

1 Article

## 2 Food Insecurity in Homeless Families in the Paris 3 Region (France): Results from the ENFAMS Survey

4 Judith Martin-Fernandez <sup>1</sup>, Sandrine Lioret <sup>2</sup>, Cécile Vuillermoz <sup>1</sup>, Pierre Chauvin <sup>1</sup> and  
5 Stéphanie Vandentorren <sup>1,3,4\*</sup>

6 <sup>1</sup> Sorbonne Universités, UPMC Univ Paris 06, INSERM, Institut Pierre Louis d'Épidémiologie et de Santé  
7 Publique (IPLESP, UMRS 1136), Department of Social Epidemiology, Paris, France.

8 <sup>2</sup> INSERM, UMR1153 Epidemiology and Biostatistics Sorbonne Paris Cité Center, Early ORigin of the Child's  
9 Health and Development Team (ORCHAD), Paris Descartes University, Paris, France.

10 <sup>3</sup> Santé publique France, French National Public Health Agency. Saint-Maurice, France.

11 <sup>4</sup> Observatoire du Samusocial de Paris, Paris, France.

12 \* Correspondence: Stephanie.VANDENTORREN@santepubliquefrance.fr

13 **Abstract:** The number of families sheltered in the Paris region (France) increased by a factor of 5  
14 between 1999 and 2009. In 2013, a survey was performed on homeless families in order to  
15 characterize their living conditions, their health needs and the developmental problems in children.  
16 This random survey was conducted in 17 languages among homeless families sheltered in  
17 emergency centers for asylum-seekers, emergency housing centers, social rehabilitation centers and  
18 social hotels in the Paris region. The situation was particularly worrying regarding their food  
19 security. Indeed, only 14.0% of people were with food security, whereas 43.3% were with low food  
20 security and 9.8% very low food security (a situation where children are also affected). Stratified  
21 multivariate robust Poisson models showed that some characteristics can lead homeless families to  
22 be at higher risk of food insecurity and/or at higher risk of falling into very low food security, such  
23 as residential instability, single parenthood, having more than 3 children, depressive symptoms,  
24 housing in social hostels, difficult access to cheap or free food locally. These harmful situations are  
25 intolerable in such a wealthy region as the Paris region. They argue for a better detection of these  
26 families, a closer social follow-up and an increase in food aid.

27 **Keywords:** homeless; food insecurity; urban health

28

### 29 1. Introduction

30 Homelessness is increasing in Europe, reaching record numbers across several member states.  
31 In France, in 2012, the number of homeless was estimated at more than 140 000, representing a 50%  
32 increase since 2001 [1]. Recently, a report showed that being young, being a migrant and having  
33 dependent family members exposes oneself to the risk of having housing difficulties [2] and that  
34 families are the fastest growing segment in the homeless population [2]. For example, in 2010 in the  
35 Paris region, the homeless hotline sheltered more families than individuals: more than 11,000  
36 parents and children were accommodated, corresponding to a 300% increase in 10 years [3]. In  
37 France, despite this dramatically increasing number of homeless families, little is known regarding  
38 their living conditions and associated health problems. Nevertheless, some studies have shown that  
39 homeless people are dramatically affected by food insecurity [4-7]. Food insecurity (FI) "exists  
40 whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable  
41 food in socially acceptable ways is limited or uncertain" [8]. It is a risk factor for poor health [9,10];  
42 this situation is particularly worrying at the more severe stage of FI when children are exposed.  
43 Several studies demonstrated that households with children experiencing food insecurity are at  
44 higher risks of birth defects [11], anemia and suboptimal nutrient intakes [12-14], poorer general  
45 health [15], chronic diseases [16,17] and mental distress [18]. In industrialized countries, food

46 insecurity has been particularly studied and monitored in the general population in the US and  
47 Canada [19-21]. In France, its study is more recent [22-24] in the aftermath of the 2008 financial crisis.

48 In this context and for the first time in France, the *Observatoire du SamuSocial de Paris* conducted  
49 in 2013 the ENFAMS (Enfants et familles sans logement) survey on homeless children and families  
50 in the Paris region [3] in order to describe their socio-demographic characteristics and evaluate their  
51 health status and needs. Based on this study, the number of sheltered families was estimated at more  
52 than 10,000 (about 35,000 people, including more than 17,000 children younger than 12 years).

53 The objectives of the present paper were to estimate the prevalence of FI in homeless families  
54 and children and the living conditions associated, in order to better understand and prevent it. It  
55 aimed to identify the characteristics of families that managed to remain food secure in this extreme  
56 situation and the characteristics of the families that are experiencing the most severe level of food  
57 insecurity.

## 58 2. Materials and Methods

### 59 2.1. Study design and participants

60 A complex sampling design was used to obtain a representative sample of 801 homeless  
61 families [3] sheltered in different kind of facilities. In France, various types of shelters exist. This  
62 study chose to focus on emergency centers, social rehabilitation centers, social hostels and centers for  
63 asylum seekers in Paris and its region. Emergency shelters are generally characterized by group  
64 accommodations that provide only short-term, basic services (overnight accommodation with  
65 breakfast). Long-term rehabilitation centers and social hostels provide rooms in a collective facility,  
66 self-contained flats or hotel rooms with stays lasting up to several months and a wide variety of  
67 services (e.g. access to a kitchen). Asylum seekers are usually sheltered in special centers with a  
68 social and administrative aid during the whole processing of the application. However, since the  
69 early 2000s, there have been a shortage of beds in these centers in the Paris region, and asylum  
70 seekers are increasingly being accommodated in cheap hotels.

71 An eligible family was defined as comprising of at least one parent (>18-year old) with at least  
72 one child younger than 13 years, speaking one of the 17 languages available for the survey and able  
73 to provide written consent to participate. Participation rate was 79%. Non-participant adults were  
74 younger (mean age: 33 years vs. 38), more often men (15.3% vs. 4.6%) and more likely to have more  
75 than two children under care (31.7% vs. 23.1%) than participants.

76 The survey design and sampling frame have been described elsewhere [3,25]. Briefly, a 3-level  
77 sampling method has been used: first a random selection of shelters (among an exhaustive list of all  
78 services in the Paris region), then a random selection of families in each selected service (either the  
79 single parent or the mother or the father was interviewed; in 95.4% of the cases this was the mother),  
80 and finally a random selection of one child from every family.

### 81 2.2. Data collection

82 After obtaining written consent, an interviewer administered a face-to-face questionnaire to the  
83 parent. It collected demographics (age, gender, country of birth, migration and residential  
84 trajectories, marital status, number of children), socio-economic characteristics (level of education,  
85 financial support, occupational status, professional experiences, housing history since the first  
86 episode of homelessness, number of accommodation moves since the beginning of the most recent  
87 episode of homelessness, social relationships, social support, and understanding of the French  
88 language). Food insecurity was measured using the Household Food Security Scale Measure  
89 (HFSSM), a scale created by the US Department of Agriculture (USDA) [26], the French translation of  
90 which was previously used in Québec [27] and in France [22]. The HFSSM questionnaire includes a  
91 preliminary question and 18 items (10 adult-referenced and 8 child-referenced). A single score  
92 ranging from 0 to 18 was calculated as the total number of affirmative responses, i.e. "yes" or  
93 "sometimes/often" to the 18 questions. It was divided into four categories defined by the usual  
94 thresholds: food security (FS, score < 3), marginal food security (MFS, score = 3-7), low food security

95 (LFS, score = 8-12) and very low food security (VLFS, score > 13) [28,29]. The last and most severe  
96 category (VLFS) indicates disrupted eating patterns and reduced food intake that affect also the  
97 children in the Household (HH).

98 This study has been approved by 2 ethics committees (the *Comité de protection des personnes* of  
99 the Paris region, and the national *Comité consultatif sur le traitement de l'information en matière de*  
100 *recherche*) and by the *Commission Nationale de l'Informatique et des Libertés*, in charge of the citizens'  
101 data protection.

### 102 2.3. Outcomes

103 Due to the specificity of our population, we chose to focus on the 2 extreme situations: food  
104 security and very low food security. Two dichotomous variables were used in multivariable  
105 analyses: Food-secure (FS) vs. Food-insecure (i.e. MFS+LFS+VLFS, model 1); and VLFS vs. LFS  
106 (model 2) in order to study specifically what distinguished people between these two most severe  
107 categories, i.e. what might contribute to cause people with low food security fall into very low food  
108 security where their children were also affected.

### 109 2.4. Covariates

110 HH monthly income was calculated as the total HH income divided by the number of people in  
111 the consumption unit (CU) on the basis of the OECD scale [30]. It was used as a continuous  
112 numerical variable (expressed in fifties of €/CU increments), then as a stratification categorical  
113 variable (due to interactions discussed below). For this latter purpose, we computed a different  
114 variable for each of the two models: (i) for model 1, the threshold for stratification was set as the  
115 mean income of people in FS (i.e. 477€/CU); (ii) for model 2, the threshold for stratification was set as  
116 the mean income of people experiencing VLFS (i.e. 160 €/CU).

117 Depressive mood was defined as a positive answer to the following question: "During the last  
118 12 months, did you feel constantly sad, depressed or without any hope for at least 2 weeks?"

119 Living conditions were addressed based on the type of housing (social hostels; emergency  
120 housing centers; centers for asylum seekers or social rehabilitation centers), the number of  
121 accommodation moves since the beginning of the most recent episode of homelessness (mentioned  
122 as "number of moves" in the rest of the paper), and the housing condition before homelessness. The  
123 latter concerned the place of housing before the first experience of homelessness (mentioned as  
124 "housing conditions before homelessness" in the rest of the paper): personal or family home; housed  
125 by someone (friend, family or relative); in a shelter, a hotel or a slum; or just arrived in France. In  
126 multivariate analysis, we built a dichotomous variable "just arrived in France" versus all the other  
127 conditions in order to examine this specific population who experienced homelessness as soon as  
128 they arrived in France.

129 Matrimonial status (married; divorced; widowed; single; or other) and the number of children  
130 in the HH (1 or 2; 3; 4 or more) allowed us to characterize the family situation at the time of the  
131 survey.

132 Social isolation was based on 5 questions about the frequency of interactions (by phone, email,  
133 or letters) with family members or relatives over the last 12 months, leading to a dichotomized  
134 variable ( $\geq 1$  contact vs. none).

### 135 2.5. Statistical analyses

136 Sampling weights (defined as the inverse of the inclusion probability) were computed for all  
137 participants and used for all the prevalence estimates. Chi-square tests were used to study the  
138 factors associated with food insecurity. Robust Poisson regression models were computed in order  
139 to estimate adjusted Incidence Rate Ratios (aIRR) and their 95 percent confidence intervals (CIs) in  
140 both models 1 and 2. Since there was a strong interaction between food security status, income and  
141 other factors, both models were simultaneously stratified by income and adjusted by 50€ increment  
142 income. Statistics were performed on Stata 12® (StataCorp, Texas, USA).

143 **3. Results**

144 For the current analysis, we excluded the families who did not answer the HFSSM (n=29, 3.6%),  
 145 which led to a sample of 772 homeless families. These excluded families showed no statistically  
 146 difference in their mean age or their mean income from the included ones.

147 *3.1. Description of the studied population*

148 Characteristics of our sample are summarized in Table 1.

149 As mentioned above, the parent interrogated was in 96.0% of the case, the mother. They were  
 150 relatively young with a mean age of 32.4 years (SD=0.33) and more than 85% were less than 40 years  
 151 old. If 41.1% of the respondents were married (95% CI = [35.4-47.0]), 37.1% (95% CI = [32.1-42.3])  
 152 were single. In our sample, 21.5% of the households had 3 or more children. Families' monthly  
 153 income was on average 307 €/CU (SD=16.42).

154 Only 6.3% of the respondents were born in France (95% CI = [4.1-9.6]); 45.0% had a nationality  
 155 from a Sub-Saharan African country and 18.6% from one the Commonwealth of Independent States.

156 Regarding their homeless situation, approximately 30% were homeless since less than a year  
 157 but almost 50% were homeless for 2 years and more; 74.0% had experienced two moves or less in the  
 158 last 12 months when almost 8% had experienced 6 moves or more over the same period.

159 **Table 1.** Characteristics of the sample.

	n	Weighted proportions	95% CI
<b>Age group</b>			
17-25	121	15.7	[12.2-20.0]
26-30	218	27.3	[23.0-32.0]
31-39	321	42.2	[37.7-46.8]
≥ 40	112	14.9	[12.0-18.2]
<b>Gender</b>			
Men	36	4.0	[2.6-6.1]
Women	736	96.0	[93.9-97.4]
<b>Matrimonial status</b>			
Married	302	41.1	[35.4-47.0]
Divorced	48	5.6	[3.9-8.0]
Widowed	10	1.0	[0.5-2.0]
Single	307	37.1	[32.1-42.3]
Other	105	15.3	[11.8-19.5]
<b>Number of children in the HH</b>			
1 - 2	587	78.4	[73.1-82.9]
3	130	15.5	[11.9-20.0]
≥ 4	55	6.0	[4.1-8.7]
<b>Country of birth</b>			
France	40	6.3	[4.1-9.6]
Abroad	732	93.7	[90.4-95.9]
<b>Nationality</b>			
Sub-Saharan Africa	346	45.0	[40.4-49.7]
Commonwealth of Independent States	149	18.6	[15.4-22.4]
Maghreb	58	11.3	[7.9-15.8]

Europe	71	10.6	[7.6-14.8]
Non Sub-Saharan Africa	53	7.6	[5.5-10.3]
Asia	30	4.6	[2.8-7.7]
Americas	10	2.2	[0.8-5.5]
Middle East	3	0.2	[0.0-0.5]
<b>Homeless duration (years)</b>			
< 1	217	29.6	[25.1-34.7]
1 - 2	204	22.0	[18.3-26.4]
2 - 4	211	27.6	[23.0-32.8]
≥ 4	140	20.7	[16.6-25.5]
<b>Number of moves in the last 12 months</b>			
0	315	39.8	[34.5-45.2]
1 - 2	257	34.2	[29.3-39.4]
3 - 5	130	18.2	[14.8-22.2]
≥ 6	70	7.9	[5.7-10.7]

### 160 3.2. Prevalence of food insecurity

161 Prevalence of food insecurity was at a very high level. Only 14.0% of people were FS, whereas  
162 32.9% were in MFS, 43.3% in LFS and 9.8% in VLFS.

### 163 3.3. Factors associated with food security status: univariate analysis (Table 2)

164 The prevalence of FS and VLFS differed according to the type of housing. FS prevalence was  
165 higher in emergency housing centers and social rehabilitation centers (respectively 23.8% and 22.5%)  
166 when VLFS was particularly high in social hostels (11.0%,  $p=0.04$ ).

167 Housing conditions before homelessness were not significantly associated with food security  
168 status but the low level of FS (9.5%) in migrants who experienced homelessness for the first time  
169 upon arrival in France is worth noting. The prevalence of FS increased with the duration of the stay  
170 in the current accommodation, contrary to the prevalence of VLFS. The number of moves per year  
171 was lower in FS households (1.80 moves per year,  $SD=0.18$ ) as compared to VLFS ones (3.43 moves  
172 per year,  $SD=0.34$ ,  $p<0.001$ ).

173 VLFS prevalence was higher in people reporting a depressive mood (13.2% vs. 3.2%,  $p<0.001$  of  
174 those who did not) and FS prevalence was lower (respectively: 10.0% vs. 23.5%,  $p<0.001$ ).

175 Family composition was not statistically associated with FS status even though married people  
176 seemed to experience less frequently VLFS and families with 4 or more children experienced less  
177 frequently FS.

178 The mean income/CU/month was dramatically higher in FS families (477.8 €,  $SD=34.75$ ) than in  
179 VLFS ones (160.7€,  $SD=24.94$ ;  $p<0.0001$ ).

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**Table 2.** Factors associated with food security status: univariate analysis.

	n	Food security			Very low food security		
		(%)	95% CI	p	(%)	95% CI	p
<b>Type of housing</b>							
Emergency housing centers	63	23.8	[14.3-36.9]	0.02	10.9	[5.1-21.9]	0.04
Social rehabilitation centers	103	22.5	[13.5-35.1]		3.9	[1.8-8.3]	
Centers for asylum-seekers	133	15.4	[10.1-22.9]		8.3	[4.3-15.1]	
Social hostels	453	11.7	[8.7-15.5]		11.0	[7.8-15.2]	
<b>Housing condition before homelessness</b>							
At his home (or family home)	95	21.3	[13.0-32.7]	0.12	3.1	[1.1-8.3]	0.09
Housed by someone	356	14.6	[10.4-20.0]		11.8	[7.7-17.5]	
In a shelter, a hotel, a slum	42	13.6	[5.6-29.4]		10.7	[4.6-22.9]	
Upon arrival in France	267	9.5	[6.0-14.6]		10.1	[6.6-15.1]	
<b>Time spent in the present accommodation (in months, quartiles)</b>							
<4.5	192	10.6	[6.0-18.0]	0.01	16.4	[9.6-26.6]	0.005
[4.5-7.9[	189	15.7	[9.90-24.0]		8.9	[5.3-14.5]	
[7.9-15.4[	197	7.8	[4.4-13.2]		9.9	[6.3-15.2]	
≥15.4	194	21.1	[15.4-28.1]		3.8	[1.8-7.5]	
<b>Depressive mood</b>							
Yes	505	10.0	[7.0-14.2]	<0.001	13.2	[9.6-17.8]	<0.001
No	244	23.5	[18.0-30.2]		3.2	[1.8-5.6]	
<b>Matrimonial status</b>							
Married	302	15.4	[11.0-21.2]	0.056	7.6	[5.0-11.2]	0.37
Divorced	48	8.5	[4.0-17.1]		16.3	[5.9-37.9]	
Widowed	10	41.3	[12.6-77.4]		0.0	-	
Single	307	10.6	[7.7-14.5]		11.3	[7.7-16.2]	
Other	105	18.4	[10.9-29.5]		10.4	[5.4-19.1]	
<b>Number of children in the household</b>							
1 - 2	587	12.8	[9.8-16.6]	0.051	8.9	[6.0-12.8]	0.23
3	130	21.5	[14.2-30.9]		11.7	[6.9-19.1]	
≥ 4	55	9.5	[4.1-20.3]		17.3	[7.7-34.1]	
<b>Contacts with family members or relatives over the last 12 months</b>							
≥ 1	692	14.1	[11.2-17.7]	0.73	9.4	[6.8-13.0]	0.14
None	80	12.4	[6.0-23.9]		15.9	[8.7-27.3]	
<b>Number of moves per year</b>							
Mean (SD)	772	1.8	(0.2)		3.4	(0.3)	
<b>Monthly income (€/CU)</b>							
Mean (SD)	772	479	(35)		161	(24)	

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## 184 3.4. Model 1: Factors associated with food security in multivariate analysis (Table 3)

185 In the first strata (households with an income  $\leq 477$  €/CU), income was positively associated  
 186 with FS. Respondents not experiencing depressive mood were more likely to be food secure  
 187 (aIRR=2.40; 95% CI=[1.53-3.80]). The major factors linked with FS were in relation with homelessness  
 188 conditions: migrant families who were already living in France when they experienced  
 189 homelessness for the first time tended to be more often FS (even if the  $p$  value was at the border of  
 190 the significance), as were families housed in emergency housing centers, centers for asylum seekers  
 191 and social rehabilitation center (respectively: aIRR=2.25, 2.35, 2.69 with social hostel as the reference)  
 192 and those that had spent more than 15 months in the current accommodation.

193 In the second strata - i.e. in people with a little more financial resources - housing status  
 194 continued to play a role in food security (with some differences regarding these types). Families with  
 195 a monthly income above 477 €/CU were more likely to be with FS if they were housed in an  
 196 emergency housing center (aIRR=3.63; 95% CI=[1.09-12.10]), in social hostels (aIRR=4.71; 95%  
 197 CI=[1.63-13.66]) or in social rehabilitation centers (aIRR=4.84; 95% CI=[1.72-13.61]) compared to those  
 198 who lived in center for asylum seekers. In this strata also, not being in a depressive mood was  
 199 associated with being FS (aIRR=2.34; 95% CI=[1.55-3.55]). Finally, parents in a couple were 1.53 (95%  
 200 CI=[1.00-2.35]) more likely to be food secure than those who were single, divorced or widowed.

201 **Table 3.** Model 1: factors associated with food security: stratified multivariate analysis.

	aIRR	95% CI	p
<b>Among families with monthly income <math>\leq 477</math> €/CU (n=559)</b>			
Monthly income per consumption unit /50€	1.16	[1.07-1.25]	<0,001
<b>Depressive mood</b>			
Yes	Ref.	-	-
No	2.40	[1.53-3.8]	<0,001
<b>Time spent in the current accommodation (in months)</b>			
< 15	Ref.	-	-
$\geq 15$	1.75	[1.09-2.81]	0.02
<b>Type of housing</b>			
Social hostels	Ref.	-	-
Emergency housing centers	2.25	[1.17-4.31]	0.015
Centers for asylum-seekers	2.35	[1.35-4.07]	0.002
Social rehabilitation centers	2.69	[1.35-5.34]	0.005
<b>Housing condition before homelessness</b>			
Upon arrival in France	Ref.	-	-
Other	1.66	[0.99-2.79]	0.053
<b>Among families with monthly income <math>&gt; 477</math> €/CU (n=162)</b>			
Monthly income per consumption unit /50€	1.04	[1,03-1,07]	<0,001
<b>Type of housing</b>			
Centers for asylum-seekers	Ref.	-	-
Social hostels	4.71	[1.63-13.66]	0.004
Emergency housing centers	3.63	[1.09-12.1]	0.04
Social rehabilitation centers	4.84	[1.72-13.61]	0.003
<b>Depressive mood</b>			
Yes	Ref.	-	-
No	2.34	[1.55-3.55]	<0,001

**Matrimonial status**

Single, divorced, widowed	Ref.	-	-
In a couple	1.53	[1.00-2.35]	0.05

## 202 3.5. Factors associated with very low food security in multivariate analysis (Table 4)

203 In the first strata (households with a monthly income  $\leq 160$  €/CU), monthly income (per 50€  
204 increment) seemed to have a protective effect even though it is not statistically significant. The  
205 number of children was strongly associated with a VLFS status, with a dose-effect response and a  
206 highest risk being observed among families with 4 children and more (aIRR=3.30; 95%  
207 CI=[1.62-6.75]). Families whose answering parent reported a depression mood were 3.79 times (95%  
208 CI=[1.35-10.66]) more at risk of being in VLFS. The numbers of moves per year was also a risk factor  
209 for those families.

210 In the second strata, three factors remained associated with a higher risk of VLFS: the number of  
211 moves per year (aIRR=1.16, 95% CI=[1.07-1.27]), the housing condition before homelessness  
212 (globally, all the other situations were at higher risk of being VLFS than having experienced  
213 homelessness upon arrival in France) (aIRR=2.70; 95% CI=[1.19-6.15]) and the absence of any social  
214 contact in the last year (aIRR=2.37; 95% CI=[1.09-5.15]).

215 **Table 4.** Model 2: factors associated with very low food security: stratified multivariate analysis.

	aIRR	CI	p
<b>Among families with monthly income <math>\leq 160</math> €/CU (n=120)</b>			
Monthly income per consumption unit /50€	0.91	[0.67-1.23]	0.54
Number of moves per year	1.09	[1.03-1.15]	0.005
<b>Number of children in the household</b>			
1 or 2	Ref.	-	-
3	1.95	[1.04-3.66]	0.04
$\geq 4$	3.30	[1.62-6.75]	0.001
<b>Depressive mood</b>			
No	Ref.	-	-
Yes	3.79	[1.35-10.66]	0.012
<b>Among families with monthly income <math>&gt; 160</math> €/CU (n=160)</b>			
Monthly income per consumption unit /50€	0.99	[0.90-1.08]	0.77
Number of moves per year	1.16	[1.07-1.27]	0.001
<b>Couple status</b>			
Is or has been in couple	Ref.	-	-
Single	2.00	[0.96-4.18]	0.06
<b>Contacts with family members or relatives over the last 12 months</b>			
$\geq 1$	Ref.	-	-
None	2.37	[1.09-5.15]	0.03
<b>Housing condition before homelessness</b>			
Upon arrival in France	Ref.	-	-
Other	2.70	[1.19-6.15]	0.02

216 **4. Discussion**

217 This study provided original insights into the food insecurity issue and associated factors in this  
218 vulnerable and understudied population. Our results showed that the homeless population in Paris



219 urban area, characterized by foreign origins and specific familial situations (i.e. single female  
220 families, large families), was highly food insecure. Compared to the prevalence of food insecurity  
221 evaluated in 2010 in the general population living in the same urban area [22], the difference is  
222 striking (6.30% vs. 86.0%). Whereas this level of prevalence has already been observed in other  
223 studies focusing on homelessness [31-34], it is surprising and even worrying in France, a country  
224 that can be considered as a welfare state, ranking first among OCDE countries for the proportion of  
225 its GDP dedicated to public social expenditures.

226 Monthly income and the absence of depressive mood were both positively associated with FS.  
227 The poorest homeless families were also more likely to be with FS if they had benefited from some  
228 stability in their accommodation and if they had been housed in shelters rather than in social hostels.  
229 In homeless families with slightly higher income, the factors were overall similar, except few  
230 differences: asylum centers were the type of accommodation with lower FS prevalence and being in  
231 a couple was associated with a food security status.

232 Focusing on what distinguishes families in LFS from those in VLFS, we found that the latter had  
233 experienced significantly more moves per year. Among the poorest families, those who had 3  
234 children or more and/or whose responding adult was depressed were at higher risk of being VLFS.  
235 Among families with slightly higher income, single parents were twice as likely to be VLFS than  
236 those who were or had been in a couple. Also, the absence of contact with family or friends during  
237 the last year increased the likelihood of being in VLFS.

238 Our study has some limitations. ENFAMS study is a cross-sectional survey and this makes  
239 difficult to be sure of the direction of some associations we observed. If food insecurity is not  
240 considered to be the cause of moving (moves are forced in accordance with the availability of  
241 accommodations), parental separation or birth of a third child, depression and severe food  
242 insecurity may be linked in both directions as discussed later. Also our sample size was quite small  
243 and our analysis stratified, which may have led to some lack of statistical power that could explain  
244 why some factors didn't remain statistically associated in multivariate analysis.

245 On the opposite, ENFAMS study has some unique strength. Based on a random sample of  
246 homeless families, it interviewed people in 17 languages allowing taking the cultural diversity of  
247 this population group into account. Also, we used a validated questionnaire to assess food  
248 insecurity.

249 Studying food insecurity in homeless populations allowed us to analyze thoroughly how very  
250 vulnerable families could confront signs of food security or, on the contrary, fall into the most  
251 deleterious food insecurity. VLFS is indeed a state of disrupted eating patterns, reduced food intake  
252 and skipped meals that affect children as well. This situation is very extreme since it is known that  
253 food insecure parents are struggling and do their best to protect their child from FI [35]. The factors  
254 leading to such an extreme situation were therefore particularly interesting to investigate.

255 We observed – for the first time in France – that depression is linked with food insecurity in a  
256 homeless population. A large number of studies investigated this complex association among  
257 vulnerable families [36-39]. Our results also shows that homeless adults with children in a very  
258 deprived situation (with a monthly income of less than 160 €/CU) who reported a depressive mood  
259 were more than 3.5 times more at risk of being in very low food security. Depressive mood play an  
260 important part in the way families can cope with deprived situation and in their food security status.  
261 Conversely, the chronic stress associated with living in poverty has repeatedly been shown to have  
262 detrimental effects on mental health through various potential pathways [40-42].

263 Family composition is also an important determinant of food insecurity. We found that living in  
264 a couple was linked with FS whereas being single was associated with VLFS among the wealthiest.  
265 Also, the increasing number of children among the poorest subjects was associated with an  
266 increasing risk of falling into VLFS. It could easily be assumed that having 2 adults in the family  
267 increases and facilitates food access and that having more children increases the difficulties in  
268 providing enough food for everyone in the household. The absence of contact with family and  
269 relatives could indicate also that the social, psychological support usually provided by these contacts  
270 protect from the last severe form of food insecurity. Complete social and family isolation may also be

271 the result of (or the proxy for) very traumatic personal histories (directly – e.g. domestic violence –  
272 and/or indirectly, withdrawal being a consequence of posttraumatic psychological distress [43]).

273 Housing stability was associated with FS and; conversely, the risk of VLFS increased with the  
274 number of moves per year. A study highlighted the link between housing instability and food  
275 security [6] and noted that moves require a lot of personal investment and energy for the homeless  
276 and impact their usual food access process. In our population, the families have experienced a mean  
277 of 4.3 moves since they were homeless [3] and there is no doubt that such a residential instability is a  
278 source of difficulties for these families to know and access to the local cheap food supply.

279 We also observed that the type of housing was linked with the food security status: homeless  
280 families in emergency housing centers and social rehabilitation centers were both more food secure  
281 than those in social hostels or centers for asylum-seekers. We searched for a potential impact of  
282 cooking facilities available in these different types of housing since we knew that, for example,  
283 fridges, cookers, and microwaves are less available in social hostels; but we did not find any such  
284 significant association. The quality and the importance of the social services available vary  
285 depending on the different housing structures but that can not explain the differences observed  
286 since they are generally poorer in social hostels but also in emergency centers and better in social  
287 rehabilitation centers and even more so in centers for asylum-seekers. The hypothesis of the role of  
288 the geographical environment of the various housing structures deserves also to be raised. Indeed,  
289 some studies showed the impact of the social and local environment such as the living location, and  
290 the socioeconomic, social and food environment on food insecurity [44,45]. The questions of the  
291 impact of social and food environment may be important in the Paris region since homeless families  
292 are increasingly housed in structures (particularly in social hostels) located far from city centers or in  
293 neighborhoods with poor public transportation services but we had no data to further explore these  
294 issues.

295 Finally, we found some contradictory results regarding the association between FS and housing  
296 conditions before the first experience of homelessness: families who have become homeless upon  
297 arrival in France were at higher risk of food insecurity but they were also those with a lower risk of  
298 falling into VLFS. It is not surprising that the former are at risk of FI if they were also those with  
299 higher risks of not knowing how to proceed in order to acquire some cheap or free food (through  
300 food banks, soup kitchens or social groceries). Regarding the second result, we can assume that  
301 people with harsh living conditions at their arrival in France have, then, better knowledge or  
302 resources that prevent them to fall into the most severe form of food insecurity, i.e. to protect their  
303 children from FI.

## 304 5. Conclusions

305 Severe forms of food insecurity are intolerably frequent among homeless families in the Paris  
306 region, for one of the 10 wealthiest European regions and the capital region of a country that devotes  
307 a considerable part of its public budget to social welfare. From a political perspective, it seems  
308 doubtful that the situation would be the same if these homeless families were not mostly migrants.  
309 For the many social programs and professionals who work with these families, our results may help  
310 them to prevent these situations among those the most at risk, i.e. those cumulating some conditions  
311 such as residential instability, single parenthood, having more than 3 children, depressive  
312 symptoms, difficult access to cheap or free food locally and living in social hostels are risk factors of  
313 food insecurity. Food aid must be a top priority in this population; it is not out of reach if we  
314 consider that approximately 10,000 families were homeless at the time of the survey, accounting for  
315 35,000 people in a region of almost 7 million inhabitants.

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324 substantially to the paper.

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