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# Undernutrition in geriatric institutions in South-West

## France: policies and risk factors.

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Running head: Undernutrition risk in geriatric institutions

### **Abstract**

**Objective:** This study aimed to describe the nutritional status of geriatric home residents according to their place of dwelling and to identify institutional factors associated with higher rates of undernutrition.

**Method:** All institutions (514) in the Aquitaine region were interviewed for staff ratio, nutrition procedures, staff training and other procedures in the area of nutrition. A stratified random sample of 601 residents in a sub-sample of 42 institutions underwent Mini Nutritional Assessment (MNA).

**Results:** The estimated prevalence of undernutrition was 19.1 (95% CI: 14.0-24.2) with a higher rate in long-term care (48.0 % (95% CI: 15.9-80.2) than in nursing homes (14.5 % (95% CI: 10.6-18.4),  $p < .0001$ ). In univariate analyses the risk of undernutrition was higher in long-term care ( $P < .0001$ ), in settings with better weighing equipment ( $P < .0001$ ), higher

staff ratio ( $P = .0001$ ), higher rate of subjects needing help for eating ( $P < .0001$ ) and was lower in settings with a higher rate of training in nutrition screening ( $P = .0001$ ) and management ( $P < .0001$ ). In nursing homes, each item of the MNA-Short Form was independently predictive of undernutrition. In multivariate analyses in nursing homes only, better weighing equipment ( $OR_{adj} 2.34$ , 95% CI 1.39-4.12,  $P = .0017$ ) and higher staff ratio ( $OR_{adj} 1.03$ , 95% CI 1.00-1.05,  $P = .0230$ ) were associated with higher rates of undernutrition.

**Conclusions:** Undernutrition in institutions was linked to the resident health problems with little evidence in favor of the influence of institutional policies

Key Words: MNA; staff training; functional dependency; nutritional supplementation

## ***Introduction***

Undernutrition is a major concern in geriatric institutions. Outcomes of undernutrition are reported to be severe, including poor quality of life, functional decline, pressure ulcers, higher risk of hospitalization and higher mortality (1-3). Thus, it is of great interest to promote any means likely to lower the rate of undernutrition in geriatric institutions. Indeed, studies using either anthropometric criteria or the Mini Nutritional Assessment (MNA) (4) have estimated prevalence of undernutrition at 20-40% (4-12). This prevalence varies according to the kind of institutions and could be as high as 70% in long-term care according to MNA assessments (4) but as low as 2% or 6% in some settings (13, 14). Some of these studies, however, did not claim to be representative of the institutionalized population. In fact, one of them included all the geriatric institutions around Helsinki and reported that according to the MNA score, 29% of residents were undernourished and 60 % were at risk for malnutrition (12).

Nevertheless, undernourished patients could be at higher risk of institutionalization than those with adequate nutritional status, mainly due to comorbidity, cognitive and

functional impairment and, in some cases, social isolation. We have shown that low oral intake is an independent risk factor for institutionalization in hospitalized elderly people (15). An epidemiological study in an adult community population also showed that 10-year weight loss or weight gain were both associated with an increased rate of institutionalization (16). Thus, rates of undernutrition are expected to be higher in geriatric institutions than in the community and this further emphasizes the need for investigations in this area.

Indeed, it has been shown that within geriatric institutions, risk factors for low BMI or weight loss were age over 85y, low dietary intake, functional dependency and bed-ridden state, depression and chewing problems (7). In Finnish institutions, dementia, low dietary intake, functional dependency and swallowing disorders were also associated with undernutrition (12). Within nursing homes, low BMI was associated with poorer quality of life (9) and thus should be considered a target for quality improvement.

Progress in this area can come either from better prevention, diagnosis or treatment of undernutrition and its causal factors. Nutrition policies in these establishments have to address the needs of these residents. Among them, staff recognition of nutritional problems (17-19), meal delivery organization (19-23) and access to dental care (13, 14, 24) have been identified as main targets for improvement.

We aimed to estimate the rate of undernutrition in a representative sample of elderly residents in institutions in Aquitaine (South-West France) and to identify the institutional factors associated with undernutrition in these institutions.

## ***Methods***

### **Geriatric institutions**

In 2005, the DRASS Aquitaine (Direction Régionale des Affaires Sanitaires et Sociales i.e. Regional Direction of Health and Social Services of Aquitaine) sent a postal questionnaire to

the 514 nursing homes or long-term care homes in the administrative region of Aquitaine. In France, long-term care homes receive elderly people with functional impairment and severe disease requiring continuous medical care, in contrast to nursing homes which do not provide continuous nurses' presence. The number of available beds was 30,617 giving a rate of 42 beds for 1000 subjects older than 60 yr. Long-term care homes accommodated 2,845 residents and nursing homes 22,772.

The private or public status, the category (nursing home or long-term care home), the number of staff and the number of available beds in each institution were obtained by file matching with the FINESS (Fichier National des Etablissements Sanitaires et Sociaux, i.e. National File of Social and Health Care Settings). The questionnaire included items describing nutritional policies such as meal schedules, the involvement of a dietician for meal composition, and educational programs for nurses and their assistants concerning recognition and management of undernutrition, dietary recommendations, swallowing disorders and HACCP (Hazard Analysis Critical Control Points). Meal schedules were used to calculate the length of the night fasting period. The number of residents needing help for feeding was recorded. The ratio of staff to total residents was also calculated for each home and was termed the staff ratio. The questionnaire also investigated existing written procedures for undernutrition screening including screening at admission, regular weight measurement, dietary intake and hydration monitoring. The question concerning available weighing-scales proposed 3 levels of weighing equipment: no equipment or only bathroom scales, chair-scales or medical quality scale, and equipment able to weigh everybody including bed-ridden people. Capacity to offer dental examinations and physical activity was also assessed.

## Residents

A stratified random sample of 42 institutions was drawn out of the 514 institutions taking into account their public or private status, the administrative and geographic area, the

category (nursing-home or long-term care) and the number of available beds. In each stratum one institution was randomly selected whenever several were present.

These institutions were visited by a dietician who recorded more in depth the procedures used in the area of nutrition. These included undernutrition screening procedures at admission and follow-up and catering procedures: type (freeze-dried, canned, home-made) of mixed meal preparation and adaptation of meal schedules to residents' requests. The proportion of residents needing assistance during meals, those fed with mixed meals or with tube-feeding were also recorded. Capacity to adapt to particular problems was also investigated, such as swallowing rehabilitation and type of adapted hydration in case of swallowing disorders and new nutritional assessment in case of incident illness.

A random sample of 15 residents present in the institution at the time of the interview was selected in these 42 institutions. If fewer than 15 residents were present, they were all included, leading to a sample of 601 residents. An MNA form was filled in for each of these residents. Subjects were all weighed with the same platform scale. The MNA is an 18-item questionnaire including anthropometric, general, dietary and subjective assessments; the maximum score is 30 indicating the best nutritional status (4). A screening sub-scale of the MNA (MNA-Short Form, MNA-SF) includes 6 items (appetite, recent weight loss, mobility, recent disease or psychological stress, dementia or depression, BMI) with the maximum score of 14. The threshold for malnutrition screening with the MNA-SF is set at 11 or below (4). Only subjects with this score went on to assessment with the full MNA questionnaire, on which a score below 17 indicates undernutrition. The threshold value of BMI for undernutrition definition varies currently from 20 to 22 kg/m<sup>2</sup> (11, 19, 25-28). In accordance with BMI categories used in the MNA (4), we used the BMI threshold of 21 to define undernutrition (19).

## **Analysis**

Statistical analysis was performed using the SAS system (8.2, SAS institute Inc., Cary NC, USA). Values are expressed as means with standard deviations (SD) or as percentages. Chi-square tests and t-tests were used to compare qualitative or quantitative variables with a threshold  $p < 0.05$ . We compared the characteristics of the 42 institutions in the random sample to those of the 514 institutions in the area in order to ensure their representativeness.

The proportion of residents screened as at risk of malnutrition according to the MNA-SF and the proportion of subjects undernourished using the MNA were weighted according to Horvitz-Thompson equations to provide estimations of the prevalence in the whole population, taking into account the sampling frame with a 95% confidence interval (CI) (29). Estimations of these proportions according to category (nursing home or long-term care home, private or public, rural or urban) were also calculated. The association between resident characteristics based on the MNA-SF and risk of undernutrition ( $MNA < 17$ ) was estimated by univariate and then multivariate stepwise backward logistic regression ( $MNA < 17$ ) in nursing homes only, given the higher number of residents in them. Several logistic regression models were performed to investigate the association between nursing home characteristics including nutrition procedures and the risk of having a proportion of undernourished ( $MNA < 17$ ) residents above the median of the group. Random effects were used in these models to correct the cluster selection from the randomization method.

## **Results**

### **Characteristics and nutritional procedures in the whole sample**

There were 514 geriatric institutions including 469 nursing homes and 45 long-term care homes with a mean staff ratio (staff number / number of beds) of 0.3 (SD 0.4) in nursing homes and 0.6 (SD 0.8) in long-term care homes. Among these institutions, 461 completed

the questionnaire giving a non-response rate of 10.3 %. The non-respondents were more likely to be long-term care homes than nursing homes (24% versus 9%,  $p = .001$ ), to have no official approval to receive social funds (19.9% versus 6.5%,  $p = .006$ ) and to have a smaller mean size than the respondents ( $p = .04$ ). There were 288 (62.5%) private and 173 (37.5%) public settings.

In the 461 respondents, the mean proportion of residents needing help for eating was higher in long-term care homes than in nursing homes ( $P < .0001$ ) (Table 1). A dietician was involved in menu composition in 244 settings (52.9 %), with a greater proportion in public institutions (64.0 %) than in private institutions (46.2%,  $P = .002$ ). However, training for dietary issues, malnutrition screening and management, and for swallowing disorders was performed in only one third to half of the settings, with higher rates in long-term care homes. There was also a higher proportion of nursing homes than long-term care homes with no training at all (Table 1). Weighing equipment was poor in 44.3 % of nursing homes and in 5.9 % of long-term care homes (Table 1).

Only 11.5% of the institutions declared they had no nutrition procedure. The screening of nutrition problems was planned in 38.8% of the 461 institutions at admission and in 49.9% during the stay. Nutrition procedures included weight monitoring in up to 78.1 % of settings despite the inadequate weighing equipment. There was no significant difference between nursing homes and long-term care institutions except for training in swallowing disorders, which was twice as frequent in long-term care homes.

The mean night fasting period was 11.77 hours and could be as high as 13.75 hours in some nursing homes. Access to dental care was available in 60.5% of institutions with a higher rate in long-term care homes ( $P = .007$ ). Physical activity was offered in 75.3 % of institutions. The mean proportion of residents eating regular-texture food was 0.32 (SD 0.20) and the mean rate of tube-feeding was 0.05 (SD 0.01).



## Characteristics of the sample of 42 institutions

The sample consisted in 36 nursing homes and 6 long-term care homes. There were no significant differences between the random sample of 42 and the whole pool of institutions of this region, except for the proportion of institutions declaring they had no procedure, which was lower in the sample of 42 institutions (Table 1). In this sample, details of procedures were reported: nutrition screening at admission was planned in 23.1 % and consisted in seeking weight loss in 57.1 % of them, BMI determination in 11.9 % and MNA assessment in 14.3 %. These screening procedures also included screening for swallowing disorders in 52.4 %, the need for help during meals in 53.4 %, diagnosis of dementia in 52.4 %, and depression in 54.8 %. Procedures included an oral examination in 35.7 % of settings and a dental check-up in 26.2 %. To the question “If a resident suffers from swallowing disorders, do you propose specific rehabilitation?”, 21.4 % said “yes” and 23.8 % said that the event never arose. However, 97.3 % of 42 institutions said that they adapted hydration techniques in case of swallowing disorders, 73.8 % using only the highest level of liquid thickening. Hypodermoclysis hydration was also proposed in 97.3 % of settings. In 88.3% of them, re-assessment of nutritional status was planned in case of incident illness.

Use of oral nutritional supplements was declared in 41 settings; the proportion of residents taking them every day was 0.14 (SD 0.14) and the proportion of those with occasional intake was 0.08 (SD 0.16). The proportion of settings reporting the use of high-protein supplements with lactose, lactose-free high-protein supplements, regular supplements with lactose and lactose-free high-calorie supplements were respectively 59.5%, 54.8 %, 42.9 % and 31.0 %. The rate of non-response varied from 7.1 to 14.3%. The use of pharmaconutriments was declared in 26.2 % of settings.

## Residents' characteristics and risk of undernutrition in the 42 institutions

The sample included 601 subjects, 148 men and 453 women with a mean age of 84.2 years (SD 9.3) (Table 2). Subjects 80 years and older accounted for 75.4 % of the population. The oldest subjects were mainly in nursing homes (Table 2).

The number of subjects at risk for malnutrition according to the MNA-SF was 360 (59.9%). Using the full-length MNA in these 360 subjects, 104 residents were undernourished (MNA < 17), giving a rate of 17.3 % of undernutrition among the 601 residents. Taking the sampling frame into account, the resulting estimated prevalence of undernutrition in the geriatric institutions in Aquitaine was 19.1 % (95% CI: 14.0-24.2). The estimated prevalence of undernutrition in Aquitaine was higher in long-term care homes than in nursing homes (respectively 48.0 % versus 14.5 %,  $p < .0001$ ).

Comparison of the distribution of responses to the 6 items of the MNA-SF between nursing homes and long-term care showed that subjects in the former were less often restricted for mobility, had less often lost weight during the previous three months, had had acute stress or disease less frequently, and fewer of them had severe depression or dementia (Table 2). However, there was no overall significant difference in BMI distribution according to type of setting. When using a BMI threshold of less than 21 for defining undernutrition status, the proportion of undernourished subjects was 23.8 % in nursing homes and 31.0 % in long-term care. Taking the sampling frame into account, the estimated prevalence of malnutrition in Aquitaine using the criterion BMI < 21 was 24.7 % (95 % CI 20.9-28.4).

The association between residents' characteristics and risk of undernutrition is presented in table 3 and Table 4. In nursing homes (Table 3), each item of the MNA-SF was strongly predictive of undernutrition both in univariate and multivariate analyses. In the long-term care homes (Table 4, among MNA-SF items only recent food intake decline, recent disease or psychological stress and lower BMI were risk factors for undernutrition but the

limited number of subjects in this setting did not allow valid multivariate analysis to be performed.

### **Institutional characteristics, procedures and risk of undernutrition**

In univariate analyses conducted in the whole sample of 42 institutions, the risk of undernutrition (MNA < 17) was higher in subjects living in long-term care (OR 4.95, 95% CI 3.00-8.18,  $P < .0001$ ), in settings with better weighing equipment (OR 2.70, 95% CI 1.70-4.30,  $P < .0001$ ), with a higher staff ratio (OR 1.02, 95% CI 1.01-1.03,  $P = .0001$ ), with a higher rate of subjects needing help for eating (OR 1.02, 95% CI 1.01-1.03,  $P < .0001$ ), and was lower in settings with higher percentages of training in nutrition screening (OR 0.43, 95% CI 0.28-0.67,  $P = .0001$ ) and management (OR 0.40, 95% CI 0.26-0.61,  $P < .0001$ ).

In univariate analyses in nursing homes, the risk of undernutrition was higher in subjects living in settings with better weighing equipment (OR 2.53, 95% CI 1.47-4.35,  $P = .0008$ ), with a higher staff ratio (OR 1.03, 95% CI 1.00-1.05,  $P = .0102$ ), with a higher rate of subjects needing help for eating (OR 18.27, 95% CI 7.9-42.2,  $P < .001$ ). This risk was lower in settings with a higher rate of training for undernutrition screening (OR 0.54, 95% CI 0.32-0.91,  $P = .020$ ), for malnutrition management (OR 0.53, 95% CI 0.31-0.92,  $P = .0247$ ), and for management of swallowing disorders (OR 0.33, 95% CI 0.34-0.95,  $P = .0325$ ). In multivariate analyses, we found an association only between a higher risk of undernutrition and better weighing equipment (OR 2.34, 95% CI 1.39-4.12,  $P = .0017$ ) and a higher staff ratio (OR 1.03, 95% CI 1.00-1.05,  $P = .0230$ ).

In long-term care homes, the risk of undernutrition in univariate analysis increased in settings with a higher staff ratio (OR 1.01, 95% CI 1.00-1.05,  $P = .0136$ ), and with longer fasting at night (OR 1.00, 95% CI 1.00-1.00,  $P = .0125$ ).

In nursing homes we compared the characteristics of the 18 institutions in which the proportion of undernourished residents was less than the median (22.25 %) with those of the

18 others (Table 5). Recourse to a dietician for menu supervision was less frequent in settings with a higher proportion of undernourished subjects ( $P = .009$ ). All other characteristics were similar in both categories.

## **Discussion**

This study demonstrates large differences in prevalence of undernutrition according to types of institution. The prevalence was 3 times higher in long-term care homes compared to nursing homes. In both kinds of settings the main risk factors for undernutrition were linked to subjects themselves. However, in nursing homes, univariate analysis has shown that lower rates of undernutrition were associated with higher rates of nutritional care and prevention.

The results of the MNA-SF showed very large differences in distribution of mobility dependency, mental problems and acute morbidity according to facilities. In the area of nutrition, the proportion of residents needing help for eating was also very different between the types of settings. Dependency for eating puts the resident in the category of severe dependency (30). These differences in functional dependency were expected due to the different assignments given to these settings and to the recruitment choice for residents. The estimated prevalence of malnutrition in Aquitaine using the MNA (19.1%) is in the lowest part of the prevalence range found in other studies (4-12). Using the BMI threshold of 21 (19), the estimated prevalence was slightly higher but remained in the lowest values. In Danish nursing homes (5), prevalence of BMI lower than 20 was as high as 33% compared to 24.7 % in this study with a BMI lower than 21. In the long-term care homes, more subjects were undernourished, but the proportion of subjects with a BMI < 21 was still lower (31%) than in the Danish study (5).

In a large sample of nursing home residents in the USA (6832 subjects), weight loss occurred in 9.9% of subjects and 25% of residents had a BMI < 19.4 (7). With the MNA-SF,

we found that weight loss occurred in almost 30 % of the residents and that the proportion of them with a BMI < 21 was 23.8%. Furthermore, the proportion of weight losers was very different according to the type of settings, in contrast to BMI distribution which was similar with only a trend for a higher proportion of very low BMI (< 19) in long-term care homes. On the other hand, in settings without adequate weighing equipment, the response to the question of weight loss was likely “do not know”, thus under- or over-estimating the score on this MNA-SF item to an unpredictable extent. If we had defined undernutrition on the basis of weight loss, the proportion would have been much higher; on the contrary, if we had used the BMI, it would have been lower, suggesting that a multidimensional measure of undernutrition is necessary. Low value responses to each item of the MNA-SF strongly predicted undernutrition in our sample of residents. Indeed, in the large sample of Blaum et al. (7), items predicting weight loss or low BMI were those included in the MNA and most of them in the MNA-SF. Furthermore, it was previously shown that the energy intake of malnourished subjects according to the MNA was below their needs, in contrast to subjects with MNA over 24 (31). This was confirmed elsewhere using other undernutrition criteria (12, 32).

Associations between undernutrition and impaired function or high need of care, dementia, swallowing difficulties, constipation and agitation were also evidenced (12, 31). Demented patients seem to shift their best energy intake to breakfast, particularly if they have behavioral disturbances (33), thereby confirming the impact of agitation on malnutrition risk (12).

Admission to French long-term care homes is primarily granted to the most functionally dependent patients and those who need more medical care due to severe chronic disease apart from dementia, such as heart failure, cancer, and chronic obstructive respiratory disease. These conditions seem to increase particularly the risk of undernutrition in these

settings as shown here. In the nursing homes, the rates of dependency, recent acute diseases or psychological stress were much lower, and all items of the MNA-SF remained independently associated with the risk of undernutrition. It seems at the first glance that a higher rate of procedures, organization and equipment was associated with a higher rate of undernutrition.

This could simply reflect the particular selection of the patients with higher level of health problems in the best qualified settings. Only in nursing homes would it seem that inadequate recourse to the services of a dietician and lower rate of procedures were linked to a higher rate of undernutrition.

Despite the fact that nutritional procedures existed, the rate of malnutrition was still high. Organizational factors causing malnutrition were described in the review by Cowan et al. (20). Here we explored only procedures concerning screening, prevention or treatment of malnutrition, and means in terms of staff ratio and recourse to a dietician. There was no precise information about the content and quality of the procedures and our data were only declarative. Nor did we investigate performances and rates of use of these procedures. Here, declared procedure of weight monitoring was certainly not correctly applied when considering the poor quality of weighing equipment. It has also been shown that in the case of dependency for eating, the main consequence of a lack of time was reduced food intake by residents (17). Another point to comment was the fact that weighing equipment was of better quality when the prevalence of undernutrition was higher. This could reflect the better awareness of the problem in these settings as discussed upper in the text, however with no apparent effect on undernutrition rate. It is noticeable that weight monitoring like food intake assessment are efficient tools for undernutrition prevention and thus should be performed even in homes with lower rate of undernutrition and included as a basic standard of care.

On the other hand, lack of procedures was likely associated with poor nutrition management. Hydration procedures were present in a large majority of institutions, probably

owing to government requirements after the 2003 heatwave which led to high mortality rate in French nursing homes. The reported large use of hypodermoclysis was clearly resulting from recommended preventive procedures against dehydration in functionally dependent patients.

Thus, strong collective will seems able to lead to a high rate of procedure implementation. Staff knowledge about undernutrition in elderly was also identified as important for the prevention of undernutrition and the care of undernourished subjects. Years as a nurse or as a nurse's assistant did not seem to positively influence knowledge about nutrition, which was best improved by specific training (18). Training and procedures in nutrition area were associated with an increased rate of undernutrition suggesting that most of the institutions were aware of the problem. However, there is much scope for improvement since only 56% of long-term care homes were conducting training in of nutrition (HACCP excluded).

Among organizational factors described by Cowan et al (20), staff communication and enforcement of regulations are both necessary to enforce these procedures. In nursing homes it has been clearly shown that weight loss and the observation of large amounts of food remaining on plates were related to decreased energy and protein intake (25, 34). Informal observation of residents during meals can help staff specifically to prevent malnutrition. For this purpose, it is possible to establish the typical profile of would-be undernourished residents by noting degree of assistance in feeding, swallowing disorders, inappropriate food texture, and subjects' agitation (35).

Finally, our indicators on diet quality were insufficient, in particular those concerning taste of food and adaptation to chewing or swallowing problems, which would have necessitated face-to-face interviews. Evans et al. have developed a food questionnaire (36, 37) which could be used in this institutionalized population. To what extent institutional adaptation to the expectations of residents can be implemented and what the resulting efficiency could be on residents' nutritional status deserves further investigation. An

anthropological study has shown that providing home-like meals in nursing homes could enhance residents' and staff satisfaction (38). One randomized study has shown a positive effect of these family-style meals on energy intake and MNA scores in nursing homes (38).

Treatment of undernutrition and its efficiency have been less documented. It seems possible to improve the energy intake of undernourished nursing home residents by using enriched food (6). However, one audit of oral liquid supplements in nursing homes showed that they could be frequently used without prior investigation of the causal factors of subjects' undernutrition (39). In our study we also found discrepancies between the declared procedures for the screening of swallowing disorders and what was proposed when the problem actually occurred. While 50% of the institutions used screening, only half of that percentage claimed that rehabilitation was required, the others considering that there was no problem. On the other hand, almost all the institutions had suitable hydration procedures.

Clinical guidelines for nutritional management are of great help in implementing the training and organization of communication of staff members and physicians in order to improve undernutrition screening, and for undertaking suitable measures for particular intake problems, such as dependency, chewing and swallowing problems, and behavioral disturbances (19).

In conclusion, the main factors of undernutrition in the institutions surveyed were linked to the residents' health problems, with little evidence suggesting the detrimental influence of institutional policies. No studies to date have shown that better management of nutritional problems can decrease the rate of undernutrition in residents. However a large scope for improvement in nutritional care was evidenced. Other endpoints such as quality of life associated with better nutritional care need therefore to be explored.



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Table 1: Characteristics of geriatric institutions in South-West France (N = 461)

	Nursing homes N = 427	Long-term care homes N=34	P*	All institutions N=461	Sample of 42 institutions	P**
Number of available beds, mean (SD)	59.5 (38.1)	68.4 (47.1)	0.29	60.2 (38.9)	71.6 (37.5)	.06
Staff number, mean (SD)	20.1 (17.9)	43.0 (38.3)	<0.001	21.7 (21.0)	26.0 (19.6)	.18
Proportion of residents needing help during meals. mean (SD)	20.9 (20.1)	57.7 (29.7)	<0.0001	24.1 (23.5)	29.4 (25.5)	.18
Place of meal preparation, (% of N)			<0.0001			
In the institution	87.1	52.9		84.6	90.5	.29
Elsewhere	12.9	47.1		15.4	9.5	
Menu supervision by dietician (% of N)			0.01			.33
Yes, a staff member	13.8	47.1		16.3	9.6	
Yes, external provider	37.5	26.5		36.7	45.2	
None	48.7	26.5		47.0	45.2	
HACCP training (% of N)	82.0	79.4	0.71	81.8	85.6	.51

Malnutrition screening training ( % of N)	29.7	50.0	0.01	31.2	42.9	.10
Malnutrition management training (% of N)	21.8	44.1	0.003	23.4	28.6	.43
Diet training (% of N)	35.1	47.1	0.20	36.0	50.0	.06
Swallowing disorders training (% of N)	26.2	55.9	0.02	27.5	33.3	.40
No training (% of N)	12.9	5.9	0.23	12.4	7.1	<.0001
Weighing equipment (% of N)			<0.0001			
None or bathroom scales	44.3	5.9		41.4	28.6	.09
Chair-scales or medical scales	28.3	29.4		28.4	33.3	.48
Special equipment for bed-ridden subjects	27.4	64.7		30.2	38.1	.26
Malnutrition screening procedure						
At admission (% of N)	38.2	47.1	0.31	38.8	38.1	.93
During the stay (% of N)	49.4	55.9	0.47	49.9	47.6	.77
Hydration follow-up procedure (% of N)	81.3	79.4	0.79	81.1	78.6	.67
Weight follow-up procedure (% of N)	77.8	82.4	0.53	78.1	80.9	.65
Dietary intake follow-up procedure (% of N)	77.8	85.3	0.30	78.3	80.9	.68
No procedure (% of N)	11.2	14.7	0.53	11.5	11.9	.93

## Night fasting period

Mean in hours (SD)	11.78 (0.62)	11.42 (0.62)	0.002	11.77 (0.62)	11.58 (0.50)	.07
Range in hours	10.25 – 13.75	10.25 – 13.00		10.25 – 13.75	10.30 – 13.65	

## Availability of (% of N)

Dental care	58.8	82.3	0.007	60.5	66.6	.41
Physical activities	75.9	67.7	0.28	75.3	88.1	.89

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P: \*comparison nursing homes versus long-term care homes; \*\* comparison 461 institutions versus sample of 42 institutions

**HACCP: Hazard Analysis Critical Control Point**

Table 2: Characteristics of the 601 residents of geriatric institutions in South-West France according to their place of dwelling.

	Nursing home residents N = 517	Long-term care home residents N = 84	P
Women (% of N)	74.7	79.8	.3
Age, mean (SD) years	84.6 (9.0)	81.8 (10.4)	.02
MNA-SF < 12 (% of N)	54.9	90.4	<.0001
MNA < 17, (% of N) (undernourished)	13.1	42.9	<.0001
Food intake decline over the past 3 months, (% of N)			0.00084
Severe loss of appetite	3.3	0	
Moderate loss of appetite	17.6	28.6	
No loss of appetite	79.1	71.4	
Weight loss during past 3 months, (% of N)			.0023
Greater than 3 kilos	7.3	17.9	
Does not know	5.6	1.2	
1 to 3 kilos	14.9	20.2	
No weight loss	72.2	60.7	
Mobility, (% of N)			
Bedridden or chair-bound	29.2	70.2	<.0001
Able to get out of bed/chair but does not go out	36.9	25.0	

Goes out	33.9	4.8	
Psychological stress or acute disease during the past 3 months, (% of N)			<.0001
Yes	16.6	35.7	
No	83.4	64.3	
Neuropsychological problems, (% of N)			<.0001
Severe dementia or depression	19.7	45.2	
Mild dementia	39.7	39.3	
None	40.6	15.5	
BMI kg/m <sup>2</sup> (% of N)			.1810
< 19	9.9	17.9	
19 to < 21	13.9	13.1	
21 to < 23	11.6	11.9	
23 and >	64.6	57.1	

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MNA: Mini Nutritional Assessment, MNA-SF: MNA short form



Table 3: Responses to the MNA-SF questions associated with risk of undernutrition (MNA < 17). Multivariate analysis in Nursing Homes (number of residents: 517).

	Undernourished MNA <17 N = 68	Others N= 349	P Univariate	Multivariate regression		
				OR	95% CI	P
Food intake decline over the past 3 months, (%)	23.5	87.5	<.0001	1		<.0001
No loss of appetite	58.8	11.4		19.3	7-6-48.7	
Moderate loss of appetite	17.7	1.1		216.9	36.8-1000	
Severe loss of appetite						
Weight loss during past 3 months, (%)			<.0001			<.0001
No weight loss	25.0	79.3		1		
1 to 3 kilos	29.4	12.7		3.9	1.4-10.6	
Does not know	19.1	3.6		14.7	4.0-54.4	
> 3 kilos	26.5	4.4		26.5	7.3-96.4	
Mobility, (%)			.0002			.002
Goes out	4.4	38.3		1		
Able to get out of bed/chair but does not go out	25.0	38.8		5.4	1.2-23.6	

Bedridden or chair-bound	70.6	22.9	32.2	7.5-138.0
Psychological stress or acute disease during the past 3 months, (%)			<.0001	<.0001
No	50	88.4	1	
Yes	50	11.6	5.8	2.4-13.9
Neuropsychological problems, (%)			.0004	.0195
None	4.4	46.1	1	
Mild dementia	35.3	40.3	4.5	0.6-32.5
Severe dementia or depression	60.3	13.6	50.1	6.1-413.3
BMI kg/m <sup>2</sup> (%)			.0072	.0005
23 and >	20.6	71.3	1	
21 to < 23	11.8	11.6	4.4	0.8-23.9
19 to < 21	32.3	11.1	14.0	3.3-59.0
< 19	35.3	6	45.9	8.8-238.4

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MNA: Mini Nutritional Assessment, MNA-SF: MNA short form

Table 4: Responses to the MNA-SF questions associated with risk of undernutrition in long term care home (Number of residents: 84).

	Undernourished	Others
	MNA <17	
	N = 36	N = 48
Food intake decline over the past 3 months, (%)		
No loss of appetite	36.1	97.9
Moderate loss of appetite	63.9	2.1
Severe loss of appetite	0	0
Weight loss during past 3 months, (%)		
No weight loss	41.7	75
1 to 3 kilos	25.0	16.7
Does not know	0	2.1
> 3 kilos	33.3	6.2
Mobility, (%)		
Goes out	0	8.3
Able to get out of bed/chair but does not go out	11.1	35.4
Bedridden or chair-bound	88.9	56.3
Psychological stress or acute disease during the past 3 months, (%)		
No	44.4	79.2
Yes	55.6	20.8
Neuropsychological problems, (%)		
None	2.8	25.0
Mild dementia	30.6	45.8

Severe dementia or depression	66.7	29.2
BMI kg/m <sup>2</sup> (%)		
23 and >	30.6	77.1
21 to < 23	8.3	14.6
19 to < 21	22.2	6.3
< 19	38.9	2.1

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MNA: Mini Nutritional Assessment, MNA-SF: MNA short form

Table 5: Characteristics of nursing homes in relation with proportion of undernourished residents (N=36)

	Proportion of undernourished residents < median, n=18	Proportion of undernourished residents > or = to median, n=18	P*
Number of available beds, mean (SD)	81.4 (43.3)	64.2 (28.3)	0.17
Staff ratio, mean (SD)	0.34 (0.13)	0.30 (0.17)	0.45
Proportion of residents needing help during meals, mean (SD)	0,27 (0.19)	0.19 (0.16)	0.18
Meals prepared in the institution, (% of N)	88.9	100.0	0.48
Menu supervision by dietician (% of N)			0.009
Yes, a staff member	5.6	0	
Yes, external provider	72.2	27.8	
None	22.2	72.2	
HACCP training (% of N)	88.9	83.3	0.46
Malnutrition screening training (% of N)	33.3	38.9	0.76
Malnutrition management training (% of N)	27.8	16.7	0.35
Diet training (% of N)	55.6	44.4	0.5

Swallowing disorders training (% of N)	44.4	16.7	0.07
Weighing equipment (% of N)			0.92
None or bathroom scales	33.3	33.3	
Chair-scales or medical scales	38.9	33.3	
Special equipment for bed-ridden people	27.8	33.3	
Malnutrition screening procedure (% of N)			
At admission	38.9	33.3	1.00
During the stay	44.4	50.0	0.74
Hydration follow-up procedure (% of N)	77.8	88.9	0.66
Weight follow-up procedure (% of N)	83.3	83.3	1.00
Dietary intake follow-up procedure (% of N)	77.8	94.4	0.15
Night fasting period			
Mean in hour (SD)	11.51 (0.63)	11.73 (0.63)	0.30
Availability of (% of N)			
Dental care	77.8	55.6	0.16
Physical activities	72.2	88.2	0.16

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