

**RESIDENTIAL NUISANCE AND HOUSEHOLD HEALTH STATUS:  
MICRO EVIDENCE FROM CAMEROON****NUISANCES RESIDENTIELLES ET ETAT DE SANTE DES MENAGES  
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This paper analyse the impact of residential nuisance on household health status in Cameroon. Multivariate models are applied on data from the Cameroon Household Survey (CHS 3) carried out in 2007 by the National Institute of Statistics (NIS). The results show that the most perceptible nuisances are: household pests such as cockroaches and mice and noise from neighbours. These nuisances explain 64.26% of residential nuisance and weakly deteriorate household health. On the contrary, the least perceptible sets of nuisances: household pests such as insects, ants and mosquitoes and noise from the transport network and trading activities multiply the probability of the degradation of household health status by 1.96 and 1.08 times respectively. These results have important implications for the implementation of public health policies to reduce health hazards caused by residential nuisance in Cameroon.

**Keywords:** Residential nuisances, externalities, residential environment, household health status

**JEL Classification:** H51; I18;

## Résumé

Cet article évalue l'impact des nuisances résidentielles sur l'état de santé perçu des ménages au Cameroun. Les données utilisées sont issues de l'enquête camerounaise auprès des ménages (ECAM 3,2007). L'utilisation des modèles multivariés a permis, d'une part d'identifier les nuisances résidentielles les plus perceptibles et d'autre part d'évaluer leur impact sur l'état de santé des ménages. L'étude relève comme nuisances les plus perceptibles : la nuisance des cafards, la nuisance des souris et celle relative aux bruits des ménages voisins. Cet ensemble explique 64,26% de la variance de nuisance résidentielle. En termes d'impact sur l'état de santé, cet ensemble impacte faiblement la probabilité de détérioration de l'état de santé des ménages. À contrario, les deux ensembles de nuisances les moins perceptibles que sont : les insectes, les fourmis et les moustiques d'une part et les nuisances des bruits du réseau de transport et des bruits des activités de commerce d'autre part, multiplient respectivement par 1,06 et 1,08 fois la probabilité de dégradation de l'état de santé des ménages.

**Mots clés :** nuisances résidentielles, effets externes, environnement résidentiel, état de santé des ménages

**JEL Classification:** H51; I18

## 1. Introduction

The proposition that the health status of households is influenced by the behaviour of individuals and the supply of health services has reinforced the necessity to enlarge the scope of the analysis of the factors susceptible to influence the health of individuals. According to Schultz (1961), health is an element of human capital defined as a set of cognitive, physical, nutritional and biological aptitudes which reinforce human capacity. According to the world Health Organisation (WHO, 2010)<sup>1</sup>, housing is one of the essential social conditions that determine the quality of life and health of individuals. The idea is that, the environment in which we live can generate nuisances to the health of individuals. These nuisances are perceived as residential nuisances. In economic theory, residential nuisances refer to the concept of negative externalities (Marshall, 1890)<sup>2</sup>. In practice, residential nuisances occur as

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<sup>1</sup> In 1947, the world Health Organisation (WHO) believed that 'health is a complete state of physical, mental and social well-being and not only the absence of illness or infirmity'.

<sup>2</sup> Inspired by Marshall (1890), external effects are those exerted by economic actions on other actions or agents with prices not taking them into account. Two external effects with opposite consequences are commonly known. These are the positive external effect and the negative external effect. The positive external effect represents the gains of an economic agent from the activities of another agent. On the contrary, the negative external effects represent the costs that an economic agent can incur from the activity of another economic agent without integrating it into the price. Thus, two externalities can be

a result of the consumption and production activities carried out by households or firms (Beture, 1996; Feitelson, Hurd and Mudge, 1996; Kaufman and Espey, 1997; Schipper, Nijkamp and Rietveld, 1998). The non-respect of hygienic rules and industrial norms expose households to illnesses. One of the characteristics of urban and rural life in developing countries is that they mingle with promiscuity and multiple economic activities, which is not without consequences on the health of households.

Studies on the impact of residential environment on the health of households have been mainly carried out in America. Wilner (1956) establishes a positive correlation between inadequate conditions of cohabitation and the recurrence of several illnesses. The author highlights four groups of illnesses linked to the residential environment: illnesses of the digestive system, injuries caused by domestic accidents, skin infections and any deficiency caused by poor sanitation system, ventilation and deficient air conditions.

Following Wilner (1956), two sets of studies emerge. The first set of studies focus on the impact of housing as an isolated entity on the health of households. Dales et al. (1991) establish a positive relationship between exposure to humidity and the appearance of respiratory affections. Also, Tanaka et al (1996) find a positive relationship between the quality of housing and infant mortality and life expectancy. In the same vein, a Canadian study carried out by Lawrence et al (2001), shows that the probability that a child living in a humid house would contract bronchitis was 32% higher than for children living in clean houses. The quality of internal air also attracted some attention. The effects of elements such as smoke from tobacco and organic solvents were evaluated. The studies of Gergen (2001) and Chan-Yeung and Dimich-Ward (2003), establish a link between exposure to secondary smoke at home and poor health such as cancer of the lung in adults and insufficient weight at birth, asthma, bronchitis, pneumonia and ear infections in children. These studies reveal the vulnerability of poor households.

The second set of studies establishes the relation between external environment of housing and the health of individuals. As such, the neighbourhood effect was examined. The studies of Babisch (2014), Basner et al. (2015) and Ragettli et al. (2016) show that the particular effect

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distinguished, consumption externalities of some goods especially tobacco, noise, polluting waste. Production externalities resulting from the productive activities of the enterprise: the emission of polluting gas such as sulphur, pollution by soil nitrate and sewage water.

of noise from the transportation network can lead to serious health problems related to stress. The study of Yen and Kaplan (1999) reach the conclusion that the characteristics of the neighbourhood and the locality affect the health as well as the mortality rate of residents. The studies of Evans and Coll (2000) and those of Blackman and Harvey (2001) examine the joint effects of the quality of housing and the neighbourhood on the health of individuals. They establish a relationship between the improvement of mental health of residents and the improvement in the quality of housing and the neighbourhood.

The different studies presented above highlight the scarcity of such studies in the context of developing countries though the problem is not less prevalent. Moreover the housing environments in developing countries have other specificities. As such there exist other types of residential nuisances specific to these countries. The present study is a prolongation of the reflection on the impact of residential environment on the health status of households in developing countries and especially in Cameroon.

In Cameroon, reports on the health of individuals in the last few years clearly indicate that all Cameroonians do not benefit from the same level of health. According to the National Institute of Statistics (NIS, 2013), the health of individuals varies according to level of education, employment or income. Moreover, the last figures of the Poor Habitat Survey show that more than 70% of the Cameroonians live in poor housing conditions. This highlights the very precarious living conditions of the population. According to the world health organisation (WHO), the health of the population of developing countries stands at 70% due to their living conditions. This study therefore has as objective to evaluate the impact of residential nuisance on household health status in Cameroon. This study is of particular interest for at least two reasons:

Firstly, it extends the scope of the conceptual and analytical framework of the analysis of the consequences of residential nuisance. The approach adopted in this study goes beyond the study of the effects of sound pollution to consider other nuisances specific to developing countries.

Secondly, it fosters the debate on the determinants of the health status of households. This approach is interesting as it is based on a much more pertinent analytical model. Since most studies mentioned above simply establish the relationship between residential environment

and household health status, this study, goes further to establish the causal link. This approach therefore improves the efficiency of public health policy by properly informing policy makers.

The rest of this paper is organised as follows: the second section presents the methodology adopted. The third section presents and interprets the results obtained. The fourth section concludes the study.

## **2. Methodology**

A two stage methodology was employed to analyse the data used in this study. Factor Analysis was first used to determine the most perceptible residential nuisances faced by households in the study area. The second stage then consisted of modelling the determinants of household health status using Probit models.

### **2.1. Data and Variables**

The data used in this study is from the Third Cameroon Household Survey (CHS 3) carried out in 2007 by the National Institute of Statistics (NIS). The survey was based on the division of the country into relatively equal sizes known as zones. Two of these zones are analysed in this study namely the urban zones of Yaoundé and Douala. Two reasons justify the choice of these urban zones. The first is their cosmopolitan nature. These are zones of high demographic intensity which fundamentally expose the population to residential nuisances. The second reason is that, these zones are centres where economic, socio-cultural, political and many other activities are concentrated and this certainly generate residential nuisances. Using random sampling techniques, a sample of 6092 households was constituted.

Two types of Variables are used in this study: independent and dependent variables. The independent variables are divided into two groups. The first group captures the socioeconomic characteristics of households and the second group takes care of residential nuisances. The description of all these variables is carried out in Table A1 appendix.

The variables capturing residential nuisances received a twofold treatment. The first level of treatment considers them as ordinal variables with four dimensions: regularly, once in a while, rarely and never. This first treatment will permit the identification of the most perceptible nuisances. The second level of treatment considers these variables in a dichotomous form. As

such, two alternatives are possible: the prevalence or the non-prevalence of the nuisance. The prevalence of nuisance is coded 1 and non-prevalence 0. This second treatment orientates the problem of nuisance in terms of the probability of occurrence.

As for the independent variable, we retain as variable “household health status”. We retain two modalities of the variable: good health or bad health.

## **2.2. Modelling the effects of residential nuisances on household health status**

The main objective of this study is to analyse the impact of residential nuisances on household health status. In the literature, there are two methods of evaluating the health status of households (Currie and Madrian, 1999). The first method is based on subjective indicators. This includes all techniques based on self-evaluation<sup>3</sup> of health status. The second method is built on objective<sup>4</sup> indicators. This method mostly concentrates on having infections and having access to health services. The debate on which of the methods is better is far from being over (Anderson & Burkhauser, 1984, 1985; Stern 1989; Bound, 1991; Dwyer and Mitchell, 1999; Kreider, 1999).

In this study, the subjective method of evaluating the health status of households is employed. The indicator of household health status used opposes individuals with ‘good’ health to individuals with ‘poor’ health. The subjective indicator of health is frequently used in health economics since it highlights some aspects that are not identified by objective indicators (Idler & Benyamini, 1997). Several studies have employed this method before (Chandola et al., 2000; Molines et al., 2000; Jenkinson et al., 2001).

According to these studies, a perceived poor health status was related to a high prevalence of illnesses. This study examines how households appreciate their health status given the residential nuisances that they are exposed to. This involves the attribution of a negative or positive value by households to their health.

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<sup>3</sup> Self-evaluation of health status can be done through: (1) self-evaluations of health (in which an individual is asked to evaluate his health status on a scale ranging from poor to very good); (2) indicators of the existence or not of health difficulties which limit the physical capacity of an individual; (3) the existence of hazards which might cause health problems which limit daily activities.

<sup>4</sup> Objective indicators of the health status of households include: (1) Indicators of the intensity of a chronic infection; (2) indicators of usage of medical services; (3) medical reports of mental health or the degree of alcoholism; (4) indicators of the nutritional status (for example the size, the weight or the body mass index) and (5) the expected or future mortality rate.

From the foregoing, probabilistic models seem to be more appropriate for the analysis. These models determine the probability that a household declares poor health status. By assuming that the event ‘declare poor health’ follows a normal distribution, the analysis is based on the estimation of a Probit model. We retain as variable of perceived health  $E_i$ . In addition we assume that the variable household health status is the result of a latent continuous variable of health  $E_i^*$  defined as:

$$E_i = 1 \text{ if } E_i^* = \text{poor health}$$

$$E_i = 0 \text{ if } E_i^* = \text{good health}$$

The study equally assumes that the latent variable is explained by two groups of factors related to socio-economic characteristics of households and residential nuisances. These two groups of factors are represented respectively by the vectors  $X_i$  and  $N_i$ . Linearly  $E_i^* = \alpha + \beta X_i + \gamma N_i + \varepsilon_i$  with  $\varepsilon_i$  the error term

The parameters  $\hat{\beta}$  and  $\hat{\gamma}$  are estimated by the maximum likelihood method with the hypothesis of non-correlation of the residual term and exogenous variables. Three models are estimated. The first model controls for the effects of the socio-economic characteristics of households. The second model on its part controls the individual effect of each residential nuisance on the probability of declaring poor health. Finally, the third model examines the combined effect of residential nuisances on the probability of declaring poor health. The different groups of nuisances are those obtained from the factor analysis.

### 3. Results and Discussions

#### 3.1. The most perceptible residential nuisances in Cameroon

The table below summarises the results on the most perceptible residential nuisances in Cameroon obtained through Factor Analysis.



**Table 1: Components related to residential nuisances.**

<b>Determinant</b>	<b>0.115</b>		
<b>KMO Test</b>	<b>0.786</b>		
<b>Barlett Test</b>	<b>0.000</b>		
<hr/>			
		<i>Variance in %</i>	
<i>Components and variables</i>	<i>Coefficients</i>	<i>Real</i>	<i>Internal</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<b>Component I</b>		52.557	<b>64.263</b>
Nuisance from cockroaches	0.774		
Nuisance from mice	0.754		
Noise from neighbouring households	0.461		
<b>Component II</b>		<b>10.862</b>	<b>13.281</b>
Nuisance from sewage	0.751		
water	0.629		
Nuisance of floods	0.505		
Nuisance from odours			
<b>Component III</b>		<b>10.358</b>	<b>12.665</b>
Nuisance of insects	0.787		
Nuisance of ants	0.681		
Nuisance from Mosquitos	0.648		
<b>Component IV</b>		<b>8.007</b>	<b>9.790</b>
Noise from transport network	0.817		
Noise from commercial activities	0.778		
<b>Total</b>		<b>81.784</b>	<b>100</b>

Source: Authors from ECAM3 (2007).

The first three lines test the adequacy of our data for factor analysis to be carried out. The Kaiser-Meyer-Olkin (KMO) test is a general measure of partial correlation between variables of the study. High values of the statistics (close to 1) indicate the importance of carrying out factor analysis. The KMO index stands at 0.786 indicating the need for factor analysis. Bartlett's test of sphericity is used to test the absence of sphericity in the data. The test therefore ascertains validity and suitability of the responses collected to the problem being addressed through the study. For Factor Analysis to be recommended suitable, the Bartlett's Test of Sphericity must be less than 0.05. In the case of this study, the test statistics is 0.000; indicating the importance to study the principal components. Component I is made up of the



most perceptible nuisances to households. These are: the nuisance of cockroaches, nuisance of mice and noise from neighbouring households. This set explains 64.26% of the variance of residential nuisances. Nuisances related to sewage water, flooding and odours explain 13.28% of the variance of residential nuisances. The third component is made up of nuisance of insects, ants and mosquitoes and explains 12.66% of the variance of residential nuisances. Finally, the fourth component that is characterised by noise from transport networks and noise from commercial activities explains 9.7% of the variance of residential nuisances.

### 3.2. Effects of residential nuisances on household health status

At the end of the analysis it is found that 22% of households reported having bad health. In addition, households which express having bad health experienced nuisance effects of more than 60%. An examination of socioeconomic variables shows that: the existence of a gender effect, 31.4% of female headed households reported having bad health as compared to 19.8% for male headed households. As for age, we observe an increasing degradation of health according to the evolution of the age of the household head. The variable matrimonial status shows a threshold of poor health (38.9%), for widows and widowers. The size of the household enables us to equally notice the increase in poor health as the number of persons in the household increases. Households which do not have an income generating activity have poorer health (41.9%), as compared to others. The level of education highlights an decrease in poor health as one move from the primary level to higher levels (23.5%, 22.5%, and 21.0%). The variable income generally reduces poor health according to the magnitude of increase.

**Table 2: The probability of declaring ‘poor health’ according to socioeconomic characteristics and residential nuisances**

	<i>Model 1</i>		<i>Model 2</i>		<i>Model 3</i>	
	<i>Odds ratio</i>	<i>P-value</i>	<i>Odds ratio</i>	<i>p-value</i>	<i>Odds ratio</i>	<i>p-value</i>
<b>Socioeconomic characteristics</b>						
<b>Sex</b>						
<b>Female</b>	0.66	0.243(4.38)**				
<b>Male</b>	<b>Ref</b>	<b>Ref</b>				
<b>Age</b>						
<b>15-30</b>	0.22	-				
<b>31-45</b>		0.858(10.98)**				

<b>46-60</b>	0.32	-0.662(9.79)**
<b>61-75</b>	0.41	-0.524(8.04)**
<b>76 and more</b>	0.66	-0.246(3.71)**
	<b>Ref</b>	<b>Ref</b>
<b>civil status</b>		
<b>Single</b>	<b>Ref</b>	<b>Ref</b>
<b>Married</b>	0.82	0.111(1.18)
<b>Free Union I</b>	0.63	-0.261(2.31)*
<b>Divorced</b>	<b>1.04</b>	0.033(0.28)
<b>Widow/widower</b>	<b>1.09</b>	0.0036(0.46)
<b>Size of the household</b>	<b>Ref</b>	<b>Ref</b>
<b>Less than 03 persons</b>	0.64	-0.175(1.44)
<b>From 03-05</b>	0.74	-0.245(2.00)*
<b>From 06-08</b>	0.65	-0.253(2.01)*
<b>From 09 to 11</b>	0.76	-0.148(1.11)
<b>persons</b>		
<b>12 persons and above</b>		
<b>Residential Status</b>		
<b>Owner</b>	<b>Ref</b>	<b>Ref</b>
<b>Tenant</b>	0.941	-0.038(0.81)
<b>CSP</b>		
<b>Boss</b>	<b>Ref</b>	<b>Ref</b>
<b>White collar worker</b>	0.91	-0.49(0.85)
<b>Blue collar worker</b>	<b>1.04</b>	<b>0.015(0.19)</b>
<b>Labourer</b>	<b>1.27</b>	<b>0.144(1.66)</b>
<b>Level of education</b>		
<b>Primary</b>	0.72	-0.183(1.97)*
<b>Secondary</b>	0.93	-0.035(0.41)
<b>Higher</b>	<b>Ref</b>	<b>Ref</b>
<b>Income</b>		
<b>Quintile1</b>	<b>1.09</b>	0.003(0.45)
<b>Quintile2</b>	<b>1.05</b>	0.009(0.08)
<b>Quintile3</b>	<b>1.01</b>	0.002(0.02)
<b>Quintile4</b>	0.90	-0.078(0.73)
<b>Quintile5</b>	<b>Ref</b>	<b>Ref</b>
<b>Nuisances</b>		
<b>Noise from transports</b>	0.847	-0.097(2.06)*
	<b>Ref</b>	<b>Ref</b>
<b>Noise from household activities</b>	0.906	-0.059(0.86)
	<b>1.03</b>	0.021(0.29)
<b>nuisance from floods</b>	<b>1.74</b>	0.332(3.09)**
	<b>1.00</b>	0.007(0.13)
<b>nuisance from sewage water</b>	<b>1.08</b>	0.047(0.66)
	<b>1.22</b>	0.121(2.05)*
<b>nuisance from</b>	<b>1.00</b>	-0.002(0.03)

drainage systems	0.962	-0.025(0.48)	
Nuisance from odours	<b>1.13</b>	0.076(1.21)	
Nuisance from mosquitos	0.765	-0.153(2.38)*	
Nuisance from cockroaches			
Nuisance from ants			
Nuisance from insects			
Nuisance from mice			
Nuisance from rats			
Groups of nuisances			
Component 1		<b>0.951</b>	-0,036(2.57)
Component 2		<b>Ref</b>	<b>Ref</b>
Component 3		<b>1.06</b>	0,036(2.27)
Component 4		<b>1.08</b>	0,047(3.65)
-2Loglikelihood	-2898.87	1959.786	-19688.534
Size	6092	3535	3527

**Source:** author from ECAM3 (2007) \* and\*\* refer to the thresholds of 1% and 5%. The figures in brackets represent standard errors.

**NB:** Component I represent the group of nuisances made up of; the nuisance of cockroaches, nuisance from mice and noise from neighbouring households. Component 2 concerns: nuisance related to sewage water, flooding and odours. The third component is relative to: nuisance from insects, ants and mosquitoes. Component 4 refers to: nuisance from the noise of transport networks and noise from commercial activities.

The results presented in Table 2 above highlight two main groups of factors. The first group concerns the effect of socioeconomic characteristics. The second group is related to the effects of residential nuisance. In order to interpret the effects of these variables on perceived health of households we use two statistics. The first is the Odds ratio. The second is the significance of P-value. An Odds Ratio (OR) expresses the effect of a variable on the probability of declaring poor health with respect to a reference situation. The nature of the association is measured by comparing the value of the OR with 1. If it is more than 1 then the variable in question increases the probability of declaring poor health.

As for the individual characteristics of households, the results show the effect of variables such as: sex, age, size of the household, the socio-professional category and income. On the Basis of the P-value having a woman as household head has a significant effect on the

probability of declaring poor health. In developing countries like Cameroon, women are generally excluded from the labour market. This reduces their economic power and makes them more vulnerable health wise. These results conform to those obtained by Bianchi and Milkie (2010). At the level of age of the person in question, the study shows a negative relation between the evolution of age and the probability of declaring poor health. The effect of the size of the household is perceptible at a threshold of 1%. Households with more than 6 persons are likely to declare poor health. The promiscuity factor can be cited in this case in the sense that the overpopulation of a house reflects a poor living environment. This can increase the risk of illnesses in households. In other words the size of the household implies enormous expenses on health. This is not readily available to the vulnerable and so can affect the health of the households in question. These results corroborate those of Baker *et al.*, (1999); and Hewitt *et al.*, (2006). Having a primary level of education affects the probability of declaring poor health and is in line with the studies of Dannefer (2003); Fritzell *et al.*, (2007); Weitoft Ringbäck *et al.*, (2002); Whitehead *et al.*, (2000).

On the basis of the Odds ratio the study reveals a very significant impact of matrimonial status especially the fact of being divorced or widow. These two statuses increase the probability of declaring poor health with respect to the single status. These results are in coherence with previous studies which have shown invariably that individuals living as couples have a better physically and psychologically health and they have higher life expectancy than individuals who do not live as couples whether divorced, widow or never married (Cairney *et al.*, 2003; Mirowsky and Ross, 2003; Schumacher and Vilpert, 2011; Wickrama *et al.*, 2006). Living as a couple suggests some social stability which implies an economic status that is favourable to better health of the households concerned.

Moreover, the socio- professional category of blue collar workers and unskilled workers multiply respectively by 1.04 and 1.27 the risk of declaring poor health relative to households which benefit from the status of boss. As for income, belonging to the first, second and third quintile increases respectively by 1.09, 1.05 and 1.01 the probability of declaring poor health with respect to households in the fifth quintile. The income of households is a major indicator of expenses on health. The first, second and third quintiles are respectively the poorest, poor and average persons. They do not always have enough income to pay for their health expenses which can expose them to an indecent environment. The results obtained corroborate those of

Van, Ourti, O'Donnell and Doorslaer (2009). Generally these results show that there exist a positive correlation between individual characteristics of households and their health. However, these variables are not the only ones to explain the health status of households.

The impact of residential nuisances on health is analysed in two phases. Individually, the results show that, at the 1% level of significance, a negative effect of nuisances related to noise from transport, the nuisance of ants and the nuisance from the presence of rats. Based on the Odds ratio, all nuisances except those related to the presence of mice increase the probability that a household declares poor health. All the risks related to these nuisances are greater than 1. These nuisances multiply according to their risk the probability of declaring poor health. The more a household is exposed to each of the nuisances, the more its health status depreciates. These results confirm the theories supported by empirical studies which highlight the risk of deterioration of physical and psychological health of households exposed to different forms of nuisances (Wilner et al., 1957)

As for the effects of nuisance according to their components, the results reveal that even though component I is significant at the 1% level of significance, only components 3 and 4 increase the probability of declaring poor health. These two components multiply the probability of declaring poor health respectively by 1.06 and 1.08. These results effectively reflect the reality of life of the population of Cameroon. The recurrence of illnesses such as malaria, skin infections will be attributed to the nuisances of component 3. Nevertheless, we observe that there is more and more development of psychological and mental pathologies in the Cameroonian population. The significant impact of noise from multiple economic activities as suggested by component 4 is therefore in conformity to facts. These results correspond to those of previous studies especially those of Babisch (2014), Basner (2015), and Yen and Kaplan (1999). But the particularity of this study is based on the fact that it integrates other nuisances other than those usually analysed in the previous studies notably animal nuisances. These additional nuisances reflect the prevailing living environment of developing countries in general and specifically Cameroon.

#### **4. Conclusion**

The objective of this study was to evaluate the impact of residential nuisances on the perceived health of households in Cameroon. It aims at improving the living conditions of

individuals by informing public health policies. As a result the central place occupied by housing in the daily life of individuals explains why it is considered as a channel through which socioeconomic factors interact on the health of households. The orientation in this study is based on the idea that the residential milieu exposes members of the household to several nuisances. This is susceptible of impacting the health status of Cameroonian households. The first articulations of this study enable us to identify the most perceptible nuisances in Cameroonian households. It is found that there are four groups of nuisances faced by Cameroonian households. In a decreasing order of the level of perceptibility, these groups of nuisances are: nuisance of cockroaches, nuisance of mice and noise from neighbouring households. This set explains 64.26% of the variance of residential nuisances. Nuisance related to sewage water, flooding and odours explain 13.28% of the variance of residential nuisances. Nuisance from insects, ants and mosquitoes explain 12.66% of the variance of residential nuisance. Finally, nuisance from the noise of transport networks and noise from commercial activities represent 9.7% of the variance of residential nuisances. In terms of their impact on the perceived health of households the study suggests a strong significance of the second and third group of nuisances. These two groups of nuisances multiply by more than 1 the relative risk of depreciation of the health of households. These results imply new orientations in health policy. The policies have to go beyond classic investments articulated around health institutions. Improvements in the quality of the residential environment have to be a priority. Actions of anti-nuisance (fighting against rats and mice) and disinfection have to be carried out. Moreover, an effort has to be made in the disinfection of the drainage system and the respect of urbanisation norms so as to avoid the phenomenon of flooding. The active intervention of local governments is necessary to put in place local hygiene and sanitation dispositions. There should be particular focus on the education of the population so as to make them preserve a descent residential environment. All these preventive measures enable to reduce the risk of degradation of the health of households to the maximum.

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## Appendix

**Table A1:** Description of variables retained.

Variables	Definition
<b>Age of the reference person (RP)</b>	1= (15-30) ; 2= (31-45) ; 3= (46-60) ; 4= (61-75) ; 5= (76-90)
<b>Sex of the RP</b>	Two modalities are retained as usual : 1-Male, 2-Female
<b>Matrimonial Situation</b>	In this study it is divided into four modalities namely : 1-Married, 2-Single , 3-Widower/Widow 4-Divorced 5-Free Union But in order to determine the models of analysis , all these modalities are dichotomous and take the value of 1 if the person in question corresponds to this modality and 0 if not .
<b>Number of persons in households</b>	Five options were retained namely : 1-less than 03 persons, 2- from 03 to 05 persons, 3-from 06 to 08 persons, 4- from 09 to 11 persons, 5- 12 persons and more
<b>Children in charge</b>	Indicates the number of children under ones responsibility.
<b>Health status :</b>	Healthy 1 : Subjective health measures , that is a qualitative variable with four modalities 0= bad ; 1=average; 2= fairly good ; 3=good
<b>Case of recent illness</b>	Indicator of short term illness (recent). Dummy 1= illness two weeks before the survey; 0=if not.
<b>Case of chronic diseases</b>	Indicator of long term illness. 1= if the individual has been ill for more than one months ; 0= if not.

<b>Employment status of RP</b>	This is a binary variable, and takes the value 1 if the person has a profession and 0 if not.
<b>Socio-professional Status</b>	Four variants were retained namely: 1-status of blue collar worker, 2- status of qualified employee, 3- status of manual worker, 4- status of boss, 5- status of sole proprietor. The socio-professional status was completed by the variable relative to the sector of activity. In this later, three sectors were retained namely: 1- the public sector, 2-the private sector and 3-the informal sector. All these variables are dichotomous and take the value 1 in case of effectiveness and 0 if not.
<b>Ethnic group</b>	Dummy =1 if the individual is from one of the provinces of this group and 0 if not. The groups are defined as follows : North (Extreme north, north, Adamawa); 2= Centre; 3= South (South and East) ; 4= West (West, North-West, South-West) ; 5= Littoral
<b>Religion of the RP</b>	Four groups are retained: Muslim, Catholic, Protestant, other religions ; that are all represented by a dummy.
<b>Income of the RP</b>	Income is the real economic variable. It enables to determine the effects of economic power of households. Given the reluctance of households in declaring their real revenue, we have retained the monthly salary. Five rages were retained namely : (Revenue 1= $\leq 36000$ ; 2= (37-74000) ; 3= (75-150000) ; 4= (151-302000); 5= (303000 et plus)
<b>The highest level of education</b>	Three modalities were retained: 1-primary level, 2- secondary level 3- higher level. Each level is represented by a dummy.
<b>Sound Nuisances</b>	Divided into two categories namely those from productive economic activities (industry, urban transport, enterprise,

airport, seaport, bars, discotheques) and those from consumption activities (consumption of music, feasting activities of the neighbour, from a worship place). All these nuisances are considered dummy

**Non sound Nuisances** These are notably the presence of standing water points near the residence, beside marshy areas, beside garbage containers, beside sewage water, emission of toxic gas. All are dummy.

**Nuisances from animals** This last group represents the level of cohabitation with domestic animals (dogs, *cat*, *livestock*, *pigs*) on one hand and the other hand non domestic animals and disturbing insects (mousses, *cockroaches* *ants*, *flying insects*, *frogs*, and *amphibians*, *lizards*. They are also like dummy.

Source : Authors from ECAM3(2007)

**Table A2:** Socioeconomic variables, residential nuisances and perceived households health

Variables		Modalities	Health status	
Sex of the head of household			Good	Bad
		Male	80,2%	19,8%
		Female	68,6%	31,4%
Age of household head		Less than 30 years	85,6%	14,4%
		30-39 years	82,8%	17,2%
		40-49 years	77,4%	22,6%
		50-59 years	70,6%	29,4%
		60 years and more	59,2%	40,8%
Marital Status		Single	79,6%	20,4%
		Married monogamy	80,2%	19,8%
		Married polygamy	78,3%	21,7%
		Widower/widow	61,1%	38,9%

	Divorced	70,5%	29,5%
	Free Union	80,6%	19,4%
<b>Size of the household</b>	2 persons	77,9%	22,1%
	From 3 to 5 persons	77,0%	23,0%
	From 6 to	76,7%	23,3%
	From 9 to 11 persons	75,3%	24,7%
	12 persons and more	70,1%	29,9%
<b>Standard of living</b>	Poor	79,1%	20,9%
	Not poor	76,5%	23,5%
<b>Socio-professional category</b>	Blue collar worker	75,3%	24,7%
	Agent	82,2%	17,8%
	Manual labourer	83,0%	17,0%
	Boss	77,5%	22,6%
<b>Level of education</b>	Primary	76,5%	23,5%
	Secondary	77,5%	22,5%
	Higher	79,0%	21,0%
<b>Class of income</b>	Less than 37000	78,6%	21,4%
	37 to 74000	80,8%	19,2%
	75 to 150000	80,9%	19,1%
	151 to 302000	78,4%	21,6%
	303 to 606000	81,5%	18,5%
	607 to 1214000	81,5%	18,5%
<b>Noise from households</b>	Non prevalent	74,5%	25,5%
	Prevalent	75,6%	24,4%
<b>Noise from transport</b>	Non prevalent	73,2%	26,8%
	Prevalent	76,5%	23,5%
<b>Noise from trading activities</b>	Non prevalent	74,4%	25,6%
	Prevalent	76,4%	23,6%
<b>Floods</b>	Non prevalent	76,8%	23,2%
	Prevalent	78,7%	21,3%



<b>water around the neighbourhood</b>	Non prevalent	77,3%	22,7%
	Prevalent	74,4%	25,6%
<b>Water from Drainage systems</b>	Non prevalent	77,3%	22,7%
	Prevalent	68,9%	31,1%
<b>odours</b>	Non prevalent	77,4%	22,6%
	Prevalent	75,6%	24,4%
<b>Nuisance from mosquitos</b>	Non prevalent	76,9%	23,1%
	Prevalent	77,1%	22,9%
<b>Nuisance from cockroaches</b>	Non prevalent	79,1%	20,9%
	Prevalent	76,3%	23,7%
<b>Nuisance from ants</b>	Non prevalent	77,1%	22,9%
	Prevalent	77,1%	22,9%
<b>Nuisance from insects</b>	Non prevalent	76,6%	23,4%
	Prevalent	77,6%	22,4%
<b>Nuisance from mice</b>	Non prevalent	80,2%	19,8%
	Prevalent	76,3%	23,7%
<b>Nuisance from rats</b>	Non prevalent	76,7%	23,3%
	Prevalent	78,8%	21,2%
<b>Percentage of total</b>		<b>77,1%</b>	<b>22,9%</b>

Source: Author from ECAM3 (2007)