

Impact of the earthquake of September 26, 1997 in Umbria, Italy on the socioenvironmental and psychophysical conditions of an elderly population

P. Mecocci¹, A. Di Iorio², S. Pezzuto¹, P. Rinaldi¹, G. Simonelli¹, D. Maggio¹, P. Montesperelli³, A. Longo¹, A. Cherubini¹, N. Chiarappa³, G. Abate², and U. Senin¹

¹Department of Gerontology and Geriatrics, University of Perugia, Perugia, ²Chair of Gerontology and Geriatrics, University G.D'Annunzio, Chieti, ³Istituto Regionale Ricerche Economiche e Sociali (IRRES), Perugia, Italy

ABSTRACT. *The consequences of natural disasters on the social and health status of older people have not been deeply considered. The aim of this study was to evaluate the socioenvironmental and psychophysical conditions of an elderly population after a devastating earthquake. A randomly selected group of 332 older people (≥64 years) was selected among 1548 eligible subjects living in the city of Nocera Umbra four months after an earthquake of 5.6 magnitude on the Richter scale. Three geriatricians evaluated the study subjects by means of a structured interview, and standardized scales, which considered physical and mental status, mood and anxiety, and self-perception of well-being, as well as the characteristics of family composition and social interactions. Of the study subjects, 11.1% lived alone, and 33.4% with the spouse only. Most were self-sufficient in the basic activities of daily life. Musculoskeletal diseases and hypertension were the most frequently observed pathologies in this geriatric population. In addition, 47.9% of the subjects lived in temporary houses; this group more frequently suffered from hypertension, and had a higher score of comorbidity as measured by Cumulative Illness Rating Scale (CIRS) compared to people who remained at home. People living in the pre-fabricated huts also showed a higher score on the Geriatric Depression Scale and the Hamilton scale for anxiety, and complained more often of their health status, evaluated as self-perception of well-being, when compared to the home dwellers. Although all the studied subjects suffered from the discomforts caused by the earthquake, the precariousness of living in temporary*

houses, whose structural characteristics do not take the needs of elderly subjects into account, could justify the higher distress experienced by persons housed in the huts. These observations suggest that, after natural disasters, emergency programs should be more adapted to elderly people, whose needs and expectations are often different from those of young adults.

(Aging Clin. Exp. Res. 12: 281-286, 2000)

©2000, Editrice Kurtis

INTRODUCTION

Much can be learned from the international literature on the consequences that natural catastrophes have on children, young people and adults (1-5). However, few studies have been carried out in elderly populations subjected to this kind of stress in terms of functional and social state, physical and psychic health, morbidity and mortality (6-8). We studied how the elderly population was affected by the earthquake that devastated an area between Umbria and Marche, regions of Central Italy, on September 26, 1997.

The earthquake had a maximum intensity at 11:42 a.m. with a violent quake of 5.6 magnitude on the Richter scale; it had been preceded by another quake of 4.8 magnitude at 2:33 a.m. of the same day. Although there were few deaths, the earthquake caused extensive damage to buildings, including the collapse of two vaults in the upper Basilica of St. Francis in Assisi, where frescos by Giotto and Cimabue were irreparably lost. The experts defined the earthquake as anomalous because it was followed by innumerable

Key words: Earthquake, elderly, psychological status, social condition.

Correspondence: P. Mecocci, M.D., Ph.D., Department of Gerontology and Geriatrics, University of Perugia, Via Eugubina 42, 06122 Perugia, Italy. E-mail: geriat@unipg.it

Received November 23, 1999; accepted in revised form March 17, 2000.

quakes (about 3300) in the succeeding six months. The Civil Defense declared that 1178 public buildings and 7526 private buildings were uninhabitable, leaving a total of 18276 persons homeless. Consequently, 154 areas throughout the region were set up with standard inhabitable modules.

Under the auspices of the local authorities, we had the opportunity to evaluate the social and health conditions of a group of persons aged 64 years and over in Nocera Umbra, an Umbrian mountain village and one of the communities most damaged by the quake. This study was based on the fact that the population in this age range represents the one most at risk of morbidity, disability and mortality (7, 9, 10). Almost half the elderly of our group were housed in temporary accommodations (pre-fabricated huts), while the others remained in their own homes. The aim of our study was to evaluate the socioenvironmental and health conditions, and the functional, emotional and cognitive state of the people aged 64 years and over who had experienced the seismic event and, thereafter, compare these aspects in elderly people who remained at home *vs* those who were transferred to temporary accommodations.

SUBJECTS AND METHODS

Three hundred and eighty-four residents over 64 years of age were randomly selected among 1048 persons listed in the electoral registers of the City of Nocera Umbra (Umbria, Italy). Twenty-three subjects were not found, and an equal number were redrawn from the electoral registers. At the end, 332 persons were found, and accepted to participate in the study, which was carried out from January 21 to February 28, 1998, about four months after the initial earthquake.

Three geriatricians (S.P., P.R., G.S.) carried out structured interviews aimed at evaluating physical and mental status, mood and anxiety, self-perception of well-being and noting family composition and social interactions. The enrollment phase was preceded by one of operative training to standardize the method of interviewing and codifying the answers.

To this purpose, the protocol included a survey card divided into a social section to record births, marriages, deaths and socioenvironmental data, the state of friendly and family relationships, social activities and free time, and a health section for the state of physical and psychic health and, in particular, comorbidity and functional, cognitive and emotional states. Data relative to therapy was recorded on an appropriate form. Blood pressure and pulse rate were also evaluated.

The principal chronic and intercurrent pathologies were codified by means of the ICD-9. Based on this codification, the Cumulative Illness Rating Scale (CIRS) was compiled (11, 12). This instrument considers the severity of the illness for each of the major organs and systems, including mental disorders and hypertension. Every item has a score ranging from 0 (absence of illness) to 4 (maximum severity of illness).

The functional state was evaluated by the 21-item OMS scale. This instrument was adopted as it considers both the basic (ADL) and the instrumental activities (IADL) of daily living (13). It also allowed us to evaluate the overall functional state by means of the combined calculation of the dependencies of the two sub-scales.

Cognitive disturbances were evaluated by the Short Portable Mental Status Questionnaire (score range 0-10), which also allows an evaluation of the severity of the mental deficit (14, 15). Dementia was diagnosed according to DSM-III R criteria, while the level of depression and state of anxiety were evaluated with the Geriatric Depression Scale (GDS) and the Hamilton Anxiety Scale (HAS), respectively (16, 17).

Finally, the level of health status as perceived by the subject was assessed by means of a visual-analogical scale in which 0 corresponds to feeling a very bad state of health, and 10 to a maximum state of well-being.

Statistical analysis

Statistical analysis was carried out using the SPSS statistical package (Statistical Package for the Social Science) (18). The results are expressed as means \pm standard error (SE). The cohort enrolled in the study was divided into two groups: residents in their own homes, and those housed in temporary accommodations. The differences between the two groups were analyzed by means of Student's *t*-test for the continuous variables, while χ^2 was used for the categorical and ordinal variables. All data were also age- and sex-adjusted *via* logistic regression. When multiple comparisons were made, the correction of Bonferroni-Dunn was applied. A two-tailed *p*-value ≤ 0.05 was considered significant.

RESULTS

The mean age of the overall population studied was 75.09 ± 0.39 years; 58.4% of the sample consisted of women, and 41.6% of men. The average number of family members living with the interviewees was 2.11 ± 0.09 ; 11.1% of these elderly subjects

lived alone, and 33.4% lived only with their spouse, who in most cases was the same age as the subject him/herself. The average number of years of schooling of the sample was 4.24 ± 0.16 . The principal previous occupation was full-time farmer (33.5%), followed by service sector worker (28%); 26% of the sample were full-time housewives, 11.1% were laborers, and 1.5% had other occupations.

After the seismic event, support from family members and volunteers was considered good by 55.5% and 47.5%, and fair by 35.5% and 22.3%, respectively, of the overall population. Support from relatives and from friends/neighbors was considered fair by 56.6% and 43.9%, respectively, of the interviewees. Regarding social activities and free time, most of the elderly people watched the TV news (60.4%) every day; 8.7% read newspapers and 8.0% magazines everyday.

The pathologies most frequently observed in the population were musculoskeletal diseases (69.2%), hypertension (47.2%), gastroenteric (36.4%), psychiatric (35.2%) and respiratory (34.6%) diseases. With regard to mental illnesses, depression was found in 60%, dementia in 13.3%, and anxiety in 0.3% of the studied subjects.

The mean number of drugs per person was 2.4, with the highest prevalence for antihypertensive (27.1%), diuretics (19.5%) and glycosides (14.1%).

The majority of the population was completely self-sufficient in ADL (90.1%), and a little less in IADL (61.1%).

Of the 332 subjects recruited, 173 were living in their own original homes and 159 in pre-fabricated huts four months after the earthquake.

A comparison between subjects residing in their own homes and those living in temporary accommodations disclosed similar social and registry office characteristics (Table 1), although subjects in the first group were slightly older (75.9 ± 0.5 vs 74.2 ± 0.5 ; $p=0.02$), more educated (4.7 ± 0.3 vs 3.7 ± 0.2 ; $p=0.003$) and had a larger number of family members living with them ($p=0.04$).

Support from family members was mainly judged good (55.5% vs 53.5%) and fair (32.4 vs 37.1) by both groups. Help from friends-neighbors was mostly fair (41.6% vs 44.7%), whilst support received from volunteers was judged good by 52.2% of the residents in pre-fabricated huts, and by 41.6% of home dwellers ($p=0.001$).

The group living in the pre-fabricated huts had a higher CIRS score of comorbidity (6.3 ± 0.3 vs 5.3 ± 0.39), and suffered more frequently from hypertension, although after adjustment for age and sex this latter difference became slightly not significant ($p<0.06$) (Table 2).

While functional and cognitive states did not differ

Table 1 - Demographic and socioenvironmental variables between home and pre-fabricated hut residents.

	Home*	Hut*	p
No. of subjects	173	159	
Age	75.9 ± 0.5	74.2 ± 0.5	0.02
Gender (female)	96 (55.5%)	98 (61.6%)	0.25
No. of family members living with earthquake victim			
0	15 (8.7%)	22 (13.8%)	0.14
1	57 (32.9%)	68 (42.8%)	0.08
2-3	61 (35.3%)	46 (28.9%)	0.22
+ 4	40 (23.1%)	23 (14.5%)	0.04
Civil State			0.94
Married	110 (63.6%)	98 (61.6%)	
Widowed	54 (31.2%)	54 (34.0%)	
Unmarried	9 (5.2%)	7 (4.4%)	
Years of schooling	4.7 ± 0.3	3.7 ± 0.2	0.003
Previous occupation			
Farmer	58 (33.5%)	53 (33.3%)	0.98
Service sector worker	53 (30.6%)	40 (25.3%)	0.26
Housewife	43 (24.9%)	43 (27.0%)	0.21
Laborer	15 (8.7%)	22 (13.8%)	0.13
Other	4 (2.3%)	1 (0.6%)	0.37

*Prevalence in brackets.

Table 2 - Pathologies and comorbidity score in home and pre-fabricated hut residents.

	Home*	Hut*	<i>p</i>	<i>p</i>
Cardiac	52 (30.1%)	56 (35.2%)	0.31	0.18
Vascular	32 (18.5%)	39 (24.3%)	0.18	0.15
Respiratory tract	58 (33.5%)	57 (35.8%)	0.65	0.47
Upper gastroenteric tract	31 (17.9%)	38 (23.9%)	0.17	0.16
Lower gastroenteric tract	26 (15.0%)	26 (16.4%)	0.74	0.75
Renal	9 (5.2%)	15 (9.4%)	0.13	0.14
Genitourinary tract	38 (22%)	33 (20.8%)	0.78	0.79
Musculoskeletal	116 (67.1%)	115 (72.3%)	0.30	0.41
Neurological	21 (12.1%)	20 (12.6%)	0.90	0.45
Endocrine	34 (19.7%)	34 (21.4%)	0.69	0.84
Psychiatric	58 (33.5%)	59 (37.1%)	0.49	0.51
Hypertension	73 (42.2%)	84 (52.8%)	0.05	0.06
Other	35 (20.2%)	38 (23.9%)	0.42	0.25
CIRS ¹ Score	5.3±0.3	6.3±0.3	0.02	0.009
CIRS Classes (3-4)	45 (26.0%)	43 (27.0%)	0.83	0.51

¹CIRS: Cumulative Illness Rating Scale. *Prevalence in brackets.

p is the *p*-value after adjustment for age and sex.

significantly, depression (assessed by means of the GDS) was significantly higher among people living in temporary houses (7.6 ± 0.3 vs 6.6 ± 0.3). Anxiety (assessed by HAS) was a little higher in the hut group (7.7 ± 0.5 vs 6.4 ± 0.4), which also complained more often about its health as evaluated by a self-perceived well-being scale (4.0 ± 0.2 vs 4.5 ± 0.2) (Table 3).

People living in temporary houses more frequently used NSAIDs (14.5% vs 5.8%), glycosides (17% vs 11.6%), and antihypertensive drugs (32.7% vs 22%) as shown in Table 4.

DISCUSSION

The general overall picture emerging from this analysis of elderly subjects living in the earthquake-struck community of Nocera Umbra, is one of a population of elderly people, mainly women, with a mean age of seventy-five and a low level of education.

Almost all of the elderly who were interviewed were completely self-sufficient in carrying out the basic and instrumental activities of daily life. This finding is in contrast with literature reports regarding the prevalence of disability in the more advanced age ranges (9, 13, 19). One possible explanation is that the most disabled may have been transferred immediately after the earthquake to other areas. Furthermore, our sample is quite small compared with those

Table 3 - Cognitive, functional and mood states in home and pre-fabricated hut residents.

	Home*	Hut*	<i>p</i>	<i>p</i>
SPMSQ score	1.8±0.2	1.8±0.1	0.84	0.17
Diagnosis of Dementia DSM III R	26 (15.1%)	18 (11.4%)	0.32	0.86
GDS	6.6±0.3	7.6±0.3	0.01	0.04
HAS	6.4±0.4	7.7±0.5	0.05	0.07
Self-perception of health state	4.5±0.2	4.0±0.2	0.04	0.08
Average no. of dependencies in ADL	0.4±0.1	0.3±0.1	0.69	0.98
Average no. of dependencies in IADL	1.0±0.1	0.9±0.1	0.64	0.46
Average no. of dependencies in OMS 21 items	3.1±0.4	2.8±0.4	0.54	0.84

SPMSQ: Short Portable Mental Status Questionnaire; GDS: Geriatric Depression Scale; HAS: Hamilton Anxiety Scale; ADL: Activities of Daily Living; IADL: Instrumental Activities of Daily Living; OMS 21 items: Scale including items from both ADL and IADL.

*Prevalence in brackets.

p is the *p*-value after adjustment for age and sex.

Table 4 - Use of drugs in the period following the earthquake by home and pre-fabricated hut residents.

	Home*	Hut*	p	p
No. of drugs	2.3±0.1	2.5±0.1	0.30	0.07
NSAIDs	10 (5.8%)	23 (14.5%)	0.008	0.02
Antihypertensives	38 (22.0%)	52 (32.7%)	0.02	0.07
Glycosides	20 (11.6%)	27 (17.0%)	0.15	0.007
Hypoglycemic drugs	18 (10.4%)	14 (8.8%)	0.62	0.79
Diuretics	31 (17.9%)	34 (21.4%)	0.42	0.36
Antiasthmatic drugs	15 (8.7%)	20 (12.6%)	0.24	0.19
Psychotropics	19 (11.0%)	11 (6.9%)	0.19	0.36

*Prevalence in brackets.

p is the p-value after adjustment for age and sex.

of specific studies addressing the prevalence of disability in the various age ranges (9). It is noteworthy that more than 30% of the studied subjects lived only with a spouse of the same age, a condition at risk if valuable and strong support is needed.

The most prevalent pathologies were the musculoskeletal ones, followed by systemic arterial hypertension, gastroenteric, psychiatric (mainly anxiety and depression) and respiratory pathologies. The prevalence of dementia in a population with a mean age of seventy-five was comparable to that reported in the literature (5, 7, 9, 20-22).

On average, each subject took more than two drugs, and the most frequently used medications were antihypertensives (diuretics and venous vasodilators excluded).

The comparison between people living at home and those housed in temporary accommodations showed that the general index of comorbidity was slightly higher among the elderly living in huts. This might likely be related to the worsening of pre-existing pathologies such as respiratory and musculoskeletal diseases. In this regard, it is possible that exposure to the low temperatures and humidity of the pre-fabricated huts made the respiratory, osteo-articular and cardiac diseases more acute, thus favoring the more frequent use of antiasthmatics, NSAIDs and glycosides. Similarly, the emergency could have been the origin of the increase in arterial pressure values, and the number of mental problems, resulting in wide resort to the relative specific drugs (23, 24). This hypothesis is further supported by the observation that people living in the pre-fabricated huts more frequently suffered from hypertension, and used more antihypertensive drugs. This is probably due to diverse living conditions, and the considerable adrenergic stimulating action on the vascular apparatus caused by the stress related not only to the seismic event, but also

the precariousness of their situation (20, 24, 25).

The scores relative to the evaluation of mood, anxiety and self-perception of health status were also worse among the elderly housed in pre-fabricated huts. Indeed, in the opinion of the interviewers, several aspects of these temporary living conditions were the main causes of this finding. Furthermore, the difficulty of reconstruction and the feeling of being in a hopeless situation undoubtedly contributes to the psychological stress experienced by elderly people living in pre-fabricated accommodations. In fact, the likelihood of being able to rebuild their homes, and reconstruct their pre-earthquake neighborhood is extremely low. Accordingly, it is probable that symptoms of anxiety and depression will increase over time, and the health status will progressively deteriorate, in particular when most of the volunteers and support service personnel leave the area.

The structural characteristics of the pre-fabricated huts may also explain the increase in the risk of illness during the cold seasons. In fact, their present design does not furnish a healthy environment for elderly persons affected by a series of pathologies. The huts are poorly insulated, and thus very humid during the winter due to condensation caused by heating a small environment in the absence of adequate ventilation. The huts are small, a little more than 33 square meters in area, and have little living space, especially for families composed of more than two people; they were delivered without ramps for the disabled and/or access stairs to the dwelling which is more than 35 cm above ground level. They are precariously set on cement blocks, and thus subject to movements similar to those caused by the earthquakes, due to strong gusts of wind always blowing in this mountain area, thereby increasing the fear of new quakes, anxiety and insecurity.

The psychological distress experienced by elderly persons should be considered more carefully after such disasters. Solutions provided in the emergency

phase are often too standardized, being tailored to a general adult population and not adequate for old people. Indeed, the specific needs of the elderly are often not considered, and their sufferings and expectations are underestimated (7).

In Western countries, where elderly people account for an ever increasing proportion of the population, we think it is important to identify solutions that are appropriate for this group. When designing assistance and evacuation plans, the relevant Authorities should consider providing accommodations that meet their particular needs, i.e., wider doors for wheelchair access, lower step at entrance, etc.

REFERENCES

1. Ironson G., Wynings C., Schneiderman N., Baum A., Rodriguez M., Greenwood D., Benight C., Antoni M., La Perriere A., Huang H.S., Klimas N., Fletcher M.A.: Post-traumatic stress symptoms, intrusive thoughts, loss, and immune function after hurricane Andrew. *Psychosomatic Med.* 5: 128-141, 1997.
2. Trichopoulos D., Katsouyami K., Zavitsanos X., Tzonou A., Dalla-Vorgia P.: Psychological stress and fatal heart attack: the Athens (1981) earthquake natural experiment. *Lancet* i: 441-443, 1983.
3. Leor J., Poole W.K., Kloner R.A.: Sudden cardiac death triggered by an earthquake. *New Engl. J. Med.* 334: 413-419, 1996.
4. Trevisan M., Celentano E., Meucci C., Farinaro E., Jossa F., Krogh V., Giumetti D., Panico S., Scottoni A., Mancini M.: Short-term effect of natural disasters on coronary heart disease risk factor. *Arteriosclerosis* 6: 491-494, 1986.
5. Raphael B., Lundin T., Weisaeth L.: A research method for the study of psychological and psychiatric aspects of disaster. *Acta Psychiatr. Scand.* 80 (S 353):1-75, 1989.
6. Kato H., Asukaik N., Miyake Y., Minakawa K., Nishiyama A.: Post-traumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanshin-Awaji earthquake in Japan. *Acta Psychiatr. Scand.* 93: 477-481, 1996.
7. Tanida N.: What happened to elderly people in the great Hanshin earthquake. *BMJ* 313: 1133-1135, 1996.
8. Goenjian A.K., Najarian L.M., Pynoos R.S., Steinberg A.M., Manoukian G., Tavosian A., Fairbanks L.A.: Post-traumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. *Am. J. Psychiatry* 151: 895-901, 1994.
9. NCHS: *Aging in the eighties: the prevalence of comorbidity and its association with disability. Vital and Health Statistics.* National Center for Health Statistics, Advance data, Hyattsville, MD, 1989.
10. Kario K., Ohashi T., on behalf of the Tsuna Medical Association: Increased coronary heart disease mortality after the Hanshin-Awaji earthquake among the older community on Awaji islands. *J. Am. Geriatr. Soc.* 45: 610-613, 1997.
11. Linn B.S., Linn M.W., Gurel L.: Cumulative Illness Rating Scale. *J. Am. Geriatr. Soc.* 16: 622-626, 1969.
12. Parmelee P.A., Thuras P.D., Kats I.R., Powel Lawton M.: Validation of the Cumulative Illness Rating Scale in a geriatric residential population. *J. Am. Geriatr. Soc.* 4: 130-137, 1995.
13. Ferrucci L., Guralnik J.M., Baroni A., Tesi G., Antonini E., Marchionni N.: Value of combined assessment of physical health and functional status to alternative diagnosis in aged people living in the community. A prospective study in Florence, Italy. *J. Gerontol.* 4: M52-M56, 1991.
14. American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R)*. American Psychiatric Press, Washington D.C., 3rd ed. revised, 1987.
15. Pfeiffer E.: A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *J. Am. Geriatr. Soc.* 23: 433-441, 1975.
16. Yesavage J.A., Brink T.L., Rose T.L., Lum O., Huang O., Adey V.: Development and validation of a geriatric screening scale: a preliminary report. *J. Psychiatr. Res.* 17: 37-49, 1983.
17. Hamilton M.: The assessment of anxiety states by a rating. *Br. J. Med. Psychol.* 30: 50-55, 1959.
18. Statistical Package for the Social Science Rel. 6.0 Chicago, Illinois.
19. Percy C., Muir C.: The international comparability of cancer mortality data: results of international death certificate study. *Am. J. Epidemiol.* 129: 934-946, 1989.
20. Nobili A., Tettamanti M., Frattura L., Spagnoli A., Ferraro L., Marrazzo E., Ostino G., Comelli M.: Drug use by the elderly in Italy. *Ann. Pharmacother.* 31: 416-422, 1997.
21. Phifer J.F.: Psychological distress and somatic symptoms after natural disaster: differential vulnerability among older adults. *Psychol. Aging* 5: 412-420, 1990.
22. Brett E.A., Ostroff R.: Imagery and post-traumatic stress disorder: an overview. *Am. J. Psychiatry* 142: 417-424, 1985.
23. Inui A., Kitaoka H., Majima M., Takamiya S., Uemoto M., Yonegaga C., Honda M., Shirakawa K., Ueno N., Amano K., Morita S., Kawara A., Yokono K., Kasuga M., Taniguchi H.: Effect of the Kobe earthquake on stress and glycemic control in patients with diabetes mellitus. *Arch. Intern. Med.* 158: 274-278, 1998.
24. Saito K., Il Kim J., Maekawa K., Ikeda Y., Yokoyama M.: The Great Hanshin-Awaji earthquake aggravates blood pressure control in treated hypertensive patients. *Am. J. Hypertens.* 10: 217-221, 1997.
25. Volridis E.M., Mallios K.D., Papantonis T.M.: Holter monitoring during 1981 Athens earthquakes. *Lancet* i: 1281-1282, 1983.