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Discovery of Decomposed and Mummified Corpses in the Domestic Setting—A Marker of Social Isolation?

ABSTRACT: Mass media reports attribute the occurrence of decomposed or mummified corpses in a domestic setting mainly to an increasing social isolation of elderly people. Not much is known about the demographic and medical conditions under which individuals are found months or even years after death in their homes.

For this study, autopsy reports of individuals found dead and mummified or decomposed between 1993 and 1997 with those from 1963 to 1967 were retrospectively analyzed.

Between 1993 and 1997, a total number of 320 individuals were found decomposed at home compared to 412 such cases between 1963 and 1967. The proportion of individuals older than 64 years was significantly higher during the 1990s study period. Furthermore, the proportion of deaths attributable to natural causes was significantly lower during the 1990s, whereas the rate of suicides was nearly three times higher.

KEYWORDS: forensic science, forensic medicine, social isolation, unemployment, alcohol abuse, decomposition and mummification of corpses

The discovery of decomposed and/or mummified corpses in private homes months or even years after the death of an individual excites media attention occasionally and initiates a broad discussion about the lonely death of those nobody seems to miss. In this context, media reports focus on the worsening of the economic and social situation as an explanation for the delayed finding of these corpses. Thus, for example, in 1992 the mummified corpses of two elderly sisters were found six and seven years, respectively, after their death in their apartment (1). Unpaid electricity bills caused the power station to turn off electricity. When the mailbox was running over, the postman deposited the mail at the post office. The landlord did not notice anything unusual—the rent had been paid regularly by standing order. At last, a clerk registered sparse bank account movements, and thus the apartment was opened and the corpses were found. The neighbors stated they had thought that the two women had died a long time ago. Furthermore, they pointed out that neighborly support was no usual habit in this house. This led to broad media coverage: the rise in the ratio of old people among the total population, resulting in isolation of elderly people in addition to a deficient family infrastructure, isolation of outcasts in urban areas, and missing social and neighborly relationships were easily established as culprits for this incident. In similar cases, media reports very often reminisce about times when “healthy” kinship and neighborly support cared for those endangered by loneliness and social isolation. These “good old times” are often referred to as times of economic and social prosperity and well being,

such as the early 1960s, usually known as the German “economic miracle,” in the course of which Germany became the third greatest economic power in the world.

There are several—mainly forensic—studies focusing on biological postmortem processes occurring in human tissue *after* death, such as decomposition, mummification, lesions due to arthropods, or the impediments in ascertainment of cause of death in such corpses (2–5). Only a few studies are examining sociodemographic and medical conditions under which these individuals died alone in their homes and were found weeks, months, or even years after their death. Schulz et al. described six cases of mummification of human remains in domestic settings. All six individuals were male, aged between 22 and 77 years, and living socially isolated (6). Gurley et al. investigated the circumstances under which emergency medical services found persons in their homes alone and helpless or dead over a twelve-week period in San Francisco. In this study 23% of the study population was found dead. Those individuals were significantly younger than those found alive. Furthermore, the percentage of male individuals was much higher among those found dead (7).

The aim of this study was to evaluate the widely accepted hypothesis suggested by mass media that occurrences of decomposed bodies in private homes represented a phenomenon of our time.

Methods

For this purpose, the results of postmortem examinations on individuals found dead and decomposed in Vienna, the Austrian capital with currently 1.6 million inhabitants, between 1993 and 1997 were compared to those of equivalent cases occurring between 1963 and 1967. During this post-war/post-occupation period, the economy in mid-European countries prospered significantly. Fur-

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thermore, this period is associated with stable family and social infrastructures.

In Vienna, in all cases of sudden death and deaths due to the possible fault of a third party which occur outside hospitals an autopsy has to be performed. All these cases are examined at the Institute of Forensic Medicine in Vienna (8). All reports include a detailed report on case history and description of autopsy findings. External postmortem examination and autopsy procedures refer to a standardized protocol, which was implemented in the 19th century.

All cases were reviewed and recorded by two research assistants, who were instructed to include only cases in which advanced signs of decomposition (widespread discoloration of the skin and/or blistering due to decomposition and/or extensive larval infestation) or mummification were documented. Only those corpses found in apartments were included. Two experienced experts for forensic medicine supervised data collection. The Viennese department of Public Health (MA 15) provided data about the total number of deaths and deaths occurring outside hospitals and nursing homes. The number of all corpses found decomposed was related to these figures.

Data collected included: number of cases; personal variables such as gender, age, profession, time span between last social contact and date of discovery; reason for discovery; medical data, such as cause of death.

“Meteorology and Geodynamics” in Vienna (“Hohe Warte”) provided mean outside temperatures per month to test a probable influence of weather conditions on the number of decomposition cases.

Statistics

The nature of the study was exploratory. The results have to be interpreted descriptively. For temporal analysis, each year was divided into quarters. Spearman’s correlation analysis was used to evaluate frequencies of events across time. Metric variables (such as age) were described as median and range between minimum and maximum. Categorical variables such as gender were analyzed using frequency tables. A *p*-value of less than 0.05 was considered statistically significant for correlation and contingency tables analysis. SAS 8.01[®] (SAS Institute Inc., Cary, NC) was used for numerical analysis.

Results

Study Population

Between 1993 and 1997 there were 320 cases (93 female and 227 male) compared to 412 cases (232 female and 180 male) between 1963 and 1967 (Table 1, Fig. 1). No significant increase or

TABLE 1—Characteristics of individuals found decomposed in private homes, Vienna 1963–1967 and 1993–1997, respectively.

	1963–1967			1993–1997		
	Female <i>n</i> (%)	Male <i>n</i> (%)	Total	Female <i>n</i> (%)	Male <i>n</i> (%)	Total
<i>n</i>	232	180	412	93	227	320
Age distribution						
<25 (%)	8 (3.5%)	15 (8.3%)	23 (5.6%)	3 (3.2%)	12 (5.3%)	15 (4.7%)
25–34 (%)	3 (1.3%)	5 (2.8%)	8 (1.9%)	10 (10.8%)	26 (11.5%)	36 (11.3%)
35–44 (%)	7 (3.0%)	14 (7.8%)	21 (5.1%)	10 (10.8%)	38 (16.7%)	48 (15.0%)
45–54 (%)	17 (7.3%)	16 (8.9%)	33 (8.0%)	12 (12.9%)	48 (21.2%)	60 (18.8%)
55–64 (%)	28 (12.1%)	42 (23.3%)	70 (17.0%)	5 (5.4%)	43 (18.9%)	48 (15.0%)
65–74 (%)	93 (40.1%)	61 (33.9%)	154 (37.4%)	18 (19.4%)	34 (15.0%)	52 (16.3%)
75–84 (%)	68 (29.9%)	25 (13.9%)	93 (22.6%)	21 (22.6%)	17 (7.5%)	38 (11.9%)
≥85 (%)	8 (3.5%)	2 (1.1%)	10 (2.4%)	14 (15.1%)	9 (4.0%)	23 (7.2%)

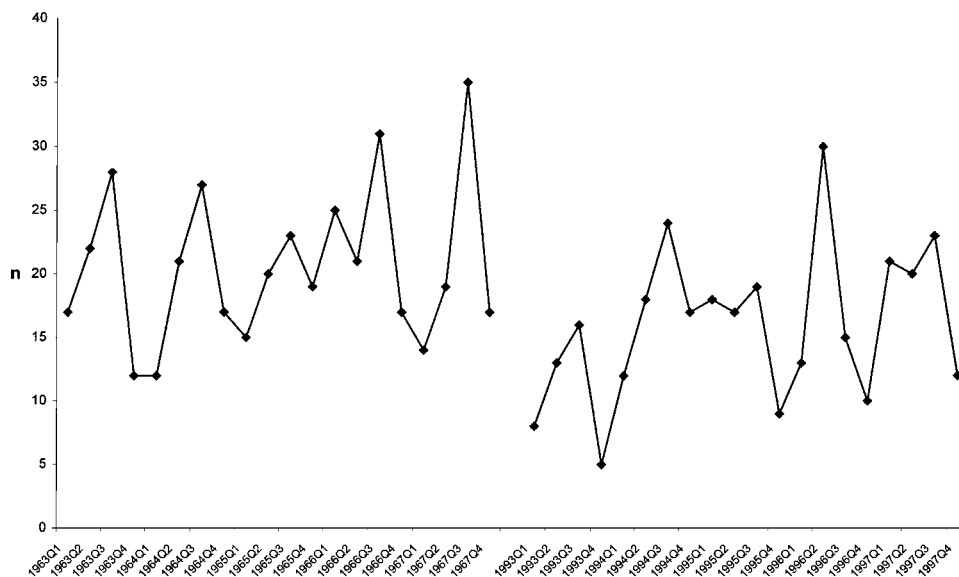


FIG. 1—Number of corpses discovered decomposed in private homes, Vienna 1963–1967 and 1993–1997.

decrease in the number of cases could be observed during both study periods (Spearman correlation coefficient: 1990s: $\rho = 0.56$, $p = 0.32$ 1960s: $\rho = 0.56$, $p = 0.25$) (Fig. 1). The median annual number of such cases was 68 (range: 42–76 cases) compared to 79 (range 77–94) cases observed during the 1960s study period (Wilcoxon-2-Sample Test: $p < 0.05$). Related to the annual number of deaths occurring outside hospitals and nursing homes throughout both study periods, no significant increase or decrease in the number of cases could be ascertained (1990s: 1.14% vs. 1960s: 1.02%; Wilcoxon-2-Sample-Test: $p = 0.24$) (Table 2).

The monthly number of cases increased with increasing monthly mean outside temperatures (Pearson correlation coefficient = 0.50, $p < 0.05$). However, a significant higher mean outside temperature during the months of January, March, May, June, July, August, and December during the 1990s did not result in a higher number of decomposition cases compared to the 1960s study period.

During the 1990s study period, 29.1% of all examined corpses were female compared to 56.3% during the 1960s. Thus, the percentage of female corpses found decomposed in private homes was significantly higher during the 1960s ($\chi^2 = 54.2$, d.f. = 1, $p < 0.05$) (Table 1).

Throughout both study periods, women were significantly older than men. (1990s: median age: females, 69.0 years [29 to 93 years] vs. males: 53.5 years [20 to 91 years]; Wilcoxon 2-Sample Test: $p < 0.05$; 1960s: median age for females: 71.0 years (20 to 95 years] vs. males: 62.3 years [19–86 years]; Wilcoxon 2-Sample Test: $p < 0.05$).

Age distributions differed significantly between the two study periods (Maentel-Haenzel- χ^2 -Test: $p < 0.05$) (Table 1, Fig. 2). The proportion of individuals older than 64 years was significantly lower between 1993 and 1997 (1990s: 35.4% vs. 1960s: 62.4%; $\chi^2 = 52.8$, d.f. = 1; $p < 0.05$).

Between 1993 and 1997, 58.3% (39 females and 147 males) in the group of employable age (<60 years) were unemployed, in contrast to 2 individuals (2 females) between 1963 and 1967. No significant difference could be substantiated between females and males (d.f. = 1; $\chi^2 = 0.32$; $p = 0.57$).

Circumstances of Discovery

During the 1990s study period, 58.6% of all record files ($n = 188$) concluded the time span between the last contact and the discovery of the corpse. Between 1963 and 1967, such data were

available for 44.1% of all cases ($n = 182$). During the 1990s, in 13.3% of these cases ($n = 25$) the last social contact with the deceased was registered less than one week before the discovery, compared to 41.8% ($n = 76$) during the 1960s study period. A time span longer than one week but lesser than one month was recorded for 71.3% ($n = 134$) and 79.1% ($n = 144$) during the 1960s. During the 1990s, the time span between last social contact and discovery of the corpse exceeded one month in 6.1% ($n = 31$) compared to 1.6% ($n = 3$) throughout the 1960s. The median time period between last social contact and discovery was significantly longer during the 1990s (1990s: 30 [range: 6–365] days vs. 1960s: 12 [5–60] days; Wilcoxon-2-Sample Test: $p < 0.05$). Throughout both study periods, cadaverous stench (1990s: 120 cases vs. 1960s: 115 cases) and aggregation of mail (1990s: 42 cases vs. 1960s: 55 cases) registered by neighbors or passersby were the main causes for opening an apartment and discovering the corpse. Only 17 corpses between 1993 and 1997 and 14 corpses between 1963 and 1967, respectively, were found because relatives or friends missed an individual.

Causes of Death (Table 3)

The proportion of individuals dying from natural causes was significantly lower during the 1990s study period: 46.2% ($n = 147$) died due to myocardial infarction or cardiac failure compared to 62.6% ($n = 258$) between 1963 and 1967. Diseases of the respiratory system (e.g., pneumonia) could be ascertained as the cause of death in 3.4% ($n = 11$) during the 1990s and 6.1% ($n = 25$) during the 1960s, respectively. 3.2% ($n = 10$) versus 7.3% ($n = 30$) died due to cerebral hemorrhage.

The proportion of deaths due to diseases of the digestive system (such as gastrointestinal hemorrhage or hepatic failure) was significantly higher between 1993 and 1997: in 8.1% ($n = 26$) this was the leading cause of death compared to 1.9% ($n = 8$) throughout the 1960s study period.

In four cases (1.3%) intoxication with illicit drugs could be determined as cause of death throughout the 1990s study period. No such case was observed between 1963 and 1967.

25.3% ($n = 81$) of all individuals found decomposed in apartments between 1993 and 1997 committed suicide compared to 9.2% ($n = 38$) throughout the 1960s study period. In 6.5% ($n = 21$) during the 1990s and 10.0% ($n = 41$) during the 1960s, respectively, death occurred as a consequence of accidents in the domestic setting. In the remaining 5.3% ($n = 17$) and 2.9% ($n = 12$), respectively, a cause of death could not be ascertained by the postmortem examination because of advanced putrefaction processes.

TABLE 2—Number of decomposed corpses related to the number of all deaths occurring outside hospitals, Vienna 1963–1967 and 1993–1997.

	Deaths (n)	Deaths Outside Hospitals (n)	Decomposed Corpses (n)	Decomposed Corpses (per 1000 Deaths Outside Hospitals)
1963	26 154	7 757	79	10.2
1964	25 786	7 799	77	9.9
1965	27 445	8 414	77	9.2
1966	26 762	8 090	94	11.6
1967	27 796	8 509	85	10.0
Total	133 943	40 569	412	10.2
1993	20 159	5 631	42	7.4
1994	19 632	5 534	71	12.8
1995	19 783	5 799	63	10.9
1996	19 346	5 705	68	11.9
1997	18 452	5 363	76	14.2
Total	97 372	28 032	320	11.4

TABLE 3—Causes of death as ascertained by autopsy for decomposed corpses found in Vienna, 1963–1967 and 1993–1997, respectively.

Cause of Death (ICD-9 codes)	1963–1967	1993–1997
All causes (000–999)	412	320
Diseases of circulatory system (390–459)	288 (69.9%)	157 (49.1%)
Diseases of respiratory system (460–519)	25 (6.1%)	11 (3.4%)
Diseases of the digestive system (460–519)	8 (1.9%)	26 (8.1%)
Suicide (E 950–E 958)	38 (9.2%)	83 (25.9%)
Injuries and Intoxications (800–900)	41 (10.0%)	25 (7.8%)
Cause of death not specifiable (798)*	12 (2.9%)	18 (5.6%)

* Because of advanced putrefaction processes.

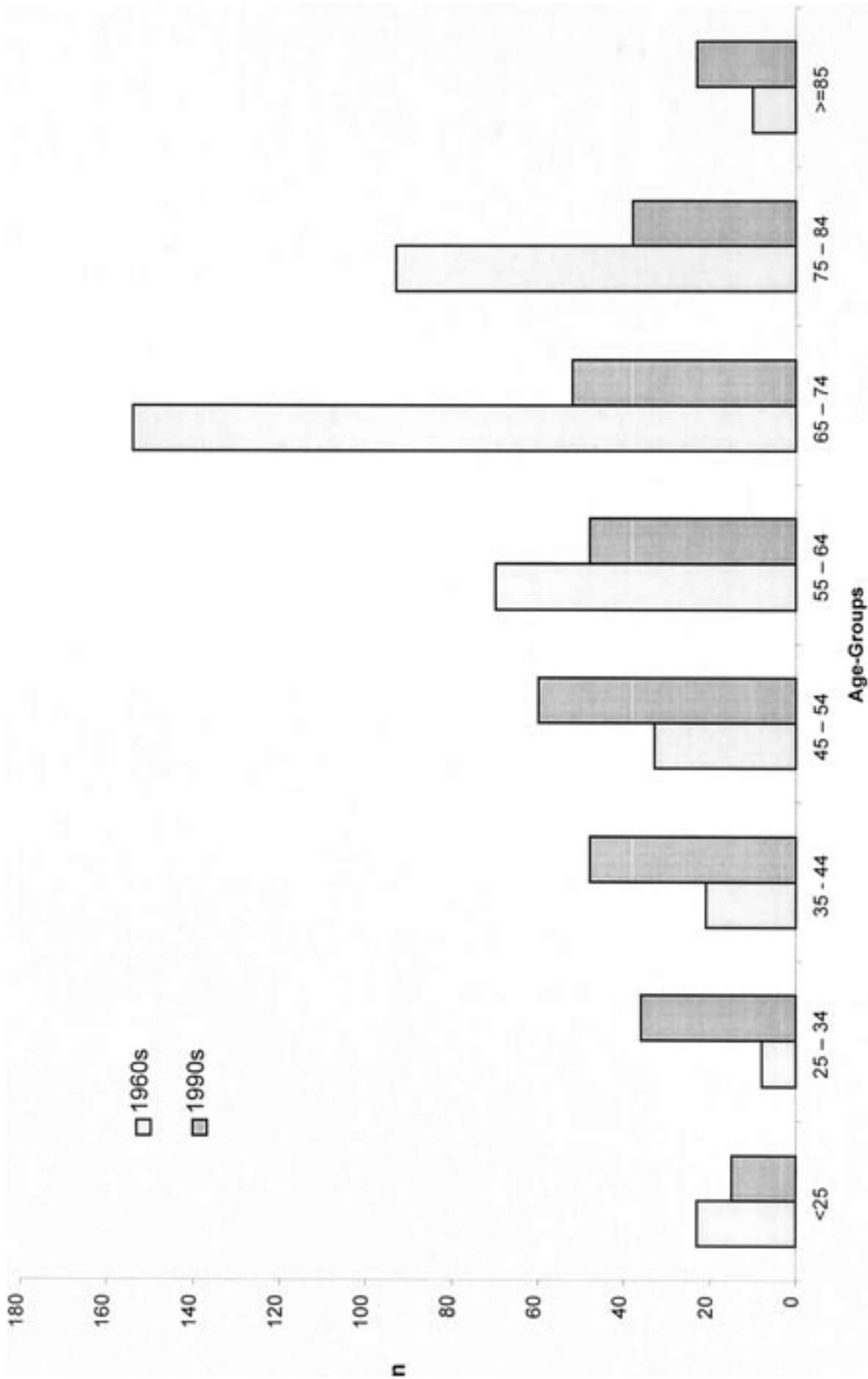


FIG. 2—Age distribution—decomposed corpses, Vienna 1963–1967 vs. 1993–1997.

Discussion

According to the results of this study, the discovery of decomposed corpses does not represent a specific phenomenon of the 1990s. The total number of individuals found decomposed in their homes was even lower during the 1990s study period. However, related to the number of all deaths occurring outside hospitals or nursing homes during the two periods, no significant difference could be substantiated.

From time to time mass media report about the most spectacular of these cases, usually after mummified corpses are discovered years after death. Thus, these singular cases are presented as indicators for the increasing neglect of elderly people living alone. However, such reports largely overlook the fact that decomposition and mummification of corpses in a domestic setting has always been a common phenomenon to the forensic expert witness—in this study approximately 70 cases per year were observed.

The significant differences among age groups, especially the noticeable decrease of cases among individuals older than 60 years, may well be explained by a considerably increasing number of pensioners homes and home-care facilities (e.g., meals on wheels, mobile nurses). In 1969 there were two pensioners homes in Vienna compared to 31 in 1995. Still, there was no difference between the two study periods in the age group of individuals older than 80 years (Table 1). All of them lived in single households. On the one hand, high numbers of elderly people living alone independently can be appreciated as an advance for social policy. On the other hand, it has been suggested by various authors that elderly people living alone were an at-risk group (9–11). A study by Ilife et al. performed in 1992 describing elderly people living alone revealed that 15% of all cases had no working phone and 20% did not have neighbors who could gain access to their homes if needed. One quarter of the study subjects living alone perceived themselves as being without someone whom they could contact in case of emergency (12). In Gurley's study about people found home alone or dead by emergency medical services, the median age of the patients was 78 years for women and 65 years for men (7). Preventive home visits by Medicare professionals or even electronic telephone checks, calling circles among elderly people, and the use of devices that are commercially available to call for help are reasonable alternatives for those who are not checked on regularly by family or friends (13). As in the most industrialized countries, the Austrian population tended to age throughout the last centuries. During the 1990s, the number of older citizens (aged 65+) was nearly twice as high as it was during the 1960s. Thus, changes in the age breakdown between both study periods should rather result in an "older study population" throughout the 1990s than the 1960s (14).

During both study periods, the number of corpses found decomposed in their homes was increasing with rising mean outside temperatures.

The increasing number of individuals younger than 60 years, together with a remarkable decrease of the proportion of female individuals during the 1990s study period (Table 1), might reflect ongoing alterations of social living conditions, especially of men among younger age groups: increasing unemployment rates (1963: 2.8% vs. 1997: 7.1%)(15) and divorce rates (1961: 13.8% vs. 1997: 38.6%) have become essential determinants (16). About 21% of all male individuals found dead and decomposed throughout the 1990s study period were unemployed. The influence of unemployment on mental and physical health is a well-studied subject (17,18). An estimate emerging from the OPCS longitudinal study in the U.K. of a 20% excess risk of death among those actively seeking work seems widely accepted (19).

Furthermore, between the two decades significant differences for the causes of death were discovered. The lower proportion of individuals dying from diseases of the circulatory and respiratory system or injuries may well be a consequence of the relatively younger study population throughout the 1990s. However, especially in these cases, essential medical issues have to be taken into consideration: certainly, many of these individuals may have died quickly and painlessly. Yet, in some of these cases a fall, stroke, or some other not necessarily lethal incident may have caused immobility and incapacity to call for help and thus result in prolonged suffering and agony. In such cases death usually occurs due to pneumonia, severe dehydration, death from exposure to cold, etc. Thus, it can be assumed that in some of these cases suffering and presumably even death could have been prevented by timely intervention.

The increasing number of deaths due to diseases of the digestive system could at least partly be explained by two facts: this group includes (1) deaths due to hepatic failure caused by liver cirrhosis and gastrointestinal hemorrhage, well-known consequences of chronic alcohol consumption, (2) hepatic failure as a consequence of an infection with the hepatitis B/C virus. Chronic alcohol consumption has become a serious problem, especially among single-living, unemployed younger men (20). Infection with the hepatitis B/C virus is only one of many hazards associated with intravenous drug use. The first drug-related death in Vienna occurred in 1968 and drug use did not become a problem until the mid-1980s in Austria (21). In this study, in four cases intoxication with illicit substances was ascertained as the leading cause of death between 1993 and 1997. Throughout this study period, a total of 629 drug-overdose deaths occurred in Vienna (22).

The number of suicides was about twice as high throughout the 1990s study period. Previously specified features, such as loneliness, unemployment, or alcoholism, have been identified as substantial risk factors for suicidal behavior (23). In the OPCS Longitudinal Study, men unemployed at the 1971 census had a standardized mortality ratio for suicide of 236 (19).

In conclusion, our study showed that decomposition of corpses in a domestic setting has become a phenomenon not only affecting older age groups, as often described by mass media reports. Through decades more and more young individuals have been found decomposed in their homes. The results of this study indicate that the extensive development of caring facilities for elderly people has shown some impact on the number of individuals in older age groups found decomposed in their homes. It will be a great challenge for our social and medical system to identify younger subgroups of the population endangered by loneliness and the risk of dying alone. Greater attention should be paid to the mental and physical health of younger subgroups going through stressful life events, such as unemployment or divorce.

References

1. Bauer G, Mortinger H, Hübsch P. Mumifizierte Leichen in der Großstadt. In: Stefenelli N, editor. "Körper ohne Leben." Böhlenau: Wien-Köln-Weimar 1998.
2. Mann RW, Bass WM, Meadows L. Time since death and decomposition of the human body: variables and observations in case and experimental field studies. *J Forensic Sci* 1990 Jan;35 (1):103–11.
3. Nelson EL. Estimation of short-term post-mortem interval utilizing core body temperature: a new algorithm. *Forensic Sci Int* 2000 Mar 13; 109(1):31–8.
4. Corry JE. A review. Possible sources of ethanol ante- and post-mortem: its relationship to the biochemistry and microbiology of decomposition. *J Appl Bacteriol* 1978 Feb;44(1):1–56.
5. Catts EP, Goff ML. Forensic entomology in criminal investigations. *Annu Rev Entomol* 1992;37:253–72.

6. Schulz F, Tsokos M, Püschel K. Natürliche Mumifikation im häuslichen Milieu. *Rechtsmedizin* 1999;10:32–38.
7. Gurley RJ, Lum N, Sande M, et al. Persons found in their homes helpless or dead. *N Engl J Med* 1996;334:1710–6.
8. Klupp N, Risser D, Heinzl H, et al. Forensic autopsies from 1984 to 1993 in Vienna, Austria. *J Forensic Sci* 1997 Jul;42(4):675–7.
9. World Health Organisation. Prevention of mental disorders in the elderly. Copenhagen: WHO, 1977.
10. Royal College of General Practitioners. Care of old people: a framework for progress. London: RCGP, 1990.
11. Taylor RC, Ford G. The elderly at risk: a critical examination of commonly identified risk groups. *JR Coll Gen Pract* 1983;33:699–705.
12. Iliffe S, Tai SS, Haines A, et al. Are elderly people living alone an at risk group? *BMJ* 1992;305:1001–4.
13. van Rossum E, Frederiks CMA, Philipsen H, et al. Effects of preventive home visits to elderly people. *BMJ* 2000 Mar 18;320(7237):754–8.
14. Statistics Austria. Demographisches Jahrbuch Österreichs 1998 (Demographic Yearbook Austria 1998). Vienna, 1999.
15. Statistics Austria. Arbeitsmarktlage in Österreich seit 1964 (Employment situation in Austria since 1964). Vienna, 1999.
16. Statistics Austria. Statistisches Jahrbuch 1998: Ehescheidungen 1961 bis 1997. (Statistical Yearbook 1998: Divorces between 1961 and 1997). Vienna, 1998.
17. Fox AJ. Socio-demographic consequences of unemployment: a study of changes in individuals' characteristics between 1971 and 1981. London: City University, Social Statistics Research Unit, 1986.
18. Warr PB. Work, unemployment and mental health. Oxford: Oxford University Press, 1987.
19. Moser KA, Fox AJ, Jones DR. Unemployment and mortality in the OPCS Longitudinal Study. *Lancet* 1984;iii:1324–8.
20. Schmeiser-Rieder A, Kunze M. Wiener Männergesundheitsbericht. (Viennese report on men's health) 1999;146–7.
21. Risser D, Schneider B. Drug-related deaths between 1985 and 1992 examined at the Institute of Forensic Medicine in Vienna, Austria. *Addiction* 1994 Jul;89(7):851–7.
22. Haas S, Guzei K, Türscherl E. Report on the Drug Situation 1999. Österreichisches Bundesinstitut für Gesundheitswesen (ÖBIG). Vienna, 1999.
23. Jin RL, Shah CP, Svoboda TJ. The impact of unemployment on health: a review of the evidence. *CMAJ* 1995 Sept 1;153(5):529–40.

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