<sup>6</sup> The impact of the diseases on QOL in general practice has been addressed so far using selected samples of patients,<sup>7–13</sup> usually from studies including a limited number of medical practices,<sup>8 10 11 13</sup> and/or mainly focused on chronic conditions.<sup>7 9–11</sup> To the best of our knowledge, no nationwide study of the burden of disease combining both prevalence measures and QOL assessment for a large variety of diseases is currently available. To compensate for this paucity of information, some studies have evaluated the impact for diseases in primary care calling upon modelling data derived from studies in medical specialties<sup>14–16</sup> and/or in hospital settings,<sup>17 18</sup> or from general population surveys.<sup>19–21</sup> It is not known to what extent these extrapolations are appropriate.

The aim of the Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3) survey was to provide reference figures for disease burden in primary care. For this purpose, a representative sample of general practitioners (GPs) was assembled through stratified sampling and data from their patients collated during a 1-day survey conducted by independent interviewers in the waiting room of the participating medical practices.

METHODS

Study design, settings and population

The EPI3 survey was a nationwide, observational study of a representative sample of GPs and their patients, conducted in France between March 2007 and July 2008. Its aims were to assess the burden of diseases in general practice, considering the physicians' work activity, patients' characteristics, morbidity and prescriptions.

The sample was drawn by applying a two-stage sampling process. First, GPs were randomly selected from the French national directory of physicians and invited to participate, which meant also allowing a trained research assistant to conduct a 1-day survey in

the waiting room at the doctor's practice. GPs' sampling was stratified according to the diversity of medicine practices in the country (conventional and complementary medicine such as homeopathy).

The second stage consisted of random 1-day sampling of consultations per participating physician in order to survey all patients attending the practice on a particular day. All adult and accompanied minor patients were eligible for inclusion in the EPI3 survey to the exception of those whose health status or literacy level did not allow responding to a self-administered questionnaire. The research assistant recruited up to a maximum of 15 patients on site (ie, in the waiting room) all eligible patients listed consecutively who consented to participate in the survey. Further, each physician recorded the main reason for consultation, along with the age, gender and type of national health insurance for each patient. The maximum number of patients surveyed per day was set to allow sufficient time for optimal interviews and was followed by patients' examination by the physician.

The EPI3 survey obtained regulatory approval by the national board of physicians ('Conseil National de l'Ordre des Médecins') and ethical approval by the French data protection authority ('Commission Nationale de l'Informatique et des Libertés'). Patients were informed by the participating physician that their responses would be kept confidential, and they were not remunerated for participation. Physicians received compensation fees. The study was sponsored by a pharmaceutical company, whose name was not revealed to investigators or patients.

Data collection

Patients were asked to self-complete a questionnaire covering demographic and social information (age, gender, educational level, employment status and occupation, smoking, alcohol intake, physical activity, height and weight for body mass index calculation), health insurance (regular national insurance, welfare health insurance for low income, with or without supplementary private insurance), number of visits to the participating physician within the last 12 months, or, for the same period, to other GPs or medical specialists, the length and number of hospitalisations and sick leaves.

Participants were asked whether the attending physician was their regular/primary care physician. In the French health insurance system, patients have to choose a regular physician, usually a GP, who plays a gate-keeping role for referral to specialised care. However, referral by regular GPs to other physicians is not compulsory, and patients are allowed to seek care from different physicians and their different reimbursement schemes.

Detailed information on physicians including age, gender, type of contract with national health insurance (regular fees, additional fees and no contract), working days and average duration of consultation were assessed by the research assistants at the time of inclusion.

GPs completed a medical questionnaire on patients including the main reason for consultation and up to five other diagnoses present that day. GPs were requested to record their prescriptions that day for diagnostic tests, drugs and referrals. Diagnoses were coded by a trained archivist using the ninth revision of the International Classification of Diseases using 100-3 digit-categories.<sup>22</sup>

### Health-status measurement

Among adult patients (18 years and over), health-related quality of life was assessed using the 12-Item Short Form questionnaire (SF-12),<sup>23</sup> a shortened version of the 36-Item Short Form Health Survey (SF-36) which has been shown to be a reliable outcome measurement tool in primary care.<sup>24</sup> The physical and mental component summary scores (PCS and MCS, respectively) were derived from the SF-12 questionnaire. Physical functioning (two questions), role—physical functioning (two questions), bodily pain (one question), general health (one question), vitality (one question), social functioning (one question), role—emotional functioning (two questions) and mental health (two questions) cover the same dimensions as the SF-36. The scores are standardised to population norms (based on a US norm-sample), with the mean score set at 50 (SD 10); lower scores indicate worse health, and higher scores better health. The SF-12 has been validated for use in France, the USA, the UK and many other European countries.<sup>21</sup>

### Statistical analysis

Participating and non-participating patients were compared against the collected variables on gender, age, length of time attending the GPs' practice, type of health insurance and main reason for consultation. A weighting procedure known in demographic studies as the CALMAR (CALage sur MARGes) procedure was applied to calibrate the final sample according to participation so that it closely represents the patients attending the practice.<sup>25</sup>

Participating GPs were compared with the French 'Institut de recherche et documentation en économie de la santé' sample.<sup>26</sup> The physicians' activity-related fractions were also calibrated to the real distribution of the participating physicians across the France. All reported results were obtained after weighting was applied to GPs' patients.

In this study, we reported weighted prevalence, calculated as a percentage reported to the whole population, regardless of whether the diagnosis was isolated or associated with other diagnoses. Weighted PCS and MCS measures of the SF-12 were computed according to the algorithm given by Ware *et al* for 100 different conditions, which were further grouped into 13 broad diseases categories plus one covering preventive motives of consultation and other medical acts.<sup>23</sup> Means and SDs were estimated for the whole adult sample and for each diagnosis. When a three-digit category from the ninth

revision of the International Classification of Diseases had <30 patients, the category was grouped with one or several categories under the same heading. When grouping within the same heading was not relevant, categories with <30 patients were grouped in the category 'other' within each main category.

Each disease category was calculated as a percentage reported to the whole population of participating patients over the age of 18 years, regardless of whether this diagnosis was isolated or associated with others, in order to provide a complete picture of morbidity cared for in general practice.

Among adults over 18 years, associations of age, gender, education, type of insurance and 13 broad disease categories with lower MCS and PCS scores (defined as below the first quartile with scores of 34 and 39 for MCS and PCS, respectively) were evaluated using multivariate logistic regression. Odds ratios (OR) and 95% CI are presented for each of these factors. In addition, the same analysis was conducted for the two remaining categories, pregnancy follow-up and preventive motives, which were not considered in the multivariate analysis. The association between the number of comorbidities and the two SF-12 composite scores was tested using linear regression. The possibility of a clustering effect at the practice level was tested using Generalised Estimating Equations multivariate models. We used SAS statistical software (V.9.1) for data analysis. The present study was reported following the 'Strengthening the Reporting of Observational Studies in Epidemiology' statement for cross-sectional studies.<sup>27</sup>

## RESULTS

The sequential recruitment of physicians was carried out by random stratified sampling from the phone directory for GPs. Among the 3345 GPs initially contacted, 428 (12.8%) agreed to participate in the survey. At the end of recruitment in July 2008, an additional sample of 13 861 GPs were contacted to ensure a representative sample of GPs from all types of primary care practice in France (strictly allopaths, homeopaths and mixed practice). Despite the intrusive nature of the survey, allowing trained research assistants to collect data directly in the waiting room at the medical practice on the very day of consultation, a final sample of 825 participating GPs recruited a total of 11 809 patients eligible for the present study. Of these, 174 were unaccompanied minors, 315 were non-French speakers, 109 had severe psychiatric disorders, 2151 declined participation, 408 were beyond the maximum number possible to be interviewed within the allocated time on site, and 93 had incomplete data and were excluded, allowing a total of 8559 patients for the present analysis.

### Physicians

The median age of physicians was 52 years (IQR=33–57) and of these, 24% were women; 54% worked in solo medical practice, 40% worked with other

GPs, and 6% collaborated with specialists or other healthcare professionals; 31% of the GPs practised additional medical activities within hospitals, healthcare centres, the health administration or the pharmaceutical industry. Most of the GPs (90%) hold a regular contract with the National Health Insurance organisation, while 9% hold a special contract allowing extra fees; a very small proportion (0.4%) had no contract. The mean daily working time at the practice (excluding home visits) was 9 h (IQR: 2–10.5), and each of the 825 GPs participating in the study recruited on average 8.7 patients (SD 2.2).

**Patients**

The characteristics of participating (n=8559) and non-participating patients with complete data (n=3157) used to calibrate the sample are presented in table 1. We report here the results based on weighted characteristics. The mean age of the 8559 participating patients was 44.9 years (SD 21.9), and 7133 (83.3%) were adults over 18. At least 44% of patients had a secondary-school degree, 16% were overweight (BMI>30 kg/m<sup>2</sup>), and more than 61% exercised longer than 31 min per day. Nine out of ten patients were French-born (90%), 9% were covered by a government-funded insurance for low-

**Table 1** Characteristics of non-participating and participating patients: results of the calibrated data (Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3) survey 2008)

	Non-participants* (n=3157)	Participants (n=8559)	Weighted percentage
Mean (SD)			
Age (years)	47.7 (24.0)	43.3 (22.8)	44.9 (21.9)
n (%)			
Female gender	1701 (53.9)	5367 (62.7)	57.9
Length of relationship with the physician			
First time	265 (8.4)	782 (9.1)	7.7
<1 year	316 (10.0)	1315 (15.4)	11.9
1–5 years	743 (23.5)	2380 (27.8)	27.4
More than 5 years	1703 (53.9)	4015 (46.9)	53.0
Government-funded health insurance	308 (9.8)	621 (7.4)	9.4
Longstanding disease status		1925 (22.5)	27.7
Complementary health insurance		7839 (91.6)	90.3
Index physician declared as treating physician		6379 (74.5)	84.3
Body mass index (kg/m <sup>2</sup> )			
<25		5548 (64.8)	52.4
25–30		2045 (23.9)	31.8
30 and over		966 (11.3)	15.8
Tobacco consumption			
Non-smoker		4303 (50.3)	47.4
Past smoker		1961 (22.9)	24.4
Current smoker		2252 (26.3)	28.2
Alcohol consumption			
Never		2908 (34.2)	35.2
Sometimes		4649 (54.6)	52.5
Daily		957 (11.2)	12.4
Physical exercise			
<10 min per day		2235 (26.1)	28.3
10 min and over		6199 (72.4)	71.7
Nationality			
French-born subjects		7787 (91.0)	90.3
French born abroad		341 (4.0)	4.7
Non-French nationality		357 (4.2)	5.0
Educational attainment			
Secondary-school degree* †, college, university graduation		4179 (48.8)	44.0
Employment status			
Employed		4544 (53.1)	50.4
On unemployment benefits		378 (4.4)	4.7
Homemaker		647 (7.6)	6.6
Retired and other unemployed		2562 (29.9)	34.3
Student		348 (4.1)	4.1

\*Available characteristics used for calibration.

†French baccalaureate.

income people, and 90% had a private supplementary insurance. Among the 8559 patients, 8% had attended the practice for the first time, 12% had attended for 1 year or less, 27% had attended between 1 and 5 years, and 53% had attended for 5 years or more. Over 84% of participants named the recruiting physician as their regular treating physician. About 28% of patients were registered by the national health insurance as having multiple or severe chronic diseases and requiring special health insurance coverage.

### Burden of 100 diseases in primary care

The prevalence of each of the 100 and 13 broad non-exclusive diagnosis categories (a compilation of all five diagnoses recorded by the GPs) is presented in table 2. Altogether, diseases of the musculoskeletal system were the most frequently diagnosed conditions (29%), followed by cardiovascular diseases (26.7%), and sleep, anxiety and depressive disorders (22%). Preventive-care consultations, vaccinations and consultation for administrative purposes accounted for 19% of the total diagnoses. Almost half the patients (49%) exhibited two or more comorbidities.

Overall mean scores for PCS and MCS were 45.6 (SD 8.8) and 41.5 (SD 8.6), respectively. Considering PCS, scores ranged from 40.3 (SD 11.0) for one group of unspecified musculoskeletal conditions to 50.2 (SD 11.0) for vaccinations. On the whole, musculoskeletal disorders had the lowest scores with the cancer and other severe diseases category, while skin-related diseases, preventive-care consultation and infectious diseases showed the highest PCS. With regard to MCS, scores ranged from 33.0 (SD 10.2) for depressive disorders to 45.3 for patients with fractures, sprains or dislocation. Overall, the lowest scores were found among patients with mood and sleep disorders, while injury, preventive motives and cardiovascular diseases exhibited the highest scores. Both MCS and PCS decreased significantly with increasing numbers of comorbidities (figure 1). For example, MCS decreased from 43.3 for patients seeking preventive care advice to 38.5 for those with four diagnoses or more ( $p$  for trend  $<0.0001$ ) and PCS from 49.2 to 40.4 ( $p$  for trend  $<0.0001$ ).

### Determinants of health-related quality of life

The associations between patient characteristics and 13 broad categories of diseases are presented in table 3. A low PCS was significantly associated with an older age (OR=2.48; 95% CI 2.08 to 2.96 for patients over 75 years as compared with adults between 18 and 44 years). A low PCS was negatively associated with a high educational attainment (OR=0.65; 95% CI 0.59 to 0.72 for secondary-school level or higher in comparison with lower educational level), while low MCS scores were associated with gender (OR=1.62; 95% CI 1.45 to 1.81 for women as compared with men) and younger age. Government-funded health-insurance cover was associated with both poor PCS and MCS (OR=1.38; 95% CI 1.15 to 1.65 and OR=1.42; 95% CI 1.19 to 1.70, respectively).

With regard to the disease categories, musculoskeletal diseases (OR=2.31; 95% CI 2.08 to 2.57), injury and poisoning (OR=1.88; 95% CI 1.52 to 2.33), other diseases including cancer (OR=1.73; 95% CI 1.38 to 2.16), diseases of the nervous system, head and neck (OR=1.24; 95% CI 1.02 to 1.51) and cardiovascular diseases (OR=1.22; 95% CI 1.08 to 1.38) were significant predictors of lower PCS score, whereas the opposite was found for skin and subcutaneous tissue diseases (OR=0.68; 95% CI 0.51 to 0.90) or with obesity and dyslipidaemia (OR=0.79; 95% CI 0.67 to 0.94). Significantly poor MCS were observed in patients suffering from anxiety, depression and sleep disorders (OR=3.58; 95% CI 3.22 to 3.98), and experiencing 'other diseases' including cancer (OR=1.35; 95% CI 1.06 to 1.72). Conversely, OR for MCS was significantly decreased for patients with cardiovascular diseases (OR=0.84; 95% CI 0.73 to 0.96). Testing the effect of clustering at the practice level yielded similar results, but to ensure parsimony of the generated models it was decided not to report such effects.

### DISCUSSION

The EPI3 survey is, to our knowledge, the first nationwide survey in general practice to provide 100 reference figures for burden of disease assessment, combining both on-site independent recruitment of a large number of patients and additional medical information from GPs. On-site selection and recruitment by an independent investigator limited the possibility of selection bias among patients, and the participation of physicians added high specificity to medical data collection.

There is a clear need for more data on QOL of patients.<sup>6</sup> In the UK, the General Practice Research Database assembled a very large sample of 400 surgeries and 2500 individual GPs, providing detailed information on health conditions besides prescriptions, but to our knowledge not on patients' QOL.<sup>3</sup> The Dutch national survey of general practice carried out in 1987 and 2001 gives an assessment of quality of care, but only provided by the patients themselves.<sup>2</sup>

The EPI3 survey found a similar prevalence for both diseases<sup>10 28</sup> and comorbidities<sup>7 9 10 13</sup> as in several other studies, which indicate a good representativeness of our weighted sample. Musculoskeletal and psychological disorders were experienced by more than half the patients attending physicians during the course of the study and represented a significant case load at GP practices. When both physical- and mental status impairment and prevalence are considered, our study further highlighted the heaviest burden of musculoskeletal disorders.

With regard to physical status, the EPI3 survey showed a similar average PCS score to other primary-care<sup>7 8 10 11</sup> or disease-specific<sup>14 15 29</sup> surveys using the SF-12 or SF-36 questionnaires. The mean PCS were lower than reference values computed in the French reference sample<sup>21</sup> and in

**Table 2** Morbidity rates and 12-Item Short Form questionnaire mental and physical component scores according to 100 International Classification of Diseases diagnoses (Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3)-LA-SER-2008, weighted data n=7133)

Diseases	Morbidity* n (%)	PCS Mean (SD)	MCS Mean (SD)
All patients		45.6 (8.8)	41.5 (8.6)
Diseases of the musculoskeletal system	2069 (29.0)	42.7 (8.4)	41.6 (8.3)
Osteoarthritis	324 (4.5)	41.1 (10.7)	41.7 (11.0)
Unspecified joint disorders	171 (2.4)	42.5 (9.9)	42.6 (10.2)
Intervertebral and cervical disc disorders	276 (3.9)	44.0 (11.4)	40.6 (10.3)
Lumbago	360 (5.0)	42.1 (10.1)	41.6 (9.4)
Rotator cuff syndrome of shoulder and allied disorders	98 (1.4)	42.5 (10.1)	42.0 (9.8)
Other affections of shoulder region	121 (1.7)	42.6 (9.7)	42.4 (9.1)
Enthesopathy of elbow region	77 (1.1)	41.8 (9.3)	43.1 (10.5)
Unspecified enthesopathy	257 (3.6)	42.3 (10.5)	42.1 (10.0)
Rheumatism, excluding the back	112 (1.6)	42.9 (10.1)	42.3 (9.8)
Spondylosis and other inflammatory spondylopathies	84 (1.2)	42.1 (9.9)	43.1 (8.4)
Sciatica	194 (2.7)	42.3 (10.1)	41.7 (9.6)
Pain in thoracic spine	51 (0.7)	42.6 (9.8)	41.3 (9.2)
Osteoporosis	162 (2.3)	44.0 (10.7)	41.9 (10.8)
Diseases of connective tissue	36 (0.5)	45.5 (9.3)	40.5 (10.9)
Unspecified back disorders	193 (2.7)	42.1 (10.2)	41.3 (9.7)
Other unspecified musculoskeletal disorders	76 (1.1)	40.3 (11.0)	41.7 (11.6)
Hypertension, cardiovascular and circulatory diseases	1904 (26.7)	43.7 (9.0)	42.5 (8.6)
Hypertension	1111 (15.6)	43.9 (11.3)	42.8 (10.7)
Acute myocardial infarction	84 (1.2)	40.8 (11.4)	42.0 (9.4)
Other symptoms involving cardiovascular system	53 (0.7)	46.0 (9.5)	43.7 (8.2)
Angina pectoris	66 (0.9)	41.8 (11.8)	43.7 (10.5)
Cardiac dysrhythmias	139 (1.9)	42.9 (11.5)	42.7 (11.1)
Diseases of veins and lymphatics	92 (1.3)	45.3 (10.5)	41.3 (10.8)
Pulmonary, artery and cerebrovascular diseases	144 (2.0)	42.1 (11.7)	42.7 (10.6)
Other ischaemic heart diseases	96 (1.3)	41.1 (11.9)	42.1 (11.1)
Other diseases of the circulatory system	229 (3.2)	45.3 (10.3)	41.8 (11.0)
Anxiety, depression and sleep disorders	1569 (22.0)	44.8 (8.9)	36.3 (8.5)
Psychotic conditions	68 (1.0)	44.2 (12.6)	37.6 (12.3)
Anxiety states	420 (5.9)	47.8 (10.5)	35.5 (9.7)
Dysrhythmia	182 (2.6)	47.2 (10.2)	35.4 (9.2)
Acute and chronic stress	85 (1.2)	46.9 (10.6)	36.1 (9.5)
Personality disorders, disturbance of conduct and dependence syndrome	81 (1.1)	46.4 (10.9)	38.8 (11.2)
Eating disorders, tics, stuttering and other syndromes	277 (3.9)	47.4 (10.4)	37.1 (10.7)
Depressive disorders	497 (7.0)	45.3 (11.4)	33.0 (10.2)
Malaise and fatigue	114 (1.6)	45.4 (11.1)	38.7 (9.7)
Sleep disorders	87 (1.2)	46.1 (10.7)	38.5 (9.4)
Nervousness, cachexia and unspecified psychological distress	30 (0.4)	41.9 (13.5)	39.9 (12.8)
Dizziness and giddiness	59 (0.8)	46.3 (9.8)	40.2 (10.4)
Other general symptoms	75 (5.8)	46.0 (11.1)	39.2 (10.4)
Diseases of the respiratory system	1419 (19.9)	46.3 (8.5)	41.9 (8.4)
Acute nasopharyngitis	306 (4.3)	48.2 (9.8)	41.6 (9.7)
Acute pharyngitis	60 (0.8)	49.3 (10.4)	42.5 (10.5)
Acute tracheitis	120 (1.7)	48.4 (10.1)	41.4 (10.4)
Acute bronchitis or other upper-respiratory infections	66 (0.2)	41.9 (12.3)	43.0 (8.0)
Chronic nasopharyngitis	52 (0.3)	50.0 (8.1)	42.9 (8.7)
Chronic sinusitis and laryngitis	126 (1.7)	48.0 (9.9)	40.3 (8.9)
Allergic rhinitis	124 (1.7)	47.5 (10.7)	42.3 (9.6)
Pneumonia and flu	53 (0.6)	46.8 (10.2)	41.1 (10.8)
Chronic obstructive pulmonary diseases (except asthma)	160 (2.2)	44.8 (10.4)	41.2 (10.0)
Asthma	148 (2.1)	44.0 (11.5)	41.4 (10.5)
Lung diseases	64 (0.9)	41.0 (12.3)	42.0 (9.5)
Other diseases of the respiratory system	210 (2.9)	45.1 (11.6)	42.4 (10.4)
Medical exams and preventive motives	1101 (15.4)	47.4 (9.2)	42.4 (10.1)

Continued

Table 2 Continued

Diseases	Morbidity* n (%)	PCS Mean (SD)	MCS Mean (SD)
Medical exam: handicap influencing health status	41 (0.6)	45.9 (9.4)	39.4 (12.6)
Medical exam: aftercare and specific procedures	285 (4.0)	45.9 (11.6)	41.2 (10.8)
Medical exam for health check-up	286 (4.0)	46.9 (11.3)	43.1 (10.8)
Laboratories findings	53 (0.7)	48.5 (9.8)	42.9 (10.9)
Vaccination	121 (1.7)	50.2 (11.0)	42.6 (10.5)
Pregnancy follow-up	122 (1.7)	47.4 (11.8)	41.8 (10.4)
Administrative purposes	380 (5.3)	47.2 (11.7)	42.5 (9.9)
Diabetes, thyroid gland and other endocrine disorders	785 (11.0)	43.9 (8.6)	41.5 (8.1)
Hypothyroidism	187 (2.6)	45.3 (11.0)	39.6 (10.9)
Goitre	45 (0.6)	46.5 (9.3)	41.3 (9.8)
Diabetes mellitus	312 (4.4)	42.9 (11.2)	42.0 (10.5)
Diseases of other endocrine glands	78 (1.1)	43.9 (11.9)	41.0 (10.8)
Other thyroid disorders	52 (0.7)	45.7 (10.8)	40.0 (10.1)
Obesity and dyslipidaemia	742 (10.4)	45.2 (9.1)	42.0 (8.9)
Hypercholesterolaemia	266 (3.7)	45.1 (10.9)	42.6 (10.2)
Unspecified disorder of lipid metabolism	135 (1.9)	45.5 (10.5)	42.8 (9.2)
Overweight, obesity and other hyperalimentation	169 (2.4)	47.6 (11.4)	40.2 (10.4)
Other hyperlipidaemia	105 (1.1)	45.6 (11.3)	42.4 (10.6)
Other symptoms concerning nutrition, metabolism and development	70 (1.0)	48.6 (10.1)	40.3 (10.4)
Diseases of the digestive system	742 (10.4)	45.9 (8.4)	39.9 (8.4)
Oesophageal diseases	81 (1.1)	44.3 (10.3)	41.5 (9.8)
Diseases of stomach	121 (1.7)	45.6 (10.0)	40.1 (9.7)
Diseases of intestines and peritoneum	72 (1.0)	45.1 (10.1)	40.2 (9.9)
Symptoms involving the abdomen	161 (2.3)	46.9 (10.4)	39.9 (11.0)
Non-infectious enteritis and colitis	105 (1.5)	47.5 (9.5)	41.8 (9.9)
Diseases of oral cavity, salivary glands and jaws	39 (0.5)	49.0 (8.8)	40.3 (10.0)
Appendicitis and hernia	43 (0.6)	44.1 (10.6)	40.0 (10.2)
Other diseases of the digestive system	144 (2.0)	44.8 (10.8)	39.7 (9.9)
Diseases of the nervous system, head and neck	449 (6.3)	43.3 (9.4)	39.6 (9.1)
Disorders of the central nervous system	95 (1.3)	41.3 (13.6)	42.2 (11.2)
Migraine	114 (1.6)	46.6 (10.2)	39.7 (10.1)
Symptoms involving the head and neck	96 (1.3)	46.3 (10.8)	40.8 (10.2)
Diseases of the eye	54 (0.7)	51.8 (9.9)	37.4 (10.6)
Diseases of the ear and mastoid processes	112 (1.6)	46.9 (10.8)	41.6 (11.0)
Other disorders of the nervous system and sense organs	145 (2.0)	44.6 (10.3)	39.9 (10.6)
Diseases of the genitourinary system	400 (5.6)	45.5 (9.6)	41.5 (8.9)
Cystitis	115 (1.6)	47.9 (11.5)	40.3 (10.2)
Diseases of male genital organs	85 (1.2)	46.0 (10.9)	43.0 (11.0)
Diseases of female genital organs	139 (1.9)	48.4 (11.3)	39.8 (10.8)
Nephrosis and nephritis	86 (1.2)	44.8 (11.6)	41.7 (10.6)
Complications of pregnancy and congenital anomalies	42 (0.6)	43.5 (12.8)	40.4 (10.5)
Injury and poisoning	342 (4.8)	43.5 (9.2)	43.5 (8.3)
Fractures, sprains and dislocations	103 (1.4)	41.9 (10.5)	45.3 (9.7)
Traumas and injuries to organs	54 (0.8)	44.3 (12.9)	44.1 (11.4)
Burns and amputations	62 (0.9)	44.4 (11.6)	43.1 (10.4)
Intoxications and allergies to toxic drugs	108 (1.5)	47.3 (11.6)	41.5 (10.7)
Poisoning, other allergy and side effect of surgery	55 (0.8)	44.3 (11.1)	40.3 (9.3)
Cancer and infrequent diseases	289 (4.1)	42.0 (9.3)	40.4 (8.5)
Neoplasms	174 (2.4)	41.8 (11.6)	40.7 (10.6)
Benign tumours	54 (0.8)	44.7 (10.9)	40.8 (10.7)
Blood diseases	56 (0.8)	45.3 (11.1)	41.2 (9.5)
Skin and subcutaneous tissue diseases	243 (3.4)	48.8 (7.8)	41.7 (9.6)
Infections of skin and subcutaneous tissue	55 (0.8)	46.1 (11.0)	40.4 (11.3)
Inflammatory conditions of skin and subcutaneous tissue	163 (2.3)	47.3 (9.9)	42.2 (10.4)
Other diseases of skin and subcutaneous tissue	89 (1.2)	49.7 (8.5)	40.1 (11.0)
Infectious diseases	228 (3.2)	47.1 (7.6)	40.7 (7.1)
Parasitic diseases	76 (1.1)	47.1 (11.1)	42.1 (10.7)

Continued

Table 2 Continued

Diseases	Morbidity* n (%)	PCS Mean (SD)	MCS Mean (SD)
Bacterial diseases	82 (1.1)	47.0 (10.0)	39.9 (9.8)
Viral diseases (including HIV)	122 (1.7)	46.5 (11.6)	40.5 (10.1)
Fever and other physiological disturbances of temperature regulation	77 (1.1)	46.3 (10.4)	40.1 (8.4)

\*Each condition category is non-exclusive.

the 2003 Household survey (JL Lanoe, unpublished data, 2003). Within practices, older age,<sup>30–33</sup> low education attainment and government-funded insurance<sup>30 32 33</sup> were associated with lower PCS. When disease categories were considered, musculoskeletal diseases were associated with the lowest PCS,<sup>8 34 35</sup> with PCS of similar magnitude to other European surveys including musculoskeletal diseases patients.<sup>29</sup>

Regarding mental status, although socio-demographic characteristics had a similar impact on MCS, the EPI3 survey showed significantly lower MCS scores than other studies in general practice.<sup>7 8 10 11</sup> Additional comorbidities, which were reported for half of the EPI3 survey sample, could not alone explain this difference with other studies: MCS usually scored an average three points lower than those of patients with one morbidity.<sup>16</sup> We believe that our findings could be explained instead by a different methodology: in all other studies conducted in general practice,<sup>7 8 10 11</sup> mostly including a small number of medical practices,<sup>8 10 11 13</sup> physicians may have selected participants. Our study was free from this bias in view of the selection of consecutive eligible patients in the GP's waiting room. In studies in which patients were interviewed for targeted mental disorders<sup>15</sup> or when MCS were assessed among patients seeking specialty care,<sup>36 37</sup> MCS measures were somewhat similar to ours. In the EPI3 survey, psychological and psychiatric diseases had the greatest negative impact on mental function consistent with other surveys in primary care<sup>7 10</sup>; it must be appreciated that associated MCS values were more similar to those of another study

conducted on patients with specific psychiatric disorders.<sup>15</sup> Lower MCS may thus highlight the overall burden of psychological distress and related diseases of patients seen in primary care.

**Strengths and limitations of the study**

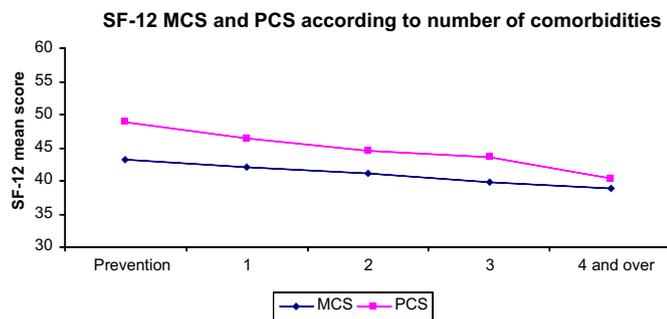
Among the main strengths of our study, the unique combined data from patients and physicians allowed provision of reference figures for the vast majority of diseases encountered in primary care for a large number of patients. Quality-adjusted life years are usually estimated for health economics and mainly derived from QOL measures assessed from EuroQoL standardised instruments (EQ5D).<sup>1</sup> Interestingly, the conversion of SF-12 values into EQ5D Utility values has been recently documented,<sup>38</sup> suggesting that our results could be extended for that purpose as previously reported.<sup>39</sup>

Additionally, SF-12 questionnaires have been found to provide reliable QOL measurement across studies,<sup>22 24</sup> even among patients with acute conditions.<sup>40</sup> Although its validity in older patients is moderate,<sup>41</sup> our sample was representative of the general population, thus minimising this possible bias on our results.

Finally, a lack of representativeness was an important limitation in other studies.<sup>11 42</sup> The sample size of physicians participating in the EPI3 survey is within the range established for other French surveys (from 100 to 1006).<sup>26</sup> Physicians were randomly selected from the national telephone directory, which includes general practitioners currently practising in primary care. This was preferred to professional registries of physicians, which lists all registered GPs, regardless of whether they are currently practising or not.

The weighted geographical distribution of the 825 GPs participating in the survey was similar to the national distribution of GPs in private practice across the 22 French regions surveyed, and the distribution of physicians' individual characteristics regarding age, gender type of contract with national health insurance and type of practice differed only slightly from national statistics<sup>26</sup>: female participation was slightly lower (23.5% compared with 26% in the IRDES sample), but the distribution between sectors was similar (8.9% vs 8.5% in sectors 1 and 2, respectively).

In terms of the representativeness of the patients, the calibrated sample of the EPI3 survey was compared with other nationwide studies and has demonstrated its efficiency through other criteria that were not used in the



**Figure 1** Health-related quality of life: 12-Item Short Form questionnaire (SF-12) mental (MCS) and physical (PCS) component scores per number of comorbidities Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3)-2008 (weighted data).

**Table 3** Health-related quality of life: 12-Item Short Form questionnaire, with Factors and 13 broad diagnoses associated with mental component score and physical component score below the 25th percentile (OR from multivariable logistic regression models adjusted for age, gender, education level, insurance coverage and 13 categories of diseases (aOR) and 95% CI), for Etude épidémiologique de l'Impact de santé public sur 3 groupes de pathologies (EPI3)-LA-SER-2008 (weighted data)

	Low physical component score		Low mental component score	
	aOR*	95% CI	aOR*	95% CI
Age (years)				
18–44	1	1	1	1
45–64	1.22	1.08 to 1.39	0.96	0.85 to 1.08
65–74	1.47	1.25 to 1.73	0.65	0.55 to 0.78
75 and over	2.48	2.08 to 2.96	0.70	0.57 to 0.86
Gender: female versus male	1.03	0.93 to 1.14	1.62	1.45 to 1.81
Education: secondary school degree versus lower diploma	0.65	0.59 to 0.72	1.00	0.90 to 1.11
Government-funded insurance (vs regular health insurance)	1.38	1.15 to 1.65	1.42	1.19 to 1.70
Diseases of the musculoskeletal system	2.31	2.08 to 2.57	0.95	0.85 to 1.06
Cardiovascular diseases	1.22	1.08 to 1.38	0.84	0.73 to 0.96
Anxiety, depression and sleep disorders	0.99	0.88 to 1.11	3.58	3.22 to 3.98
Diseases of the respiratory system	1.03	0.91 to 1.18	0.91	0.80 to 1.04
Obesity and dyslipidaemia	0.79	0.67 to 0.94	0.93	0.78 to 1.11
Diabetes, thyroid gland and other endocrine disorders	1.15	0.97 to 1.35	1.18	0.99 to 1.41
Diseases of the digestive system	1.01	0.86 to 1.19	1.15	0.89 to 1.38
Diseases of the genitourinary system	0.95	0.76 to 1.19	1.11	0.89 to 1.38
Diseases of the nervous system, head and neck	1.24	1.02 to 1.51	1.07	0.88 to 1.31
Skin and subcutaneous tissue diseases	0.68	0.51 to 0.90	0.92	0.71 to 1.19
Bacterial, viral and parasitic systemic diseases	1.17	0.89 to 1.54	1.12	0.86 to 1.48
Injury and poisoning	1.88	1.52 to 2.33	0.80	0.61 to 1.03
Other diseases (cancer and infrequent diseases)	1.73	1.38 to 2.16	1.35	1.06 to 1.72

\*aOR, adjusted odds ratio.

calibration.<sup>28</sup> For instance, patients registered by health insurance as eligible to the ‘longstanding disease’ programme accounted for 28% in the EPI3 survey, which is very similar to the 27% in national census among GP patients.<sup>28</sup>

Our study also had several limitations. First, as outlined earlier, requirement to collect very specific data was quite intrusive, leading to a relatively low response rate from the GPs. However, stratified recruitment phases and sample sizes from both GPs and patients highly representative of national standards ensured strong external validity of the results. Second, we did not include an assessment of home consultations, common among GPs in France,<sup>27</sup> which could have led to an underestimation of burden of disease. Finally, a multiplicative effect of morbidity which has been found to be associated with QOL impairment was not assessed in our study. Some authors suggested using severity scores to complement the information on morbidity<sup>12 13</sup> and assess the impact of multimorbidity, which have already been tackled here but will be the subject of further development in future research within the EPI3 research project. It was a deliberate choice to provide an instant overview of general practice across France and the burden of a large pattern of diseases on patients’ QOL as

shown in previous studies which also described an independent effect of diseases on QOL.<sup>9–11</sup>

### CONCLUSION

The EPI3 survey is the first nationwide study to report reference values for the burden of 100 different diseases in general practice, collected from a large representative sample of patients attending primary care practices. Our findings suggest that mental impairment may be underestimated in general practice. Ongoing development of healthcare policies and clinical guidelines on the treatment of diseases should rely on a direct assessment of QOL and morbidities in GP medical practices.

GPs foster continuous care, sometimes requiring highly specialised therapy to deal with comorbidities and complex situations. The present study shows that the burden of diseases in primary care is high but also can be diverse. The EPI3 survey provides information on the overall burden of diseases in general practice along with the QOL of patients regarding comorbidities as seen in this healthcare setting. This information is of great value to public health and economic assessment of healthcare, at a time when QOL is becoming a prevalent factor for care delivery and the development of clinical practice guidelines.

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**Ethics approval** Ethics approval was provided by French data protection authority ('Commission Nationale de l'Informatique et des Libertés').

**Contributors** The work presented here was carried out with the involvement of every author. LGB, BB, FL, FR, JM, DG, BA, GD, AMM, MR and LA conceived both the research theme and the methods, analysed the data and interpreted the results. LGB implemented the trial in France, analysed the data, and together with FL, and LA drafted and revised the paper. All members of EPI3-LASER group designed the study. FL and LA analysed the data. All authors have contributed to, read and approved the final manuscript.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** No additional data available.

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STROBE Statement—Checklist (*cross-sectional studies*): ‘Benchmarking the burden of 100 diseases: results of a nationwide representative survey within general practices’ by Lamiae Grimaldi-Bensouda et al.

	<b>Item No</b>	<b>Recommendation</b>	
<b>Title and abstract</b>	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	✓
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	✓
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	✓
Objectives	3	State specific objectives, including any prespecified hypotheses	✓
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	✓
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	✓
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	✓
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	✓
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	✓
Bias	9	Describe any efforts to address potential sources of bias	✓
Study size	10	Explain how the study size was arrived at	✓
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	✓
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	✓
		(b) Describe any methods used to examine subgroups and interactions	✓
		(c) Explain how missing data were addressed	N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(e) Describe any sensitivity analyses	N/A
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	✓
		(b) Give reasons for non-participation at each stage	✓
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	✓
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15*	Report numbers of outcome events or summary measures	✓

Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(b) Report category boundaries when continuous variables were categorized	N/A
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	✓
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	✓
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	✓
Generalisability	21	Discuss the generalisability (external validity) of the study results	✓
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	✓

Symbols: ✓, checked; N/A, not applicable.

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).