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Asthma in France in 2006: Prevalence and Control of Symptoms

Anissa Afrite, Caroline Allonier, Laure Com-Ruelle, Nelly Le Guen
With the collaboration of Isabella Annesi-Maesano[1], Marie-Christine Delmas[2], Claire Furhman[2], Bénédicte Leynaert[3]

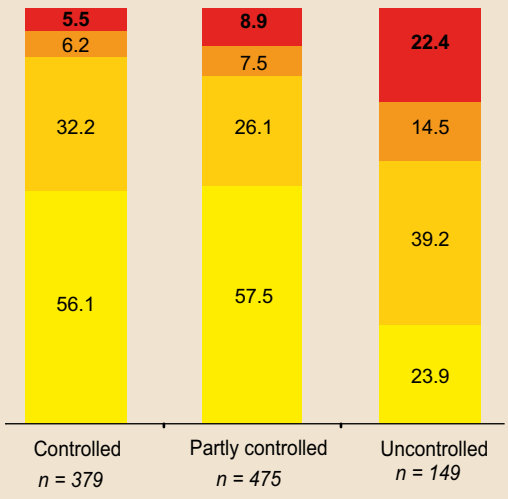
In 2006, 6.25 million people in metropolitan France reported having had asthma at least once during their lifetime, and among these, 4.15 million, *i.e.* 6.7% of the population, continued to live with it. Overall, men were as much concerned by asthma as women, but with differences according to age. Less than half of asthmatics were administered controller medications to control and reduce the intensity of symptoms related to the bronchial hyperresponsiveness which is a characteristic of this chronic disease.

Asthma symptoms were inadequately controlled for six out of ten asthmatics: 46% of asthmatics are partly controlled and 15% completely uncontrolled. Among the completely uncontrolled asthmatics, one quarter did not follow any long-term daily treatment.

Ceteris paribus, being obese, current smoking, living in a low-income or single-parent household increases the risk of having uncontrolled asthma.

These results are drawn from the French Health, Health Care and Insurance survey (ESPS*) which is carried out on the general population. The 2006 Survey included a specific set of questions on asthma designed to identify asthmatics and assess the level of control of symptoms.

Distribution of treatment steps according to the level of asthma control



Reading guide: among the 379 individuals having controlled asthma, 56.1% only take as-needed reliever medication (step 1); 32.2% have step 2 controller medication; 6.2% have step 3 controller medication and 5.5% have step 4 or step 5 controller medication.

Field: people who reported having suffered from asthma or taken medications for asthma over the twelve months prior to the survey and for whom a level of asthma control and treatment step could be estimated (according to the GINA 2006 criteria).

Source: IRDES, data: ESPS 2006

As in many countries, asthma appears a major public health issue in France given its frequency, symptom intensity, associated morbidity, mortality and induced economic burden. For this reason, asthma was considered as a public health priority in the public health law of 9 August 2004: the objective was to reduce by 20% the frequency of asthma attacks requiring hospitalization from 2004 to 2008.

Asthma is a chronic inflammatory airways disease, characterised by airway hyperresponsiveness, whose etiology is still poorly understood. It manifests itself by variable symptoms, most often wheezing, breathlessness or coughing, which occur more often at night and can be caused or triggered by a wide range of factors: a hereditary dimension, endogenous risk factors (hormonal, psychological, digestive) and exogenous risk factors (allergens, physical exercise, air pollution, smoking, meteorological factors, viruses). Asthma treatment aims to reduce or eliminate these symptoms and consists of an overall medication and education plans combining the avoidance of factors that trigger attacks, a daily treatment (long-term treatment in the case of persistent

[1] National Institute for Health and Medical Research (INSERM*) Unity 707
[2] National Institute for Public Health Surveillance (InVS*)
[3] INSERM Unity 700

asthma) or else as-needed treatment (in the case of intermittent asthma), and therapeutic education.

Asthma prevalence has increased over the last few decades in all the industrialised countries. In France hospitalizations for asthma have decreased since 1998 for adults, but they have risen for younger children. And, as for asthma-related mortality, after stagnating during the 1990s, it has fallen noticeably since 2000, particularly among adolescents and young adults (less than 45 years old)[1].

These indicators show that asthma management has improved, but remains inadequate, despite the existence of effective medication.

Asthma control has become the central concept in the management of asthmatics: guidelines framing asthmatics' management and assessment of the level of the control of symptoms have been issued in 2004 by the French National Authority for Health (HAS*) and then in 2006, by the Global Initiative for Asthma (GINA) on an international level. For the first time in France, among the general population, our study assesses the level of asthma control according to these official criteria, compares it to the patient's treatment step and links it to the individual characteristics of the patients.

Nearly 7% of the French population is asthmatic

According to the 2006 ESPS Survey, the prevalence of current asthma (*i.e.* people having suffered from asthma or having a treatment for asthma during the twelve months prior to the survey) was estimated to be 6.7% [6.4–7.1][2]. The prevalence of cumulative asthma (people having suffered from asthma at least once during their lifetime) was 10.2% [9.7–10.6]. In 1998, these prevalence were lower, respectively 5.8% [5.5–6.2] and 8.2% (*Cf.* Graph p. 3). Our study therefore reveals an increase in the prevalence of reported asthma that two potential contributing factors may only partially explain: firstly, doctors' better identification of the disease and patients' better acceptance of the diagnosis and, secondly, slight questioning differences between 1998 and 2006.

Overall, men are as much concerned by asthma as women. However, there are variations when age is taken into account. For the under-15s, asthma is more common among boys than girls and when considering the 5 to 10 age range, they are, respectively, nearly 10% and only 6%. Above this age, women are more likely than men to report asthma. The prevalence decreases for individuals aged up to 50 years, and then rises again to 7.8% for those aged 65 or over. The same tendency, with a sex-ratio inversion towards puberty, was observed in 1998, but with a less pronounced increase in the oldest age range.

1 *Cf.* L'état de santé de la population en France, rapport 2007, Indicateurs associés à la Loi relative à la politique de santé publique, report directed by Ministry of Health Directorate for Research, Analysis, Assessment and Statistics.

2 The confidence intervals at 95% [in square brackets] indicate the estimations of prevalence.

BACKGROUND...

Asthma is a major public health problem in France. The rise in asthma prevalence over the last twenty years appears to be essentially due to cases of intermittent asthma. Furthermore, despite effective and available medication, there are still cases of non controlled moderate to severe asthma whose determinants need to be understood. The French National Authority for Health (HAS*) in 2004 and the Global Initiative for Asthma (GINA) on international level, in 2006, both issued guidelines for asthma management and assessment of the level of asthma control. In 1998, the IRDES carried out a first assessment, through its Health, Health Care and Insurance survey (ESPS*), in order to estimate the overall asthma prevalence and its distribution according to stages of severity. In 2006, the IRDES performed a new assessment by taking into account the evolution of the concepts in the asthmatics management and focused its analysis on the level of asthma control and its determinants.

This study has been conducted through a partnership with the National Institute for Health Surveillance (InVS*), AstraZeneca and Novartis.

DATA

Presentation of the French Health, Health Care and Insurance survey (ESPS)

Survey objectives

Since 1988, the Health, Health Care and Insurance survey (ESPS*) provides information on metropolitan French population's health status, utilization of healthcare services and health insurance. Thanks to its frequency, scope and longitudinal dimension, ESPS Survey participates in evaluating health policies, monitoring of public health problems within the general population and research in the field of health economics.

ESPS Survey is drawn from sample composed of compulsory insured persons. This procedure makes it possible notably pairing the survey data with those from Health Insurance benefit files, thus providing very accurate and detailed knowledge of health care consumption, both in terms of volume and expenditure.

The sampling method guarantees constant representativeness of the population in metropolitan France through time. Consequently, it permits to display a regular picture of health healthcare consumption and complementary health insurance as well as monitoring individual health care itineraries through time.

New questions and first results in the 2006 survey

In 2006, the ESPS survey interviewed 8,000 households and 22,000 individuals. In addition to a standard socio-demographic questionnaire, ESPS survey gathers very detailed information on health status, the patients' experience in the health care system, complementary insurance and other dimensions of socioeconomic status.

In 2006, new questions were added to the survey. Among those, a section on respiratory health drafted with the help of the ministerial Asthma Plan's working group, which is in charge of monitoring asthma prevalence and is steered by the National Institute for Health Surveillance (InVS*). It is intended to identify asthma sufferers and clinical severity of the asthma. The aim is to understand the changes in overall prevalence of the disease and of its levels of severity since 1998 — the date of the last specific questionnaire on asthma—, to study its social and environmental determinants and, lastly, to assess the level of control of asthma symptoms, in other words evaluate whether the effective treatments match national and international medical guidelines.

METHOD

Identification of asthmatics and treatment steps in the 2006 ESPS survey

Identification of asthmatics

Are considered asthmatics all respondents who reported having had at least one asthma attack or manifestation, or else having treated their asthma either both during the twelve months prior to the survey. The studied sample comprises 1,076 asthmatics.

Determination of treatment steps

To determine the patients' treatment step, we take into account their usual frequency of antiasthmatics use (daily or as–needed basis), together with the nature and dosage of each of the medications taken the day prior to the survey (essentially corticosteroids and bronchodilators, *Cf.* GINA 2006). By crossing these two elements of information we can establish patients' treatment step. When the information about the medications taken the day prior to the survey is missing, we allocate the patient with the lowest treatment step by default.

A poorer health status among asthmatics

Asthmatics aged 16 or over report poorer health status than non-asthmatics: 38% consider their health status average, poor or very poor, compared to one out of five non-asthmatics; this phenomenon is more pronounced among women, nearly half of whom consider themselves to have poor health status. This result is confirmed for comparable age and sex, with asthmatics being more likely to consider having poorer health status (odds ratio (OR) = 2.5).

Likewise, nearly three out of ten asthmatics (28%) feel that they are limited or very limited in their daily-living activities, compared to 14% of non-asthmatics. For comparable age and sex, they are more likely to see themselves as being limited (OR = 2.2) or very limited (OR = 3.0).

Asthmatics' poorer health status can be explained by the presence, besides the asthma itself, of more numerous comorbidities than for non-asthmatics.

More numerous associated diseases

All ages considered, nearly 20% of asthmatics report suffering from depression and/or anxiety, compared to 13% of non-asthmatics. Asthmatics are also more likely to report eczema (10% compared to 5% of non-asthmatics) or allergic rhinitis (more than one quarter, compared to 5%), underlining the frequent context of atopy (the tendency to present a certain number of clinical manifestations on contact with allergens that are inoffensive for normal subjects). Indeed, atopy is one of the main risk factors involved in the onset of asthma.

Asthmatics are also more likely to report gastro-oesophageal reflux (11% versus 6%) and are more often obese (BMI[3] ≥ 30 kg/m²) (16% *versus* 10%).

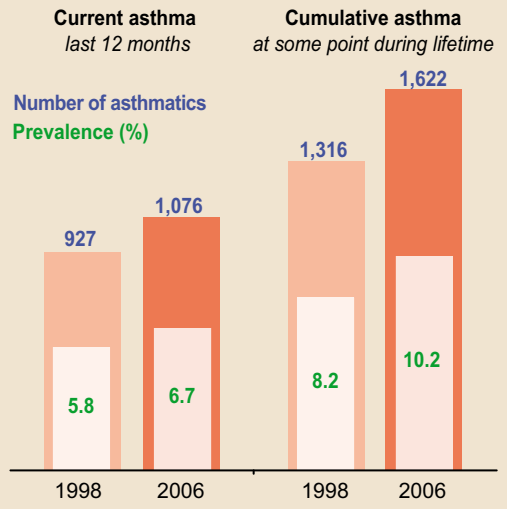
This comorbidity adds to the disease's clinical signs which, if poorly controlled, can considerably harm asthmatics' quality of life and even jeopardize their vital prognosis. On the clinical level, it is therefore important to take into consideration the level of control of symptoms when adapting the therapeutic strategy of a patient over time.

3 The body mass index (BMI) is the ratio of weight (in kilos) to the square of the height (in metres). A person is considered over/weight if their BMI lies between 25 kg/m² and 30 kg/m2; they are obese if their BMI is equal to or greater than 30 kg/m². For under-18 year-olds, the norms also take age into account.

Asthma classification based on the level of control

Until now, asthma management was based on a progressive four-level severity classification of the disease: intermittent, mild persistent, moderate persistent and severe persistent. A treatment corresponding to each of these pre-identified levels was adapted and graduated with the aim of relieving the symptoms as much as possible. The latest guidelines both on national-level (HAS, 2004) and international-level (GINA, 2006) drop that concept of intrinsic severity and focus instead on asthma control, which is patients' intensity of the clinical signs during consultation, in other words asthma's residual signs while the patient is most likely already being treated (*Cf.* box above). Ideally, compliant patients (following medical and environmental instructions to the letter) who respond well to a suitable treatment should no longer exhibit any clinical signs, or only negligible symptoms. In this case, the asthma is said to be controlled. In practice, it is not always possible to gather all the required conditions to achieve asthma control, and a certain number of patients present more or less intense symptoms. In other words, their asthma is not controlled, exposing them to exacerbations with the risk of hospitalization, or even death. The objective of asthma management is therefore to improve this control by

Current and cumulative asthma's prevalence rates. Evolution from 1998 to 2006



Reading guide: In the 2006 ESPS survey, 1,622 respondents reported having suffered from asthma at some point during their lifetime and 1,076 reported having suffered from asthma within the last twelve months.

Treated as a percentage of the whole population, these numbers enable us to calculate the prevalence rates of current and cumulative asthma: 6.7% and 10.2% respectively.

Source: IRDES, data: 2006 ESPS survey

METHOD

Asthma classification according to the level of control in the 2006 ESPS survey

The classification of asthma according to the level of control is evaluated following the guidelines issued by the Global Initiative for Asthma (GINA), revised in 2006. The 2006 ESPS survey does not provide data on the need for rescue treatment or basic lung function tests. We assess the notion of exacerbation in terms of visits to a doctor or casualty department and/or hospitalization on the occasion of an asthma attack. The classification presented below takes all these aspects into account.

Level of control	Classification rules	Clinical signs experienced over the last 12 months
Controlled	4 criteria	Daytime symptoms[a]: None or "< once a week" Nocturnal symptoms[b]: None Limitations of activitivities[c]: None Exacerbations[d]: None
Partly controlled	1 or 2 criteria OR	Daytime symptoms: "≥ once a week but < once a day" Nocturnal symptoms: from "< twice a month" to "2 to 4 times a week" Limitations of activities: Yes
	1 criterion	Exacerbations: Yes
Uncontrolled	3 criteria OR	Daytime symptoms: "≥ once a week but < once a day" Nocturnal symptoms: from "< twice a month" to "2 to 4 times a week" Limitations of activities: Yes
	1 criterion	Daytime symptoms: "About once a day" or "All the time" Nocturnal symptoms: "Almost every night"

Questions concerning asthma in the 2006 ESPS Survey

a. Over the last twelve months, how often have you had breathing difficulties because of your asthma?
b. Over the last twelve months, how many times have you woken up in the night because of your asthma?
c. Have these discomforts been serious enough to limit your physical activity (walking, sport, etc.)?
d. Over the last twelve months, how many times have you been to the doctor or casualty department on the occasion of an asthma attack?
Or:
Over the last twelve months, have you been admitted to hospital because of an asthma attack?

adapting the medication according to progressive treatment steps (*Cf.* box on p. 3) and using educational and curative corollary measures, with planned clinical monitoring of greater or lesser frequency.

Of course, the concepts of severity and control are still connected. Control is all the more difficult to achieve, and the therapeutic load (or treatment step) required is all the stronger when the intrinsic severity of the asthma (before treatment) is high and the etiological factors or triggers are complex, or even unknown.

Practitioners find this "asthma control" concept easier to implement for monitoring asthmatic patients, moreover it has several advantages that should favour its integration in medical practice, not only by the doctors but also by the patients. The degree of disease activity is assessed over a short time period (between one week and three months) before the consultation. The assessment is based on a score integrating presence or absence of simple clinical signs (frequencies of daytime and nocturnal symptoms, limitation in daily-living activities, frequency of exacerbations), aspects of treatment (the need to use rescue treatment) and basic lung function data (lung function tests performed by specialists or Piko-6 measures realised by general practitioners). These clinical signs are the same as those used previously to assess asthma severity. The most recent guidelines recommend a classification of asthma by three level of control: "controlled", "partly controlled" and "uncontrolled", according to GINA 2006 (*Cf.* box above), or "optimal", "acceptable" and "unacceptable" control, according to HAS 2004.

In the present study, we assess the level of asthma control according to the international criteria defined by GINA 2006, which is the most recent classification currently available (*Cf.* box above).

Six out of ten asthmatics have inadequately controlled asthma

According to GINA 2006, among people who lived with asthma at the time of the survey, only 39% of them had their asthma controlled. For 46% it was partly controlled and for 15% it was uncontrolled.

For reference, the 2004 HAS guidelines produce a more pessimistic assessment of the distribution of asthma control: only 17% of patients are under "optimal" control, 48% are under "acceptable" control and 35% are under "unacceptable" control . The differences between these classifications stem from HAS' stricter criteria. They are, nevertheless, consistent with each other: all the asthmas defined as non-controlled with the GINA classification are equally so with the HAS classification.

In the rest of this study, we shall most often aggregate "partly controlled asthmas" and "uncontrolled asthmas", and refer to this composite group as "inadequately controlled asthmas". The determinants of asthma control are studied with an analysis restricted to asthmatics aged sixteen or over.

Being 40 or more increases the likelihood of having an inadequately controlled asthma

Asthma prevalence varies with age, rising for people aged 65 or over. The age factor is also correlated with the control of symptoms. Among inadequately controlled asthmatics, there are more people aged 40 or over (62%) than among controlled

Univariate analysis: comparison of distributions according to the individual characteristics of patients with controlled and inadequately controlled asthma

	Distribution of asthmatics				Propensity to be IC vs. C
	Controlled (C)		Inadequately controlled (IC)		
	Number	%	Number	%	Odds ratio
Age					
16 to 39 years old	*157*	*47.6*	*191*	*38.1*	*Ref.*
40 to 64 years old	108	31.1	193	38.6	**1.47****
65 years and over	60	21.3	98	23.3	1.34
Sexe					
Male	*155*	*46.8*	*211*	*41.1*	*Ref.*
Female	170	53.2	271	58.9	1.17
Monthly income of household per consumption unit					
Less than € 550	26	9.9	67	15.2	**2.15*****
From € 550 to € 839	61	22.1	111	26.3	**1.52****
From € 840 to € 1,299	100	33.8	117	27.6	0.98
More than €1,300	*97*	*34.2*	*116*	*30.9*	*Ref.*
Unknown	41	-	71	-	-
Level of education					
No schooling, nursery school, primary school	55	19.9	111	25.8	**1.72****
1st cycle: 1st to 4th year of secondary school, CAP and BEP (≈ National Vocational Qualification)	81	23.3	147	28.6	**1.55****
2nd cycle: 5th year to Technical or General Baccalaureate	40	12.0	54	10.9	1.15
Higher education	*92*	*27.8*	*108*	*22.6*	*Ref.*
Other	57	16.9	62	12.1	0.93
Profession of householder					
Farmer	22	7.1	19	3.7	0.80
Craftsman, shopkeeper	24	7.4	39	8.1	1.50
Manager and intellectual profession	*59*	*19.0*	*64*	*12.9*	*Ref.*
Intermediate profession	68	19.9	90	19.0	1.22
Office employee, skilled worker	105	31.9	188	39.1	**1.65****
Shop employee, unskilled worker	39	14.8	79	17.2	**1.87****
Unknown	8	-	3	-	-
Type of household					
Single person	*42*	*23.1*	*50*	*19.0*	*Ref.*
Single-parent family	14	4.1	36	7.2	**2.16****
Couple without children	86	25.5	135	27.8	1.32
Couple with one or more children	174	44.9	237	41.7	1.14
Other	9	2.5	24	4.4	**2.24***
Smoking status					
Current smoker	76	23.7	119	25.6	1.12
Former smoker	70	22.7	106	23.4	1.08
Never smoked	*166*	*53.6*	*233*	*51.0*	*Ref.*
Unknown	13	-	24	-	-
Body mass index					
Normal weight or underweight	*188*	*60.0*	*228*	*48.3*	*Ref.*
Overweight	86	26.2	153	32.3	**1.47****
Obese	41	13.8	89	19.4	1.79***
Unknown	10	-	12	-	-
Number of observations	**325**		**482**		

Description: the table presents the distribution of asthmatics with controlled and inadequately controlled asthma (columns 2 and 4 respectively) according to their individual characteristics, together with the odds ratio expressing the propensity of asthmatics to have inadequately controlled asthma rather than controlled, for each situation studied compared to a reference situation (column 5). The references are printed in italics. Level of significance of the P-value: *** = 1%; ** = 5%; * = 10%.

Interpretion guide : the value of the odds ratio 2.15, given in the fifth column of the income line "Less than €550", means that for an asthmatic living in a household with a monthly income of less than 550€ per consumption unit (€/CU), the likelihood of being "inadequately controlled" (Pic) rather than controlled (Pc) is 2.15 times higher than it is for the reference category (people living in a household with income of €1,300/CU or more): [Pic / Pc]< €550/CU = 2.15*[Pic / Pc]≥ €1,300/CU.

Field: asthmatics aged 16 or over for whom a level of control could be evaluated (according to the GINA 2006 criteria).

Source: IRDES, data: 2006 ESPS survey

asthmatics (52%). Thus, compared to a younger asthmatic, one aged between 40 and 64 is more likely to have an inadequately controlled asthma than a controlled one (OR = 1.5) (*Cf.* table opposite).

More women than men have inadequately controlled asthma (59% *versus* 41%). However, gender has no significant influence on the likelihood of being inadequately controlled rather than controlled.

Asthmatics with inadequately controlled asthma are more likely to be overweight or obese

More than one out of six asthmatics is obese: 16% compared to 10% of the non-asthmatic population. And the prevalence of asthma is higher among obese people than among the others: 10.2% compared to 6.9% among overweight people and 6.3% among normal weight or underweight people.

Moreover, people with inadequately controlled asthma are more likely to be overweight (32%) or obese (19%) than people with controlled asthma (26% and 14% respectively). So the greater the weight excess, the weaker the asthma control: compared to asthmatics of normal weight or underweight, overweight asthmatics have a higher risk of having their asthma being inadequately controlled rather than controlled (OR = 1.5); this risk is higher for obese asthmatics (OR = 1.8).

Overall, asthmatics smoke as much as non-asthmatics

Among people aged 16 or over, one out of four is a smoker, one out of four is a former smoker and two out of four have never smoked. The proportions are approximately the same among asthmatics. Therefore, asthmatics appear to smoke as much as non-asthmatics, at least when we do not take into account the number of daily cigarettes smoked. Actually, asthma prevalence among 16 year-olds or over varies very little with smoking status. Overall, and without prejudging the severity of the symptoms, the prevalence rate is 6.3% among current smokers and 6.1% among former smokers, rising, however, to 7.1% among those who have never smoked. This suggests that having asthma dissuades some people from smoking. For comparable age and sex, however, there is no significant difference.

And yet, if smoking is not in itself a cause of asthma, it is an aggravating factor. What can we say about its effect on the control of symptoms? Whether we consider controlled asthmatics or the composite group of "inadequately controlled asthmatics", nearly one in four is a current smoker, more than one in five is a former smoker and the remainder has never smoked. There is

METHOD

Statistical methods

Comparative analysis of asthmatics and non-asthmatics' characteristics

A dichotomous logistic regression model allows estimating the likelihood of being asthmatic *versus* non-asthmatic as according to each of individual characteristic, controlling for the variables "sex" and "age".

Study of the links between level of control and asthmatics' characteristics

A first analysis, using a dichotomous logistic regression model, allows estimating the likelihood of an asthmatic to be inadequately controlled *versus* controlled according to each of his individual characteristics (*Cf.* table, p. 5).

A second analysis, using an unordered polytomous logistic regression model, allows to estimate, *ceteris paribus*, and notably controlling for the variables "age", "sex" and "treatment step", the likelihood for an asthmatic, firstly to be partly controlled *versus* controlled, and secondly, to be uncontrolled versus controlled, controlling for each of the following variables: household income per consumption unit (CU), type of household, smoking status and body mass index (*Cf.* table, p. 7).

The main interest of logistic regression is that it produces odds ratios (OR) quantifying the strength of the association between each level of asthma control studied (for example, inadequately controlled asthma *versus* controlled asthma, in the first analysis) and the different factors that are likely to influence it (for example, an income of less than €550/CU), compared to a reference situation (in this example, the reference is an income above €1,300/CU). The direction of the association is defined by comparing the OR value to 1 (which is the value of the odds ratio corresponding to the reference, here ≥ € 1,300/CU). If the odds ratio of the situation being studied (< €550/CU) is greater than 1, then this situation increases the likelihood of being "inadequately controlled" rather than "controlled" (in the first analysis) or of having an asthma partly controlled or uncontrolled rather than controlled (in the second analysis).

Field

The descriptions concerning prevalence and asthmatics' characteristics cover all–age individuals and only include people aged 16 or over for the variables: perceived health status, limitation of activity and smoking status.

The distribution of level of control, based on GINA 2006 and HAS 2004 criteria, concerns all the asthmatics for whom it has been possible to evaluate a level of control.

The descriptions of asthmatics by level of control and the associated analyses only include the 16 year-olds or over for whom it has been possible to determine a level of control.

no significant difference between the two populations. So at first sight, when we group together the partly controlled and the uncontrolled asthmatics, smoking does not appear to have an impact on the control of symptoms. More detailed analysis, however, does reveal a specific effect of smoking, but only on uncontrolled asthma (*Cf.* below and table, p. 7).

The most underprivileged categories combine higher prevalence and worse control

ot only do the most underprivileged social categories suffer more from asthma, but they are also much more likely to be inadequately controlled. The prevalence rate for asthma is 9.7% among people with a monthly household income of less than €550/CU , compared to 5.8% for those with an income of €1300/CU and above. In addition, inadequately controlled asthmatics are more numerous among the households with the lowest incomes (15% compared to 10% of controlled asthmatics). The risk of being inadequately controlled clearly increases as the level of financial resources falls: it is highest for the low incomes (< €550/CU: OR = 2.15) and remains relatively high for incomes between € 550 and €840/CU (OR = 1.52).

Asthma prevalence is also higher (8.2%) among people with a low level of education that are those who have had no secondary schooling. In addition, about one quarter of them is inadequately controlled (26%, *versus* 20% among asthmatics who are controlled). Compared to people who have received higher education, this population of asthmatics has a higher risk of being inadequately controlled (OR = 1.72) as does the group of those who have received secondary schooling (OR = 1.55). Employees and workers are also more likely to be inadequately controlled (OR = 1.65 and 1.87) compared to executives and intellectual professions.

Lastly, an asthmatic living in a single-parent family is more likely to be inadequately controlled (OR = 2.16) compared to an asthmatic living alone.

A therapeutic load that is sometimes inadequate

To achieve control of clinical signs of different intensities, *i.e.* depending on the level of control of symptoms, different classes of medications with progressive dosages are indicated. The presence of inadequate control therefore raises the question of the medications taken and whether or not they are adequate.

The classification of asthma into treatment steps used in this study is also based on the GINA 2006 guidelines. This international consensus recommends using a five-step treatment strategy, reflecting a gradual increase in the intensity of the therapeutic load, in terms of dosage and/or number and type of medications needed to control the symptoms (step 1: treatment with an as-needed reliever medication without any controller medication; steps 2 to 4: more or less important daily need for inhaled corticosteroids, with or without other additional medications; step 5: systemic corticosteroids). This definition of increasing treatment steps corresponds to the gradual intensification of clinical signs (*Cf.* box, p. 3).

According to this classification, and without regards to the clinical signs, 53% of asthmatics only take reliever medications (step 1: justified solely in the case of intermittent asthma) and only 47% take a controller medication: 30% are on step 2, 8% on step 3 and 9% on steps 4 or 5, testifying to a "severe" disease. Thus, in our sample, the prevalence of asthmatics only taking reliever medication is 3.4%, and the prevalence of those taking controller medications is 1.9% for step 2, 0.5% for step 3 and 0.6% for steps 4 and 5.

The therapeutic load identifies the degree of drug management; it also

helps to assess the level of asthma activity, although it is not sufficient in itself because it does not always follow the guidelines.

Very often, the medication is inadequate

As expected, the more the level of control is inadequate, the more the share of asthmatics daily delivered with corticosteroid treatment in high doses (steps 3, 4 and 5) increases (*Cf.* Graph p. 1). However, nearly three out of ten inadequately controlled asthmatics only take reliever medications (step 1) whereas the intensity of their symptoms would require a controller medication (steps 2 to 5). Among uncontrolled asthmatics, 24% do not take a controller medication (step 1), although it should be taken in every case (this proportion rises to 58% among partly controlled asthmatics), and more than one out of two takes a controller medication that is inadequate, given the intensity of their symptoms or the level of control (39% are on step 2 and 14.5% on step 3). Lastly, despite being on the highest treatment steps (4 or 5), 22% of asthmatics remain uncontrolled, testifying to a severe asthma not responding satisfactorily to the medications (refractory asthma).

Among the controlled asthmatics, on the other hand, if 56% are controlled solely by reliever medication, testifying to an intermittent asthma, 44% are controlled by an effective controller medication of one strength or another, 5.5% on step 4 or 5, reflecting an asthma that would exhibit strong clinical signs if untreated. This interpretation is made under the hypothesis of the absence of medication overload, a reasonable hypothesis given the low percentage of steps 4 and 5 among inadequately controlled asthmas.

On the whole, if an inappropriate treatment step reduces the level of asthma control, then besides the question of medical practices, the question also arises of individual factors relating to the patient. We have identified factors that influence this control on an individual basis, and we shall verify, *ceteris paribus*, the specific effect of each of these characteristics.

Modelling of the likelihood of being partly controlled or uncontrolled according to individual characteristics

Reference: "controlled asthma"	Propensity for an asthmatic to be: partly controlled rather than controlled	Propensity for an asthmatic to be: uncontrolled rather than controlled
	Odds ratio	Odds ratio
Household monthly income per consumption unit		
Less than € 550	**1.73***	**3.13*****
From € 550 to € 839	**1.59***	1.07
From € 840 to € 1,299	1.01	0.64
More than € 1,300	*Ref.*	*Ref.*
Unknown	1.43	1.01
Type of household		
Single person	*Ref.*	*Ref.*
Single-parent family	1.69	**4.52*****
Couple without children	1.23	**2.01***
Couple with one or more children	1.26	1.97
Other	1.34	**9.30*****
Smoking status		
Current smoker	1.05	**1.79***
Former smoker	0.91	1.23
Non smoker	*Ref.*	*Ref.*
Body mass index		
Normal weight or underweight	*Ref.*	*Ref.*
Overweight	1.28	**1.64***
Obese	1.23	**2.39*****
Adjustment statistics		
-2 Log L (constant)	1665.26	
-2 Log L (constant and co-variables)	1505.33	
Number of observations	**807**	

Description: the table presents the odds ratios measuring asthmatics' propensity to have their asthma partly controlled rather than controlled (column 1), and uncontrolled rather than controlled (column 2), each situation studied is compared to a reference situation, *ceteris paribus*, and controlling for the variables "sex", "age" and "treatment step". The reference situations are printed in italics. Level of significance of the P-value: *** = 1%; ** = 5%; * = 10%.

Interpretation guide: the value of the odds ratio 3.13, indicated in the second column along the income line "less than €550", means that for an asthmatic living in a household with an income of less than €550 per consumption unit, the likelihood of being uncontrolled (Pnc) compared to that of being controlled (Pc) is 3.13 times higher than the same likelihood for the category of asthmatics living in households with an income of €1,300/CU or more (the reference category):

[Pnc / Pc]< €550/CU = 3.13*[Pnc / Pc]≥ €1,300/CU, *ceteris paribus*.

Field: asthmatics aged 16 or over for whom a level of control could be evaluated (according to the GINA 2006 criteria).

Source: IRDES, data: 2006 ESPS survey

The specific effect of asthmatics' individual characteristics on the level of control

We seek to highlight the specific effect that asthmatics' individual characteristics have on asthma control. What effects can be attributed to individual characteristics independently to treatment steps characteristics? The latter, being a conjoint expression of asthma severity, healthcare access and patients' non-compliance, have a direct influence on the level of asthma control.

At a given treatment step, poor asthma control in one category of the population reflects a higher severity of asthma in this category (as severe asthmas are difficult to control, even with a strong therapeutic load) and/or a mismatch between the therapeutic load and the level of symptoms.

From this standpoint, we analyse the effect of these characteristics on each of the three levels of asthma control: controlled, partly controlled and uncontrolled asthma (*Cf.* table p. 7).

Body weight and smoking influence the non-control of asthma

Ceteris paribus, individual factors of health risk increase the non-control of

asthma. Compared to an asthmatic with normal weight or underweight, an obese asthmatic has a higher risk of being uncontrolled rather than controlled (OR = 2.39). The same is true, to a lesser degree, for overweight asthmatics (OR = 1.64). Compared to non-smoking asthmatics, asthmatics who smoke are also more likely to be uncontrolled (OR = 1.79).

These effects are partly explained by the fact that people having risk factors develop a more severe asthma, hard to control. But it may also be the case that these people attach less importance to their health and are consequently less compliant (they do not follow medical instructions so well).

Low incomes and single-parent families increase the risk of being partly controlled or uncont

An asthmatic living in a very low-income household (< €550/CU) has a higher risk than one living in a high-income household (≥ €1,300/UC) of being partly controlled rather than controlled (OR = 1.73) and above all of being uncontrolled (OR = 3.13). For incomes within the range €550-840/CU this risk is limited to being partly controlled (OR = 1.59).

The family environment also affects the risk of not being controlled: *ceteris paribus*, an asthmatic living in a single-parent family is more likely than one living alone to be uncontrolled rather than controlled (OR = 4.52).

Knowledge of all these individual characteristics that affect the asthma control should help health professionals to improve the care management of asthmatic patients in order to prevent complications of this disease.

According to the ESPS survey, the 2006 overall prevalence of current asthma in France is 6.7%, in other words there are 4.15 million asthmatics. Six out of ten are inadequately controlled according to international guidelines: 46% partly controlled and 15% uncontrolled. In public health perspective, there has been a descrease in asthma-related mortalities and hospitalizations since the year 2000, but this study highlights the progress that still needs to be made to achieve better care management of this widespread chronic disease, by exploiting a number of levers.

From a medical standpoint, one measure would be to better adapt the treatment steps to the intensity of patients' symptoms, by ensuring that the current treatment is being respected and that inhaled treatments are being used effectively. What is needed is a global treatment strategy concomitantly treating the comorbidities and taking account of patients' socio-economic and family environment, the latter being individual risk factors of the disease and of poor control. This could be achieved by means of preventive actions and through a therapeutic education facilitated by better reimbursements by Health Insurance. Lastly, access to high-quality care should be improved, especially for asthmatics in the underprivileged social categories, inasmuch as they are often associated with inadequately controlled asthma.

These measures would help to reduce asthma-related hospitalizations and mortality, which would in turn reduce the global cost of this chronic disease for the health care system.

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See so

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GLOSSARY

- **Antiasthmatic:** anti-asthmatique
- **As-needed reliever medication:** traitement à la demande
- **Asthma management:** prise en charge de l'asthme
- **Controlled:** contrôlé
- **Control of symptoms:** contrôle des symptômes
- **Controller medication:** traitement de fond
- **Corticosteroids (corticoids):** corticoïdes
- **Cumulative asthma:** asthme cumulatif
- **Current asthma:** asthme actuel
- **Education plan:** éducation thérapeutique
- **(French) National Authority for Health (HAS):** Haute Autorité de santé (HAS)
- **Intermittent asthma:** asthme intermittent
- **Level of asthma control:** niveau de contrôle de l'asthme
- **Level of control:** niveau de contrôle
- **National Institute for Health and Medical Research (INSERM):** Institut national de la santé et de la recherche médicale
- **National Institute for Health Surveillance (InVS):** Institut de veille sanitaire
- **Partly controlled:** partiellement contrôlé
- **Persistent asthma:** asthme persistant
- **The French Health, Health Care and Insurance survey (ESPS):** Enquête santé et protection sociale (ESPS)
- **Therapeutic load:** charge thérapeutique
- **Treatment step:** palier de traitement
- **Uncontrolled:** totalement non contrôlé

IRDES INSTITUTE FOR RESEARCH AND INFORMATION IN HEALTH ECONOMICS - 10, rue Vauvenargues 75018 Paris
• Tél.: 01 53 93 43 02/17 • Fax: 01 53 93 43 07 • Site: www.irdes.fr • Email : diffusion@irdes.fr
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