CENTRE D'ÉTUDES DE L'EMPLOI

Avril
2012

Chronic Illnesses and Injuries: An Evaluation of their Impact on Occupation and Revenues

Maladies chroniques et accidents : une évaluation de leur impact sur le parcours professionnel et les revenus

Emmanuel Duguet,
Christine le Clainche

155

Document de travail

Chronic Illnesses and Injuries: An Evaluation of their Impact on Occupation and Revenues

Maladies chroniques et accidents : une évaluation de leur impact sur le parcours professionnel et les revenus

EMMANUEL DUGUET
emmanuel.duguet@u-pec.fr
ERUDITE - University of East Paris

CHRISTINE LE CLAINCHE
christine.leclainche@cee-recherche.fr
CEE and LAMETA UMR CNRS 5474, ENS Cachan

DOCUMENT DE TRAVAIL

N° 155

avril 2012

www.cee-recherche.fr

Directeur de publication : Alberto Lopez

ISSN 1776-3096
ISBN 978-2-11-128679-5

CHRONIC ILLNESSES AND INJURIES: AN EVALUATION OF THEIR IMPACT ON OCCUPATION AND REVENUES

Emmanuel Duguet, Christine le Clainche

ABSTRACT

This paper investigates whether chronic illnesses and injuries have a significant impact on the individual's performance in the labor market. We use the "Santé et Itinéraires Professionnels" (SIP, "Health and Labor Market Histories") survey, conducted in France in 2006-2007. We use the propensity score method in order to evaluate the impact of chronic illnesses and accidents on labor market participation and earnings. We find that both health events, chronic illness and accidents have a negative effect on professional careers and earnings, and that accidents have a greater impact on women's earnings.

Keywords: chronic illness, injury, wages, revenues, propensity score matching method.

Maladies chroniques et accidents : une évaluation de leur impact sur le parcours professionnel et les revenus

Résumé

Cet article traite de l'impact des maladies chroniques et des accidents sur les performances individuelles sur le marché du travail. Nous utilisons l'enquête Santé Itinéraires Professionnels *(SIP) réalisée en France en 2006-2007 et mettons en œuvre la méthode du score de propension de manière à évaluer l'impact des maladies chroniques et des accidents sur la participation aux marchés de travail et les revenus. Nous constatons que les maladies chroniques tout comme les accidents ont un effet négatif sur la carrière et les revenus. Concernant les femmes, les accidents ont un impact plus important sur les revenus et salaires.*

***Mots-clefs** : maladie chronique, accident, travail, salaires, revenus, méthode du score de propension.*

INTRODUCTION[1]

Illnesses and injuries (such as road or domestic accidents) induce important socio-economic costs such as long-term care, production loss and welfare loss. Concerning employment however, it is difficult to know how serious and how long-lasting the sequels of chronic illness or injuries are and whether their relative impact on work and earnings differs.

The aim of this paper is to investigate whether there is a significant effect of chronic illnesses and injuries on employment (professional trajectories and employment quality) and related earnings. Injuries may be considered generally as random shocks. This is also the case for some diseases which are unrelated to deliberate individual behavior.

A large number of studies have provided evidence on the impact of health on earnings and employment (see Currie, Madrian [1999] for a survey). The results obtained so far depend partly on the type of samples used, the health measures retained and the econometric methodology used. A widespread result is that health has a greater effect on number of hours worked than on wages (Chikiros, Nestel, 1981, 1985; Chirikos, 1993; Mitchell, Burkhauser, 1990). For France, evidence has been found on early retirement or on exit from the labor market partially due to health through the disability schemes for older people (Barnay, 2005; Blanchet, Debrand, 2007, Debrand, Sirven, 2009; Behaghel, Blanchet, Debrand, Roger, 2011). The effect of health on the participation in the labor market and on long-term unemployment from the beginning of the career has been less studied. A paper by Tessier and Wolff (2005) for France shows that health has an impact on work participation from the beginning of the career. Otherwise, a recent paper by Haan and Myck (2009) based on German data found that there are persistent dynamics of both bad health and unemployment. Comparable results were also obtained by Lindeboom, Llena-Nozal and van der Klauw (2006) who stressed the importance of poor living conditions during early childhood[2].

In most of the studies focusing on the link between health and employment, health is proxied by self-rated health measures. If a number of studies emphasize that the self-rated health measures are well correlated with mortality (see for instance, Idler, Benyamini, 1997) and with the consumption of medical care, the self-rated measures do not always provide a good summary of the severity of diseases (Lanoë, 2005). The main problem which arises in the study of the link between health and employment, using self-rated health measures, is not due to the fact that this measure is not correlated to the underlying health state, since it affects the status in the labor market, but rather that the measurement error does not necessarily result from a random process. There could be a justification bias: the people who diminish their working time or who exit from the labor market are more likely to declare bad health, functional limitations or work-related limitations. Therefore, the studies of the impact of health on employment can be improved when several indicators or various measures of health conditions are used.

---

1 This research has benefitted from a financial support from Drees and Dares (Research Department of French Ministry of Labour and Social Affairs). We thank for their comments on earlier versions of this paper Chantal Cases, Thierry Debrand, Florence Jusot and the participants to seminars or conferences: Conference Health at Work, July 2010, Milano; Journée de Microéconomie Appliquée (JMA), Angers, juin 2010; Journée des Economistes de la Santé Français (JESF), Lyon, décembre 2010.

2 A considerable literature takes into account the consequences of early childhood conditions on adult health (Case, Fertig, Paxson, 2005; Wadsworth, Butterworth, 2006; Trannoy, Tubeuf, Jusot, Devaux, 2010).

Fewer studies seem to have focussed on injuries. In this paper, we consider two kinds of injuries: domestic injuries and road injuries. We set working accidents aside because they imply a higher participation in the labor market before the accident, and this could bias our estimates[3].

Moller-Dano (2005) investigates whether road injuries have a causal impact on disposable income, earnings, employment and public transfer income in Denmark, using the propensity score matching method. She finds that older injured persons and low income persons have significantly lower disposable incomes than comparable non-injured persons. In the short term as well as in the long term, employment rates are lower for the injured men than for the non-injured men belonging to the reference group. No effect is found for women. Moreover, reduced earnings are found for men in general and for older women.

Another paper only partially concerning road injuries was conducted by Crichton, Stillman, Hyslop (2011) for New Zealand. They found a strong negative impact of injuries on employment and earnings. The authors also found that long-lasting injuries had more of an impact on women, older workers and those on low-incomes.

In this paper, we compare the impact of chronic illnesses with the impact of injuries on employment and earnings. Our main results are that: (i) childhood living conditions are strongly related to future bad health; (ii) alcohol and tobacco consumption are strongly related to future bad health; (iii) chronic illness and accidents have comparable negative effects on labor market participation and revenues and (iv) women suffer more from accidents than men.

This paper is organized as follows: the first section presents the data and some sample statistics. Section 2 presents the methodology used to identify the effects of illnesses and accidents on the professional career. The third section presents the results. The last section concludes.

1. THE DATA

We use the "Santé et Itinéraires Professionnels" (SIP) survey conducted in France in 2006-2007. This survey collected information about the whole professional career of individuals. It included questions about subjective health: self-rated health but also provided a detailed report of the kinds of disease and symptoms, functional and activity limitations, pain, sleep troubles, mental health – measured by Mini questionnaire – sequels and the employment trajectories (type of contract, working time, duration of employment, change of employment, unemployment) and the related earnings.

The scope of the analysis was restricted to people aged from 19 to 55. We chose this restriction because, in France, after 55, people can benefit from legal dispositions to exit the labor market ("pre-retirement"). This device has been reduced recently but was still in application at the time of the survey. We also exclude retired workers and the people who suffer from professional illnesses from the analysis; insofar as our aim is to identify the way health conditions may affect employment and working conditions and not the reverse. Overall, our sample consists of three sub-samples: people with no illnesses or injuries (N=4804), people with illnesses only (N=1105) and people with injuries only (N=970). The total sample size is 6,879.

3 The topic of the interrelation between labor market participation and working accidents is beyond the scope of this paper, and should be part of a specific study including the estimation of a system of LDVs.

Measurement of chronic illnesses and injuries

Chronic or severe illnesses

In this article, the data available on chronic illnesses provide an improvement over the standard self-declared measures. The chronic illnesses are first declared by the sufferers, but their declarations must pass the definition of long-term diseases provided by the "Sécurité sociale" (Health Care dministration). It is so because, in France, such diseases benefit from full reimbursement, so the Health Care administration controls them carefully.

In order to identify the chronic diseases, we report on epidemiologists' views of diseases causing limitations (see WHO, IDC) and on the French administrative classification of severe diseases (the so-called "Affections de Longue Durée" or ALD classification). In the SIP survey, the data set is very detailed about the type of disease, from which people suffer, in a declarative sense.

We have retained: chronic cardio-vascular diseases, cancers, incurable deafness, chronic hearing impairment (tinnitus), severe or chronic lung diseases, severe or chronic liver diseases, severe or chronic rheumatism, diabetes, severe or chronic eye disorders (impossible to correct); severe or chronic psychiatric disorders, epilepsy, addictions, AIDS or other severe diseases.

Sample definition

Age: 19 to 55 years old
Excluding retired workers
Excluding work-related health problems

We keep the following chronic diseases (SCOD variable)

2, 4, 5, 6: cardiovascular diseases
9: cancers
11, 12: lung diseases
16, 17: deafness, tinnitus
20: liver disease
23: slipped disc
28: bones and articulation diseases
31: diabetes
35: eye troubles difficult or impossible to correct
37, 38: severe mental illness
42: epilepsy
48, 49: addiction to alcohol and other products (except tobacco)
50: usually HIV

Table 1. Self-reported health and chronic illness dummy variable

Self reported Health	Reference sample* (1)	Chronic illness sample (2)	Difference (2)-(1)	Student**
Very good	44.7%	7.9%	-36.8%	23.5
Good	47.8%	34.5%	-13.2%	6.0
Average	7.2%	42.4%	+35.1%	18.2
Bad	0.2%	12.5%	+12.3%	11.0
Very bad	0.1%	2.7%	+2.6%	4.8

* Reference sample: no chronic illness and no accident reported; **: All the differences are significant at the 5% level.

The indicator that we use is a binary variable indicating the presence or absence of such a chronic disease. In order to assess its quality, we compare it to the self-reported health indicator also available in the survey (Table 1). We find that the chronic illness sample has a much lower self-reported health indicator, since good or very good health pass from 92.5% in the reference sample to 42.4% in the chronic illness sample. The percentage of bad or very bad health passes from 0.3% to 15.2%. However, if we compare the self reported indicator to the types of illness declared by the respondents, there seems to be an excessive declaration of "average health" in the chronic illness sample. This could come from the fact that "average" does not have the same meaning in the reference sample, where no chronic illness or accident is reported, and in the chronic illness sample. This difference provides a motivation to keep the chronic illness dummy variable as our health indicator for this study.

Finally, we also drop the professional chronic diseases since they imply greater participation in the labor market than the total population before the illness appeared, and this selection could have affected our estimates.

Accidents

To take accidents into account, we use the part of the questionnaire related to accidents, which includes car injuries and domestic accidents.

Finally, we exclude workplace accidents and car accidents occurring during commuting because they involve greater participation in the labor market than in the total population before the accident, and this selection could have affected our estimates.

Descriptive statistics concerning health and injuries

Table 2 provides the sample statistics. We first compare the people in the reference sample with the people in the chronic illness sample (columns (1), (2), (2)-(1)). The chronic illness sample includes older people and more women. People affected by chronic illness also have a lower level of education (more primary education, less college education) than the people in the reference sample. Looking at childhood living conditions, we find that the people in the chronic illness sample had less often been brought up by their parents than in the reference sample, that their parents more often had serious health problems and that they had more often been separated from their family. The chronic illness sample also shows different risk-related behavior: they drink less than in the reference sample (positive effect on health) and had been more often daily smokers (negative effect on health).

Table 2. Sample statistics

**: the difference is significant at the 5% level; *: the difference is significant at the 10% level.

Variables	Reference sample (1)	Chronic illness sample (2)	Difference (2)-(1)	Student (2)-(1)	Accident sample (3)	Difference (3)-(1)	Student (3)-(1)
Gender							
Women	56.8%	62.4%	5.5%	3.28**	44.5%	-12.3%	5.57**
Age							
19-27	19.4%	10.3%	-9.0%	8.08**	11.3%	-8.0%	5.74**
28-36	24.1%	16.9%	-7.2%	5.42**	18.9%	-5.3%	3.06**
37-45	28.8%	27.5%	-1.3%	0.87	26.5%	-2.3%	1.16
46-55	27.7%	45.3%	17.6%	10.37**	43.3%	15.6%	6.99**
Highest degree							
Missing	13.0%	14.9%	2.0%	1.60	12.4%	-0.6%	0.39
Primary education	2.8%	7.4%	4.5%	5.28**	3.9%	1.1%	1.05
Secondary education (professional)	5.4%	6.8%	1.3%	1.55	9.1%	3.6%	2.99**
Secondary education (general)	29.1%	31.7%	2.6%	1.64	33.2%	4.1%	1.94*
Professional baccalauréat (O-level. professional)	10.0%	8.5%	-1.6%	1.59	7.9%	-2.1%	1.68*
General baccalauréat (O-level. general)	7.6%	8.6%	0.9%	0.95	7.1%	-0.5%	0.44
Two years of college education	13.6%	8.7%	-4.9%	4.84**	10.0%	-3.6%	2.73**
At least three years of college education	18.4%	13.5%	-4.9%	4.04**	16.4%	-2.1%	1.28
Childhood							
Foreign mother	15.8%	15.4%	-0.4%	0.32	13.2%	-2.6%	1.67*
Foreign father	15.0%	15.7%	0.7%	0.55	11.2%	-3.8%	2.47**
Born in France	88.2%	87.6%	-0.7%	0.58	88.1%	-0.1%	0.05
Brought up by the mother	96.6%	94.1%	-2.5%	3.12**	94.5%	-2.1%	1.97**
Brought up by the father	88.9%	86.5%	-2.4%	2.06**	85.4%	-3.5%	2.25**
Parents had serious health problems	12.1%	18.1%	6.1%	4.65**	22.7%	10.6%	5.86**
Separated from the family	10.8%	15.7%	4.9%	3.95**	19.0%	8.1%	4.77**
Alcohol consumption							
Missing	12.2%	13.3%	1.2%	1.00	16.2%	4.0%	2.52**
Not drinking	18.5%	22.5%	4.0%	2.78**	14.0%	-4.5%	2.60**
Without risk	42.9%	43.8%	0.9%	0.50	41.2%	-1.7%	0.76
At risk. casual	22.8%	16.9%	-5.9%	4.42**	21.6%	-1.1%	0.64
At risk. chronic	3.6%	3.5%	-0.1%	0.22	6.9%	3.3%	3.29**
Tobacco consumption							
Missing	10.9%	10.8%	0.0%	0.04	14.9%	4.1%	2.69**
Not smoking	50.1%	48.4%	-1.7%	0.98	42.7%	-7.4%	3.30**
Former daily smoker	9.7%	11.7%	2.1%	1.89*	11.9%	2.2%	1.51
Casual smoker	5.5%	5.0%	-0.5%	0.66	3.4%	-2.1%	2.30**
Daily smoker	23.9%	24.1%	0.2%	0.11	27.1%	3.2%	1.63
Location :							
Lives in underprivileged suburbs	6.7%	6.8%	0.1%	0.07	7.1%	0.4%	0.36
Activity							
Has been working last week	76.5%	70.6%	-5.9%	3.76**	75.4%	-1.2%	0.58

Number of hours worked last week (if >0)	38.53	36.31	-2.22	4.73**	38.17	-0.36	0.60
Subjective satisfaction degree of the career							
Missing	5.4%	3.9%	-1.5%	2.22**	2.1%	-3.4%	4.40**
Subjective satisfaction index	7.40	6.86	-0.53	6.10**	6.99	-0.40	3.57**
Revenues							
Minimum assistance revenue last month	2.6%	4.8%	2.2%	3.09**	4.9%	2.4%	2.44**
Average monthly earnings of the household :							
Missing	4.3%	3.6%	-0.7%	1.08	2.2%	-2.1%	2.83**
Less than 1,200 Euros	13.3%	20.1%	6.8%	5.00**	19.5%	6.2%	3.43**
1,200-2,500 Euros	39.4%	39.2%	-0.2%	0.13	39.5%	0.1%	0.03
2,500-4,000 Euros	29.5%	27.5%	-2.1%	1.32	27.7%	-1.8%	0.89
More than 4,000 Euros	13.4%	9.7%	-3.8%	3.60**	11.1%	-2.3%	1.68*
Sample size (individuals)	4804	1005	-	-	970	-	-

Occupation status and revenues also differ in the chronic illness sample: these people work less than in the reference sample. They have a lower subjective satisfaction index from their career, a higher rate of minimum assistance revenue and appear more often in the lowest revenue class (less than 1,200 Euros) and less often in the highest revenue class (more than 4,000 Euros).

The comparison between the accident sample and the reference sample is presented in columns (1), (3) and (3)-(1). The accident sample includes older people and more men than in the reference sample. The accident sample also includes people with a lower level of education than in the reference sample. The childhood living conditions show significant differences with the reference sample on almost every variable: these people have more often French parents, but had been less often brought up by their parents who had more often serious health problems, and they had been more often separated from their family. Their alcohol and tobacco consumption also differs: they drink more, including to risk levels, and they more often refuse to answer the question on alcohol (the "missing" category), they also smoke more often but on a casual basis.

The injured people have not worked less often, and not worked fewer hours in the week before the survey. However, their subjective satisfaction index about their career is lower than in the reference sample. The injured people also benefit more often from the minimum assistance revenue and are more often in the lowest revenue class and less often in the highest revenue class than the people in the reference sample.

Overall there are significant differences between the reference sample and the chronic illness or accident samples. There are also differences between the chronic illness and the accident samples: the chronic illness sample includes more women and former daily smokers, while the accident sample includes more men with risky alcohol consumption. These first results motivate the following estimation strategy. First, we separate women from men to see whether there is a gender effect; secondly, we perform separate regression for chronic illnesses and accidents since individual behaviors differ regarding alcohol and tobacco; thirdly, we account explicitly for the selection biases since the reference sample does not have the same composition as the chronic illness and accident samples.

2. METHODOLOGY

Our reference group is not a control group, as the sample statistics show, and this is why we cannot rely fully on the means comparison. We follow the approach initiated by Rosenbaum and Rubin (1983, 1985; see also Rubin [2006]).

We want to measure the effect of bad health (chronic illness or injury) on professional and revenue performance variables. Therefore we should evaluate the difference between the performance that an individual has who is in bad health and the performance the same individual would have achieved in good health. The latter quantity is called the counter-factual. There are many ways to estimate a counterfactual. In this paper, we consider two families of methods: standard regression analysis ("naive regression estimators") and weighting methods ("evaluation estimators"). The standard regression analysis is presented in the Appendix, for comparison, since its estimates are likely to be biased.

Let $y_{1,i}$ the performance of individual *i* in bad health and $y_{0,i}$ the performance in good health. The evaluation problem comes from the fact that we cannot observe both quantities at the same time. Either we observe y_{1i} when the individual is in bad health or we observe y_{0i} when (s)he is not. The observable data are therefore:

$$y_i = (1 - T_i) y_{0i} + T_i y_{1i} \text{ with } T_i = \begin{cases} 1 & \text{with a bad health} \\ 0 & \text{otherwise} \end{cases}$$

Standard regression analysis

The methods in this section are useful mostly because they allow us to assess the biases associated with them. The simplest method is the "naïve estimator" equal to the difference between the average performance of the individuals in bad health and in good health. Technically this reduces to performing an OLS (Ordinary Least Squares) regression of the performance variables on the intercept and a bad health dummy variable (equal to 1 for bad health, 0 for good health). The OLS coefficient of the bad health dummy variable gives the difference of the mean performances in both groups:

$$\hat{c} = \frac{1}{N_1} \sum_{i \in I_1} y_i - \frac{1}{N_0} \sum_{i \in I_0} y_i$$

where I_1 is the index set of the bad health individuals (number: N_1), and I_0 the index set of the good health individuals (number N_0). A second method extends the previous model by adding control variables X_i, such as childhood living conditions, into the previous regression. The model becomes:

$$y_i = a + X_i b + c T_i + u_i ,$$

where u_i is the usual disturbance, assumed uncorrelated with the explanative variables.

From this model, we derive two quantities. First, for $T_i = 0$, we obtain an expected average performance $E(y_i | T_i = 0) = a + X_i b,$ and, second, for $T_i = 1$, we get the expected average

performance $E(y_i|T_i = 1) = a + X_i b + c$. This implies that the effect of bad health for the individual *i* is equal to:

$$E(y_i|T_i = 1) - E(y_i|T_i = 0) = c.$$

Compared with the naive estimator, this regression allows us to correct for the part of the performance difference that is attributable to the control variables X_i. But, strictly speaking, this estimator is not fully consistent with the evaluation problematic *even* when there is no selection bias. A third regression method is more rigorous. We assume that there are two equations corresponding to each of the potential outcomes, so that:

$$y_{0i} = a_0 + X_i b_0 + u_{0i} \text{ and } y_{1i} = a_1 + X_i b_1 + u_{1i},$$

And the observable performance is:

$$y_i = (1 - T_i) y_{0i} + T_i y_{1i} = (1 - T_i)(a_0 + X_i b_0 + u_{0i}) + T_i (a_1 + X_i b_1 + u_{1i}),$$

After some simplification, we get:

$$y_i = \beta_0 + X_i \beta_1 + T_i \beta_2 + T_i X_i \beta_3 + u_i,$$

$$\text{With } \beta_0 = a_0,\ \beta_1 = b_0, \beta_2 = a_1 - a_0, \beta_3 = b_1 - b_0, u_i = (1 - T_i) u_{0i} + T_i u_{1i}$$

which implies that one should estimate a model with all the cross products of the control variables with the bad health dummy. Moreover, if the variables X_i are centered, we can show that the coefficient of the bad health dummy, β_2, measures the average effect of bad health on the performance. The structure of this model also implies that the disturbance of the model is heteroskedastic since the disturbance is different depending on $T_i = 0$ or $T_i = 1$. We account for this property in our estimations.

Evaluation methods

The "evaluation methods" are the most important in this paper since the naive regression methods do not account for the fact that the individuals are not comparable in the bad health and good health groups. We follow the propensity score matching approach initiated by Rosenbaum and Rubin (1983, 1985) and surveyed in Lee Myoung-Jae (2005) and Rubin (2006). The usual parameter of interest in the literature is the average effect of the treatment on the treated (henceforth, ATT) defined as:

$$ATT = E(y_1 - y_0|T = 1) = E(y_1|T = 1) - E(y_0|T = 1)$$

But the ATT cannot be identified without further assumptions, since $E(y_0|T = 1)$ is not observable. The assumption of random selection is not satisfied in our study because there are a number of characteristics which may influence both the health status and the performance variables. Conditioning on a vector of covariates X, the ATT becomes:

$$ATT(X) = E(y_1 - y_0|T = 1, X) = E(y_1|T = 1, X) - E(y_0|T = 1, X)$$

where X is a vector of control variables that are not affected by the treatment. In this first paper, we consider matching on observables in order to identity a causal treatment effect on the treated (see for instance, Deheija and Wahba, 2002). The ATT may be identified by introducing the Conditional Independence Assumption:

$$E(y_0|T=1,X) = E(y_0|T=0,X)$$

This assumption implies that, conditional on X, the expected potential outcome in the case of non-treatment is the same for both treated and non treated groups. Thus the observed outcome for bad health people may be used to measure the potential outcome for good health people conditional on the individual characteristics X.

When the set of observed characteristics is large enough, matching should enable us to consistently estimate the causal effects of bad health on the performance variables. Rosenbaum and Rubin (1983) show that instead of conditioning on a high-dimension X, control for covariates can be obtained by controlling for a real-valued function of X, P(X), called the propensity score. It is defined as the probability of getting treatment (*i.e*, to be in bad health, in our study). This implies that:

$$E(Y_0 \mid T=1, P(X)) = E(Y_0 \mid T=0, P(X)),$$

The intuition of this result is the following: if two individuals have the same probability of being in bad health, and the first individual is in bad health while the other is not, then the allocation of bad health can be considered as random between these two individuals, and we can use the second individual as a counterfactual for the first individual.

Last, in order to ensure that our estimators have relevant empirical content, we need to account for a last constraint: the individuals in the treatment group and in the control group must have similar probabilities of getting treatment. Therefore we make all our estimations on the common support of the treatment probabilities. More precisely, once we have estimated the individual probabilities of being in bad health, we define the supports of the probabilities on the treated and not treated groups by the 1^{st} and 99^{th} percentiles (to avoid outliers). Then we take the intersection of these two supports. This implies that the comparisons can only be made on a part of the sample: the individuals that have probabilities of bad health close to 0 or 1 must be excluded from the evaluation. In practice, we find that between 84% and 94% of the individuals can be compared, depending on the sub-sample we consider (some performance variables are defined on subsets of the data only, so that this rate can differ).

There are several ways to apply the propensity score methodology: the most common are kernel matching and weighting. We have retained the second methodology in this paper. One reason is that kernel matching is often applied with non optimal windows and non optimal kernels, and requires the use of the bootstrap for evaluating the standard errors, therefore leading to less accuracy and longer computing time[4]. The weighting approach uses the same assumptions as kernel matching, but merely expresses the non observable sample moments by their observable counterparts, and replaces them by the corresponding empirical moments. We get the following results:

4 In practice, this could be fixed by taking an adaptative Epanechnikov kernel and cross validation on the full sample.

a/ Average effect of the treatment on the not treated:

$$c_0 = \frac{1}{N^c}\sum_{i=1}^{N^c}\left(\frac{N_0^c}{N^c}\right)^{-1} y_i\left(\frac{T_i}{\pi_i} - 1\right)$$

b/ Average effect of the treatment on the treated:

$$c_1 = \frac{1}{N^c}\sum_{i=1}^{N^c}\left(\frac{N_0^c}{N^c}\right)^{-1} y_i\left(\frac{T_i - \pi_i}{1-\pi_i}\right)$$

c/ Average effect of the treatment on the whole population:

$$c = \frac{1}{N^c}\sum_{i=1}^{N^c} y_i\left(\frac{T_i - \pi_i}{\pi_i(1-\pi_i)}\right)$$

Where π_i is the value of the propensity score for the individual *i*, N^c the number of individuals in the common support, N_0^c the number of not treated in the common support and N_1^c the corresponding number of treated individuals. In practice, we do not know the exact value of π_i, so that we have to replace it by a consistent estimator. In our application, we use a Probit model estimated by the maximum likelihood method, and get a prediction $\hat{\pi}_i$ of the propensity score, which is used for the evaluation. This clearly affects the variance of the evaluation parameters in the following way.
All our estimators can be written in the following form:

$$\hat{\theta} = \frac{1}{N^c}\sum_{i=1}^{N^C} y_i g_i(\hat{b})$$

where $\hat{b}$ is the estimated parameter from the Probit model. Using the delta method, we can estimate the variance of our estimate by:

$$\hat{V}(\hat{\theta}) = \frac{1}{N^c}\sum_{i=1}^{N^c}(\hat{\varphi}_i - \bar{\hat{\varphi}})^2$$

with

$$\hat{\varphi}_i = y_i g_i(\hat{b}) + \frac{1}{N^c}\sum_{i=1}^{N^c}\left[y_i \frac{\partial g_i}{\partial b'}(\hat{b})\right] J_1(\hat{b})^{-1} \sqrt{N^c}\, s_i(\hat{b})$$

where:

$$J_1(b) = E\left[-\frac{\partial^2 \ln f}{\partial b \partial b'}(T|X,b)\right], \quad s_i(b) = \frac{\partial \ln f(T_i|X_i,b)}{\partial b},$$

and

$$\ln f(T_i|X_i,b) = T_i \ln \Phi(X_i b) + (1-T_i)\ln(1-\Phi(X_i b)).$$

Notice that these formulas are valid for any binary model estimated by the maximum likelihood method, provided that one replaces $\Phi(X_i b)\,\Phi$ by $1 - F(-X_i b)$ where F(.) is the cdf of the disturbance of the new model (or by $F(X_i b)$ if the distribution of the new model is symmetric).

3. RESULTS

All the regressions are performed separately for men and women, for several reasons. Among the reasons, men and women do not occupy the same types of job in the labor market, and they do not have the same probabilities of getting some chronic illnesses, such as the different types of cancer. They are also paid different wages, and the predominant role of women in the education of children may affect their labor market participation compared to men. By separating men from women, we wish to increase the homogeneity of both our health and performance variables.

Propensity scores for chronic illness

Table 3 presents the Probit regression results on the probability of getting a chronic illness. The predictions of this model are the propensity scores used in Table 5. The determinants of chronic illness for women are analyzed in the first three columns. The average effect gives the variation in percentage points compared to the reference level[5]. The probability of chronic illness increases with age (+15.8% for the age class 46-55 compared to 19-27), the fact that the parents had serious health problems (+8.2%), when the girl had been separated from her family (+5.9%) and when the woman was a former daily smoker (+5.2%). The probability of getting a chronic illness decreases with the level of education (-4.7% to -7.4%) and when the girl was brought by her mother (-7%). We also find that casual alcohol consumption, compared to the other types of alcohol consumptions, reduces the probability of chronic illness (-4.5%). One explanation may be that choosing casual consumption would be associated with a more cautious attitude towards alcohol. Overall, chronic illness among women would originate partly from genetic factors, here measured by the health status of the parents, but also from childhood living conditions, the level of education reached, daily smoking and age.

The determinants of chronic illness for men are analyzed in the three last columns of Table 3. The probability of getting a chronic illness increases with age (+18.1% for the age class 46-55 compared to 19-27), the fact that the parents had serious health problems (+4.7%), and decreases with the level of education (between -7.7% and -8.3%). No effect is found for (self-reported) alcohol and tobacco consumptions.

Overall, men and women share important determinants in common: the probability of getting a chronic illness increases with age and when the parents had serious health problems; it decreases with the level of education. Women differ from men on three points: they suffer more from past daily smoking, from being separated from their family when they were young, and less when they have been brought up by their mother.

5 With our convention, one adds the average effect to the reference group probability indicated in the Table. For instance, women aged 28-36 have an increase of 4.9 points of their probability of getting a chronic illness, compared to the women aged 19-27.

Table 3. Probability of getting a chronic illness

Maximum likelihood estimation of the Probit model. **: significant at the 5% level; *: significant at the 10% level

	Women			**Men**		
	Parameter	**P value**	**Average effect**	**Parameter**	**P value**	**Average effect**
Intercept	-1.111**	0.000		-1.343**	0.000	
Age class						
19-27	Ref			Ref		
28-36	0.186**	0.050	4.9%	0.275**	0.018	6.6%
37-45	0.345**	0.000	9.2%	0.405**	0.000	9.7%
46-55	0.576**	0.000	15.8%	0.710**	0.000	18.1%
Highest education achieved						
No certificate	Ref			Ref		
Primary education	0.317**	0.023	9.0%	0.022	0.904	0.5%
Secondary education (general)	-0.123	0.332	-3.0%	-0.076	0.629	-1.6%
Secondary education (profes.)	-0.199**	0.030	-4.8%	-0.116	0.291	-2.6%
O-level. professional	-0.273**	0.021	-6.2%	-0.082	0.543	-1.8%
O-level. general	-0.103	0.360	-2.5%	-0.221	0.169	-4.5%
2 years of college education	-0.326**	0.003	-7.4%	-0.405**	0.004	-7.7%
At least 3 years of college education	-0.195**	0.050	-4.7%	-0.430**	0.001	-8.3%
Childhood						
Foreign mother	0.037	0.773	0.9%	-0.148	0.333	-3.2%
Foreign father	0.105	0.392	2.7%	0.078	0.606	1.8%
Born in France	0.131	0.245	3.2%	0.113	0.398	2.4%
Brought up by the mother	-0.254*	0.061	-7.0%	0.151	0.418	3.2%
Brought up by the father	0.034	0.719	0.8%	-0.084	0.484	-1.9%
Parents had serious health problems	0.298**	0.000	8.2%	0.198**	0.039	4.7%
Separated from family	0.220**	0.010	5.9%	0.039	0.719	0.9%
Alcohol consumption						
None	Ref			Ref		
Missing	0.089	0.565	2.3%	0.002	0.994	0.0%
Without risk	-0.113*	0.090	-2.8%	-0.044	0.682	-1.0%
At risk. casual	-0.192**	0.048	-4.5%	-0.171	0.123	-3.7%
At risk. chronic	0.138	0.517	3.7%	-0.230	0.146	-4.7%
Tobacco consumption						
None	Ref			Ref		
Missing	-0.234	0.154	-5.5%	0.019	0.933	0.4%
Former daily smoker	0.192**	0.041	5.2%	0.088	0.386	2.0%
Casual smoker	0.031	0.813	0.8%	0.059	0.667	1.4%
Daily smoker	0.015	0.824	0.4%	0.096	0.238	2.2%
Location						
Lives in underprivileged suburbs	-0.032	0.759	-0.8%	-0.088	0.551	-1.9%
Region:						
Ile-de-France	Ref			Ref		

Alsace	-0.038	0.803	-0.9%	-0.341	0.133	-6.5%
Aquitaine	0.171	0.185	4.6%	-0.197	0.225	-4.0%
Auvergne	0.009	0.964	0.2%	-0.073	0.769	-1.6%
Basse-Normandie	0.168	0.357	4.5%	0.181	0.410	4.4%
Bourgogne	0.097	0.541	2.5%	0.000	1.000	0.0%
Bretagne	0.182	0.173	4.9%	-0.186	0.251	-3.8%
Centre	-0.060	0.697	-1.5%	-0.226	0.206	-4.6%
Champagne	-0.056	0.750	-1.4%	-0.152	0.488	-3.2%
Corse	0.380	0.457	11.0%	-0.582	0.307	-9.6%
Franche-Comté	0.398**	0.023	11.5%	-0.475*	0.065	-8.4%
Haute-Normandie	0.159	0.334	4.3%	-0.065	0.767	-1.4%
Languedoc Roussillon	0.240*	0.091	6.6%	-0.384*	0.064	-7.2%
Limousin	-4.117	0.953	-18.8%	-0.383	0.188	-7.1%
Lorraine	0.347**	0.012	9.9%	0.224	0.165	5.5%
Midi-Pyrénées	0.320**	0.028	9.0%	0.075	0.668	1.7%
Nord-Pas-de-Calais	0.176	0.132	4.7%	-0.174	0.230	-3.6%
Pays de la Loire	0.074	0.539	1.9%	0.040	0.785	0.9%
Picardie	0.066	0.659	1.7%	0.028	0.871	0.6%
Poitou-Charentes	0.102	0.532	2.7%	0.180	0.346	4.4%
Provence-Alpes-Côte-d'Azur	0.232**	0.028	6.3%	-0.094	0.514	-2.0%
Rhône-Alpes	-0.099	0.388	-2.4%	-0.070	0.587	-1.5%
% correct predictions	66.5%			67.0%		
Mac Fadden R-squared	0.061			0.059		

Propensity scores for accidents

Table 4 presents the Probit estimates for accidents. The estimates for women are shown in the first three columns. The probability of having an accident for women increases with being in the oldest age class (46-55: +12.3%), when parents had serious health problems (+8.0%), when the girl was separated from her family (+9.8%) and when the woman was a former daily smoker (+4.0%). Being a former daily smoker could be related to more risky attitudes in general. The probability of having an accident decreases when the woman had a foreign father (-8.4%) and with the level of education. We think that the last two results could be related to the possession of a driving license. About the first result, we assume, cautiously, that the women having a foreign father would be less likely to take their driving test for cultural reasons. Most immigrants in France come from Africa, where women more often depend on their father or brothers for driving. The fact that they would drive less often would explain why they have fewer accidents. The second result, showing that women with at least three years of college education would have a higher probability of having an accident than less educated women, can also be related to a higher likelihood of possessing a driving license. This would come from greater and more independent revenue sources, as well as from their professional requirements.

Table 4: Probability of having an accident

Maximum likelihood estimation of the Probit model. **: significant at the 5% level; *: significant at the 10% level

	Women			**Men**		
	Parameter	**P value**	**Average effect**	**Parameter**	**P value**	**Average effect**
Intercept	-1,345	0,000		-1,532	0,000	
Age class						
19-27	Ref			Ref		
28-36	0,142	0,169	2,9%	0,229**	0,027	6,3%
37-45	0,125	0,218	2,6%	0,344**	0,000	9,5%
46-55	0,558**	0,000	12,3%	0,576**	0,000	16,5%
Highest education achieved						
No certificate	Ref			Ref		
Primary education	-0,325*	0,096	-5,5%	0,119	0,508	3,3%
Secondary education (general)	0,044	0,741	0,9%	0,273	0,067	7,9%
Secondary education (profes.)	-0,219**	0,031	-4,1%	0,146	0,181	3,9%
O-level. professional	-0,398**	0,004	-6,7%	0,144	0,281	4,0%
O-level. general	-0,334**	0,013	-5,8%	0,252*	0,088	7,2%
2 years of college education	-0,334**	0,007	-5,9%	0,091	0,482	2,5%
At least 3 years of college education	-0,137	0,211	-2,6%	0,096	0,435	2,6%
Childhood						
Foreign mother	0,205	0,167	4,4%	-0,068	0,631	-1,8%
Foreign father	-0,517**	0,001	-8,4%	-0,068	0,636	-1,8%
Born in France	-0,194	0,131	-4,2%	0,095	0,452	2,4%
Brought up by the mother	-0,237	0,119	-5,2%	0,090	0,582	2,3%
Brought up by the father	0,138	0,187	2,6%	-0,147	0,175	-4,0%
Parents had serious health problems	0,354**	0,000	8,0%	0,447**	0,000	13,3%
Separated from family	0,423**	0,000	9,8%	0,139	0,151	3,8%
Alcohol consumption						
None	Ref			Ref		
Missing	0,097	0,625	2,0%	0,437**	0,040	12,9%
Without risk	0,115	0,153	2,3%	0,122	0,247	3,3%
At risk. casual	0,159	0,142	3,3%	0,028	0,794	0,7%
At risk. chronic	-0,029	0,916	-0,6%	0,385**	0,005	11,4%
Tobacco consumption						
None	Ref			Ref		
Missing	0,213	0,290	4,6%	-0,092	0,655	-2,4%
Former daily smoker	0,189*	0,074	4,0%	0,035	0,707	0,9%
Casual smoker	0,119	0,426	2,5%	-0,387**	0,012	-8,8%
Daily smoker	0,135*	0,083	2,8%	0,071	0,333	1,9%
Location						
Lives in underprivileged suburbs	0,216*	0,053	4,7%	0,066	0,619	1,8%
Region:						
Ile-de-France	Ref			Ref		

Alsace	0,060	0,733	1,2%	0,218	0,202	6,2%
Aquitaine	0,303**	0,034	6,8%	-0,063	0,657	-1,6%
Auvergne	0,683**	0,000	18,0%	0,179	0,395	5,0%
Basse-Normandie	0,399**	0,032	9,5%	0,647**	0,000	20,6%
Bourgogne	0,081	0,671	1,7%	0,098	0,597	2,7%
Bretagne	0,233	0,114	5,1%	-0,081	0,572	-2,1%
Centre	0,111	0,520	2,3%	-0,521**	0,008	-11,2%
Champagne	0,032	0,871	0,6%	0,292*	0,098	8,5%
Corse	-3,567	0,963	-13,7%	0,040	0,930	1,1%
Franche-Comté	0,572**	0,003	14,5%	-0,051	0,795	-1,3%
Haute-Normandie	0,135	0,476	2,9%	-0,189	0,380	-4,6%
Languedoc Roussillon	0,013	0,942	0,3%	-0,175	0,307	-4,3%
Limousin	0,632**	0,008	16,4%	0,133	0,521	3,7%
Lorraine	0,624**	0,000	16,0%	-0,158	0,373	-3,9%
Midi-Pyrénées	0,055	0,776	1,1%	-0,074	0,663	-1,9%
Nord-Pas-de-Calais	-0,039	0,790	-0,8%	-0,029	0,823	-0,7%
Pays de la Loire	-0,011	0,941	-0,2%	-0,254*	0,088	-6,1%
Picardie	-0,210	0,303	-3,8%	-0,345*	0,071	-8,0%
Poitou-Charentes	0,341**	0,046	7,9%	-0,010	0,957	-0,3%
Provence-Alpes-Côte-d'Azur	0,012	0,932	0,2%	0,003	0,981	0,1%
Rhône-Alpes	0,364**	0,002	8,3%	0,110	0,330	3,0%
% correct predictions	70,9%			67,6%		
Mac Fadden R-squared	0,093			0,073		

The determinants of the probability of having an accident for men are presented in the last three columns of Table 4. The probability of a man having an accident increases with all the age classes (from +6.3% to +16.5%), the fact that his parents had serious health problems (+13.3%), and chronic alcoholism (+11.4%). The probability decreases with being a casual smoker (-8.8%). The last two results can be related to the individual behavior towards risk: while being a casual smoker reveals caution towards risk, chronic drinking clearly goes in the other direction. We would just find that the men with the more risky attitudes in their everyday life would experience more accidents than the other men.

Overall, there seems to be less difference between men and women regarding accidents than for chronic diseases. The main difference is that women suffer more from being separated from their family.

Tables 3 and 4 also give us a clear message: the illness and accident samples are not balanced, so that one cannot compare them with the reference sample directly. We use matching methods to tackle this problem. Our comments will focus on the ATT, the average treatment effect on the treated, which corresponds here to the average effect of bad health on the performance of the people in bad health.

Impact of illness on performance measures

Table 5 presents the effects of chronic illness on our performance variables. A first performance variable refers to the end-of-period occupational status and to the subjective satisfaction index over the whole professional career. The second set of variables relates to the end-of-period incomes, with a dummy variable of being a recipient of the minimum assistance revenue, and the revenue class. In this performance analysis, we also restrict ourselves to end-of-period variables.

The effect (ATT) of chronic illnesses for women is significantly negative on both present occupation and the judgment about the whole professional career. The stronger effects relate to the present employment status: ill women had less often been working the week before the survey (-4.7%) and had been working fewer hours. They also have a lower subjective satisfaction index about their whole career than they would have had if in good health. Regarding revenues, ill women are more often in the lowest revenue class and less often in the highest revenue class.

The effect (ATT) of chronic illnesses for men is similar to women. Common points first. Ill men had also less often been working during the week before the survey (-6.6%) and had been working fewer hours. Secondly, they have a lower subjective satisfaction index about their whole professional career than they would have if in good health and, thirdly, they are more often in the lowest revenue class and less often in the highest revenue class.

Overall, chronic illnesses reduce activity, the number of hours worked and the revenues of both men and women. The activity and revenue losses are of a comparable order of magnitude for both.

Impact of accidents on performance measures

Table 6 presents the effects of accidents on the performance variables. Injured women had been working less often the week before the survey (-6.0%). Their subjective satisfaction index about their whole professional career is lower when they have had an accident (at the 10% level). It also appears that there are significant differences on the revenues. Injured women are more often the recipient of the minimum assistance revenue (+5.4%). They are more often in the lowest revenue class (+9.4%) and less often in the highest revenue class than they would have been if they hadn't had an accident (-4.9% in 2,500-4,000 Euros and -2.8% above 4,000 Euros).

The effect of an accident for men is similar except for revenues. Injured men had been working less often the week before the survey (-6.0%) and have a lower satisfaction index about their whole professional career. But men do not have a higher probability of getting the minimum assistance revenue and their end-of-period revenue is higher than women's. They have a higher probability of being in the lowest revenue class (+3.9% against +9.4% for women) and a smaller probability of reaching the highest revenue class (-5.3%). In particular, they do not have a lower probability of being in the 2,500-4,000 Euros class, in contrast to women.

Overall, accidents reduce activity and revenues, but not the number of hours worked. They also have a greater impact on women's revenues than on men's revenues.

Table 5. Effects of chronic illnesses on the performance variables

**: significant at the 5% level; *: significant at the 10% level. The chronic illness probabilities are derived from Table 3.

	Women							Men						
Variable	**Average treatment effect (ATE)**		**Average treatment effect on the not treated (ATN)**		**Average treatment effect on the treated (ATT)**		**% Obs in common support**	**Average treatment effect (ATE)**		**Average treatment effect on the not treated (ATN)**		**Average treatment effect on the treated (ATT)**		**% Obs in common support**
	Effect	**P value**	**Effect**	**P value**	**Effect**	**P value**		**Effect**	**P value**	**Effect**	**P value**	**Effect**	**P value**	
Has been working last week	-0.026	0.310	-0.021	0.440	-0.047**	0.033	94.9%	-0.024	0.493	-0.017	0.669	-0.066**	0.005	93.8%
Number of hours worked last week (if >0)	-0.865	0.436	-0.575	0.636	-2.225**	0.003	93.2%	-1.263	0.457	-1.151	0.541	-1.907**	0.027	95.9%
Subjective satisfaction degree of the career : missing	-0.022**	0.024	-0.024**	0.017	-0.012	0.189	94.9%	-0.007	0.512	-0.008	0.491	-0.002	0.764	93.8%
Subjective satisfaction degree of the career (if >0)	-0.402**	0.031	-0.397*	0.052	-0.421**	0.002	95.8%	-0.538**	0.023	-0.530**	0.042	-0.579**	0.000	93.8%
Minimum assistance revenue last month	0.018*	0.075	0.019*	0.074	0.014	0.153	94.9%	0.002	0.763	0.001	0.894	0.008	0.364	93.8%
Household monthly revenue : missing	0.004	0.704	0.005	0.649	-0.001	0.923	94.9%	-0.015	0.134	-0.014	0.187	-0.022**	0.017	93.8%
Less than 1,200 Euros	0.050**	0.005	0.048**	0.010	0.058**	0.001	94.9%	0.048**	0.046	0.047*	0.061	0.048**	0.018	93.8%
1,200-2,500 Euros	-0.011	0.653	-0.010	0.689	-0.014	0.541	94.9%	0.034	0.325	0.036	0.320	0.020	0.494	93.8%
2,500-4,000 Euros	-0.007	0.734	-0.008	0.730	-0.005	0.796	94.9%	-0.012	0.671	-0.013	0.666	-0.008	0.767	93.8%
More than 4,000 Euros	-0.031**	0.034	-0.030**	0.046	-0.033**	0.015	94.9%	-0.026	0.218	-0.024	0.291	-0.038**	0.024	93.8%

Table 6. Effects of accidents on the performance variables

**: significant at the 5% level; *: significant at the 10% level. The accident probabilities are derived from Table 4.

	Women							Men						
Variable	**Average treatment effect (ATE)**		**Average treatment effect on the not treated (ATN)**		**Average treatment effect on the treated (ATT)**		**% Obs in common support**	**Average treatment effect (ATE)**		**Average treatment effect on the not treated (ATN)**		**Average treatment effect on the treated (ATT)**		**% Obs in common support**
	Effect	**P value**	**Effect**	**P value**	**Effect**	**P value**		**Effect**	**P value**	**Effect**	**P value**	**Effect**	**P value**	
Has been working last week	-0,006	0,889	0,003	0,947	-0,060**	0,027	93.4%	-0,035	0,159	-0,029	0,288	-0,060**	0,002	93.6%
Number of hours worked last week (if >0)	0,589	0,776	0,810	0,721	-0,919	0,390	90.1%	-0,787	0,465	-0,702	0,564	-1,113	0,137	94.8%
Subjective satisfaction degree of the career : missing	-0,049**	0,000	-0,051**	0,000	-0,036**	0,001	93.4%	-0,010	0,191	-0,011	0,190	-0,006	0,225	93.6%
Subjective satisfaction degree of the career (if >0)	-0,018	0,958	0,037	0,921	-0,359*	0,059	92.1%	-0,506**	0,010	-0,435**	0,047	-0,784**	0,000	93.2%
Minimum assistance revenue last month	0,018*	0,055	0,013	0,202	0,054**	0,000	93.4%	0,011	0,249	0,013	0,224	0,004	0,605	93.6%
Household monthly revenue : missing	-0,037**	0,000	-0,037**	0,000	-0,035**	0,000	93.4%	-0,012	0,136	-0,013*	0,094	-0,006	0,542	93.6%
Less than 1,200 Euros	0,093**	0,001	0,093**	0,001	0,094**	0,000	93.4%	0,037**	0,037	0,036*	0,052	0,039**	0,027	93.6%
1,200-2,500 Euros	-0,001	0,980	-0,007	0,842	0,036	0,195	93.4%	-0,013	0,635	-0,007	0,813	-0,038	0,145	93.6%
2,500-4,000 Euros	-0,038	0,205	-0,036	0,257	-0,049**	0,037	93.4%	0,009	0,728	0,009	0,734	0,008	0,752	93.6%
More than 4,000 Euros	0,017	0,512	0,024	0,386	-0,028*	0,100	93.4%	-0,044**	0,004	-0,042**	0,008	-0,053**	0,002	93.6%

COMPARISON WITH REGRESSION ESTIMATORS

The Appendix provides the OLS estimators in Tables A-1 and A-2. We find that the methods show some differences but that, overall, the OLS estimators are close to the ATE estimator (the average effect over the whole population). Therefore some wrong conclusion can emerge when the ATE is different from the ATT. The most important difference is that the OLS estimator fails to indicate that women have a lower probability of being in the two highest revenue classes when they have had an accident.

CONCLUSION

In this article we look at whether and how chronic illnesses and accidents impact individual labor market performance. First we find that childhood living conditions and the health status of the parents have a strong effect on the individual probabilities of being in bad health. Secondly, we find that health events in general reduce the end-of-period participation in the labor market, the subjective satisfaction index about the whole career and the revenues. The predominance of ill and injured persons in the lowest part of the income distribution suggests than they face lower-wage and probably less stable jobs than the ones they would have had without the bad health event.

We also find differences related to the type of bad health and to gender. First, chronic illnesses reduce both labor market participation and the number of hours worked, while accidents reduce labor market participation only. Secondly, the most important difference that we find is between genders. Women who have had an accident suffer more from revenue losses than men. The latter result suggests a gender inequality regarding health consequences in the labor market.

REFERENCES

BARNAY T., 2005, « Santé déclarée et cessation d'activité », *Revue Française d'Economie*, vol. XX, n° 2: 73-106.

BLANCHET D., DEBRAND T., 2007, « Souhaiter prendre sa retraite le plus tôt possible : Santé, satisfaction au travail et facteurs monétaires » (Wanting to Retire as Early as Possible: Health, Job Satisfaction and Monetary Factors), *Économie et Statistique*, n°403-404: 39-62.

DEBRAND T., SIRVEN N., 2009, "What are the Motivations of Pathways to Retirement in Europe: Individual, Familial, Professional Situation of Social Protection Systems", *Working Paper Irdes*, n° 28. 2009/10, 22 pages.

BEHAGHEL L., BLANCHET D., DEBRAND T., ROGER M., 2011, "Disability and Social Security Reforms: The French Case", *NBER Working Paper*, n°17055, May, 31 pages.

CASE A., FERTIG A., PAXSON C., 2005, "The Lasting Impact of Childhood Health and Circumstance", *Journal of Health Economics*, vol. 24: 365-389.

CHIRIKOS T. N., NESTEL G., 1981, "Impairment and Labor Market Outcomes: A Cross Sectional and Longitudinal Analysis", *in* Parnes H.S. (ed.), "*Work and Retirement: A Longitudinal Study of Men"*, MIT Press, Cambridge: 91-131.

CHIRIKOS T. N., NESTEL G., 1985, "Further Evidence on the Economic effects of Poor Health", *Review of Economics and Statistics* vol. 67: 61–69.

CHIRIKOS T. N., 1993, "The Relationship between Health and Labor Market Status", *Annual Review of Public Health* vol. 14: 293–312.

CRICHTON S., STILLMAN S., HYSLOP D., 2011, "Returning to Work from Injury: Longitudinal Evidence on Employment and Earnings", *Industrial and Labor Relations Review*, vol. 64, n°4, July, art.7.

CURRIE J., MADRIAN B., 1999, "Health, Health Insurance and the Labor Market", *in* Ashenfelter O., Card D.(eds), *Handbook of Labor Economics*, vol. 3, chap. 50: 3309-3416.

DEHEJIA R., WABBA S., 2002, "Propensity Score Matching Methods for Non-Experimental Causal Studies*"*, *Review of Economics and Statistics*, 84: 151-161.

HAAN P., MYCK M., 2009, "Dynamics of Poor Health and Non-Employment", *Discussion Paper*, n° 4154, April, *IZA*, 21 pages.

IDLER E. L., BENYAMINI Y., 1997, "Self-rated health and mortality: a Review of twenty – seven communities studies", *Journal of Health and Social Behaviour*, vol. 38: 21-37.

LANOË J.L., 2005, « L'État de santé en France en 2003. Santé perçue, morbidité déclarée et recours aux soins à travers l'enquête décennale santé », *Études et Résultats*, n°436, octobre, Drees, 8 pages.

LEE MYOUNG-JAE, 2005, *Micro-Econometrics for Policy, Program and Treatment Effects*. Oxford University Press. ISBN 0199267685.

LINDEBOOM M., LLENA-NOZAL A., VAN DER KLAUW B., 2006, "Disability and Work", *Tinbergen Institute Discussion Paper* 039/03, 31 pages.

MITCHELL J. M., BURKHAUSER R., 1990, "Disentangling the Effect of Arthrisis on Earnings: A Simultaneous Estimate of Wage Rates and Hours Worked", *Applied Economics*, vol. 22: 1291-1310.

MOLLER-DANO A.M., 2005, "Road Injuries and Long Run Effects on Income and Employment", *Health Economics*, vol. 14, n°9: 955-970.

ROSENBAUM P.R., RUBIN D., 1983,"The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika*, 70 (1): 41-55.

ROSENBAUM P., D. RUBIN D., 1985, "Constructing a control group using multivariate matched sampling methods that incorporate the propensity score", *The American Statistician*, vol. 39, n°1: 33-38.

RUBIN D., 2006, *Matched sampling for causal effects*. Cambridge University Press, ISBN: 9780521674362

TESSIER P., WOLFF F. C., 2005, « Offre de travail et santé en France », *Économie et Prévision*, n°168: 17-41.

TRANNOY A., TUBEUF S., JUSOT F., DEVAUX M., 2010, "Inequality of Opportunities in health in France: A first Pass", vol. 19 (8): 921-938.

WADSWORTH M., BUTTERWORTH S., 2006, "Early Life", *in* Marmot M., Wilkinson R. (2006), *Social Determinants of Health*, Oxford University Press, Chap. 3: 31-53.

APPENDIX

Table A-1. Naïve estimators of the effects of chronic illnesses (potentially biased, given for comparison with the evaluation estimators in Table 5)

The OLS regressions include all the variables presented in the Table 3 Probit model as controls. **: significant at the 5% level; *: significant at the 10% level.

	Women							Men						
Variable	**Difference of the means**		**OLS with chronic illness dummy**		**OLS with chronic illness dummy and cross products**		**Obs.**	**Difference of the means**		**OLS with chronic illness dummy**		**OLS with chronic illness dummy and cross products**		**Obs.**
	Effect	**P value**	**Effect**	**P value**	**Effect**	**P value**		**Effect**	**P value**	**Effect**	**P value**	**Effect**	**P value**	
Has been working last week	-0.057**	0.006	-0.044**	0.028	-0.02	0.314	3358	-0.043*	0.055	-0.065**	0.001	-0.052**	0.016	2451
Number of hours worked last week (if >0)	-1.868**	0.003	-1.775**	0.005	-1.180*	0.060	2358	-2.026**	0.002	-2.081**	0.001	-1.633**	0.014	2028
Subjective satisfaction degree of the career : missing	-0.016	0.103	-0.012	0.171	-0.02	0.029	3358	-0.018**	0.025	-0.006	0.461	-0.007	0.478	2451
Subjective satisfaction degree of the career (if >0)	-0.480**	0.000	-0.382**	0.001	-0.386**	0.001	3142	-0.585**	0.000	-0.615**	0.000	-0.642**	0.000	2368
Minimum assistance revenue last month	0.024**	0.013	0.015	0.110	0.016*	0.084	3358	0.015	0.104	0.012	0.176	0.004	0.601	2451
Household monthly revenue : missing	0.001	0.896	0.001	0.956	0.005	0.643	3358	-0.022**	0.008	-0.020**	0.018	-0.017*	0.069	2451
Less than 1,200 Euros	0.072**	0.000	0.057**	0.001	0.047**	0.006	3358	0.055**	0.007	0.057**	0.004	0.049**	0.019	2451
1,200-2,500 Euros	-0.016	0.450	-0.015	0.480	-0.012	0.585	3358	0.021	0.456	0.013	0.631	0.009	0.734	2451
2,500-4,000 Euros	-0.024	0.212	-0.009	0.660	-0.007	0.737	3358	-0.010	0.696	-0.013	0.600	-0.021	0.417	2451
More than 4,000 Euros	-0.033**	0.014	-0.034**	0.010	-0.032**	0.019	3358	-0.044**	0.011	-0.036**	0.029	-0.019	0.324	2451

Table A-2. Naïve estimators of the effects of accidents (potentially biased. for comparison with the evaluation estimators in Table 6)

The OLS regressions include all the variables presented in the Table 4 Probit model as controls. ** : significant at the 5% level; * : significant at the 10% level.

	Women							Men						
Variable	**Difference of the means**		**OLS with accident dummy**		**OLS with accident dummy and cross products**		**Obs.**	**Difference of the means**		**OLS with accident dummy**		**OLS with accident dummy and cross products**		**Obs.**
	Effect	**P value**	**Effect**	**P value**	**Effect**	**P value**		**Effect**	**P value**	**Effect**	**P value**	**Effect**	**P value**	
Has been working last week	-0,053**	0,029	-0,054**	0,021	-0,037	0,152	3163	-0,005	0,781	-0,037**	0,027	-0,029	0,115	2611
Number of hours worked last week (if >0)	-1,519**	0,038	-1,260*	0,071	-0,603	0,387	2232	-0,969*	0,089	-1,394**	0,016	-1,285**	0,028	2175
Subjective satisfaction degree of the career : missing	-0,037**	0,000	-0,038**	0,000	-0,047**	0,000	3163	-0,024**	0,000	-0,002	0,678	-0,002	0,853	2611
Subjective satisfaction degree of the career (if >0)	-0,494**	0,000	-0,339**	0,009	-0,198	0,163	2966	-0,369**	0,001	-0,422**	0,000	-0,472**	0,000	2528
Minimum assistance revenue last month	0,053**	0,000	0,038**	0,002	0,025**	0,027	3163	0,004	0,547	0,006	0,360	0,010	0,262	2611
Household monthly revenue : missing	-0,036**	0,000	-0,035**	0,000	-0,036**	0,000	3163	-0,008	0,331	-0,006	0,509	-0,010	0,294	2611
Less than 1,200 Euros	0,107**	0,000	0,085**	0,000	0,090**	0,000	3163	0,034**	0,044	0,045**	0,004	0,040**	0,019	2611
1,200-2,500 Euros	0,014	0,585	0,029	0,267	0,017	0,549	3163	-0,009	0,693	-0,005	0,845	0,016	0,522	2611
2,500-4,000 Euros	-0,058**	0,008	-0,051**	0,019	-0,069**	0,004	3163	0,008	0,720	0,002	0,941	-0,015	0,508	2611
More than 4,000 Euros	-0,027*	0,085	-0,027*	0,089	-0,003	0,881	3163	-0,024	0,136	-0,037**	0,015	-0,032**	0,040	2611

DERNIERS NUMÉROS PARUS :

téléchargeables à partir du site http://www.cee-recherche.fr

N° 154 *Le revenu de solidarité active ou l'avènement des droits incitatifs*
ÉVELYNE SERVERIN, BERNARD GOMEL
mars 2012

N° 153 *Formes de rupture d'emploi et trajectoires de mobilités externes. Une analyse empirique À partir de données françaises du début des années 2000*
THOMAS AMOSSE, CORINNE PERRAUDIN, HELOÏSE PETIT
novembre 2011

N° 152 *Le RSA, innovation ou réforme technocratique ? Premiers enseignements d'une monographie départementale*
BERNARD GOMEL, DOMNIQUE MEDA
novembre 2011

N° 151 *Emplois informels hétérogènes et segmentation du marché du travail turc*
MELIKA BEN SALEM, ISABELLE BENSIDOUN
octobre 2011

N° 150 *La santé des indépendants : un avantage relatif à interpréter*
ÉLISABETH ALGAVA, CATHERINE CAVALIN, SYLVIE CELERIER
octobre 2011

N° 149 *L'importance des « réseaux d'entreprises » dans la mobilité sectorielle des salariés*
OANA CALAVREZO, RICHARD DUHAUTOIS, FRANCIS KRAMARZ
septembre 2011

N° 148 *Familles monoparentales allocataires du RMI ou de l'API et trappes à inactivité : les enseignements de l'enquête sur les expérimentations du rSa en France*
AI-THU DANG, DANIELE TRANCART
septembre 2011

N° 147 *Les effets du bénévolat sur l'accès à l'emploi : une expérience contrôlée sur des jeunes qualifiés d'Île-de-France*
JONATHAN BOUGARD, THOMAS BRODATY, CELINE ÉMOND, YANNICK L'HORTY, LOÏC DU PARQUET, PASCALE PETIT
mai 2011

N° 146 *L'impact de la crise sur les trajectoires professionnelles des jeunes*
ÉLISABETH DANZIN, VERONIQUE SIMONNET, DANIELE TRANCART
mai 2011

N° 145 *Pourquoi un retour à l'emploi plus rapide à proximité de la frontière ?*
JONATHAN BOUGARD
mai 2011