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# High Life in the Sky? Mortality Rates in Swiss High-Rises

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High-rise housing continues to attract criticism in many countries as an unhealthy and unpleasant habitat that isolates people and attracts crime. Nearly one in six households in Europe are now in high-rise buildings and this number is likely to grow as space becomes more constrained (Guertler & Smith 2006). The authors of this study undertook to analyze the census records of more than one million people in Switzerland in an attempt to draw more definitive conclusions about human health and high-rises.

## Editor's Note:

*The study focused on more than 1,000 buildings, that were 8 stories or higher; the highest was 31 stories. Prior studies have addressed taller residential buildings, up to 69 stories, but have either been reviews of prior literature or studies undertaken by way of questionnaires distributed to a few dozen people in a handful of buildings (Lee et al. 2010). This is the first study, to our knowledge, to explore high-rise health using empirical data on such a wide population. Nevertheless, as more and higher residential projects are being built every day across the world, it's clear this is a ripe area for future study, which we would encourage.*

## Introduction

The World Health Organization (WHO) has identified inadequate housing conditions as an important factor contributing to injuries and preventable diseases such as cancer, respiratory, nervous system, and cardiovascular diseases (WHO 2012).

High-rise housing is of particular concern to public health. Some 36 million Europeans live in high-rise buildings (Guertler & Smith 2006). Most of these buildings originate from the high-rise construction boom of the 1960s and 1970s, and many are in poor condition, located in economically-deprived areas and include a significant share of social housing (Wassenberg et al. 2004). The influence of high-rise housing on the health of individuals and communities has been a matter of debate for decades. For example, in the 1970s some architects claimed that “there is abundant evidence to show that high buildings make people crazy” (Alexander et al. 1977: 115). High-rise housing has a persistent reputation as an unpleasant and unhealthy habitat that isolates people from their social environment and increases crime.

Still, in Switzerland and other industrialized countries, the construction of high-rise

buildings has experienced a revival in recent years in the context of dwindling land resources in urban centers. Unlike the tower blocks of the 1960s and 1970s, these are often glitzy buildings located in prime locations that include offices and shops on the lower floors and luxury apartments on the upper and top floors. Living higher up in a high-rise is more prestigious than living in one of the lower floors, rents increase with height, and the most desirable flats are located on the top floor.

Most previous studies of high-rise housing and health have focused on the structural features of high-rise buildings or characteristics of their neighborhoods, largely ignoring differences within buildings in socio-economic position or health outcomes. Even fewer studies have reported on the effects of floor of residence on health outcomes (Evans et al. 2003). The research in this paper used data from the Swiss National Cohort to examine the association of the floor of residence with all-cause and cause-specific mortality in Switzerland.

## Methods

### Swiss National Cohort

The Swiss National Cohort (SNC) is a national longitudinal study of mortality based on the

linkage of census data with mortality and emigration records. The linkages used a combination of deterministic and probabilistic methods based on sex, date of birth, marital status, nationality, religion, place of residence, and other variables (Bopp et al. 2009, Spoerri et al. 2010).

The database analyzed for this study consisted of 2000 census data that were linked to deaths and emigration records up to the end of 2008. The census consists of three questionnaires: one for the individual person, a household questionnaire, and a questionnaire on the building.

The floor of each dwelling was recorded on the household questionnaire. The building questionnaire provided information on the total number of floors in the building. In order to examine the gradient of mortality across floors, we restricted our analysis to residents of buildings with at least four floors. We included persons aged 30–94 years who participated in the census of December 5, 2000. We excluded persons aged below 30, because linkage is less complete in this age group (Bopp et al. 2009) and some individuals may still be in (tertiary) education. We also excluded individuals living in institutions, individuals with no exact information on the floor of residence, people living in temporary or provisional housing, and people with missing information on their highest achieved level of education.

## Variables

We grouped civil status into the categories “Single”, “Married”, “Widowed”, and “Divorced”. Nationality was in three categories: “Swiss”, “Europe other than Switzerland”, and “Other/unknown”; religion in four: “Protestant”, “Roman Catholic”, “No religious affiliation”, and “Other/unknown”; spoken language was also in four: “German”, “French”, “Italian”, and “Other”. We grouped highest educational achievement as “Primary or less”, “Secondary”, or “Tertiary”. We collapsed the 33-grade socio-professional categorization of occupations developed by the Swiss Federal Statistical Office (2002) into eight categories of socio-professional status, capturing skill level and position of individuals on the labor

market. “Type of household” was divided into four categories on the basis of the number of adults and children in the household: “Single-person household”, “Couple without children”, “Household with one or more children”, and “Other”. We grouped household ownership type into “Rented flat”, “Owned flat”, and “Other”. Household crowding was defined as the total number of persons per number of rooms and treated as a continuous variable. The floors in the buildings were categorized into nine levels: “Ground Floor”, Floors 1 to 7, and “Floor 8 and above”. Flats located on the ground floor, raised ground floor, and basement were combined in the category “Ground Floor”.

## Mortality

We explored associations of floor of residence at the time of census with all-cause and cause-specific mortality between December 5, 2000 and December 31, 2008. The deaths were coded according to the tenth revision of the International Classification of Deaths, Injuries and Causes of Death (ICD-10).

Outcomes were: deaths from all causes, cardiovascular diseases, myocardial infarction, stroke, respiratory diseases, alcohol-related deaths (ONS 2012), stomach cancer, lung cancer, breast cancer, prostate cancer, transport accidents, suicide, and suicide by jumping from a high place.

## Statistical Analysis

We modeled the hazard ratio of death across floors of residence for all-cause mortality and specific causes of death using Cox regression models. Time of observation was from the date of census (December 5, 2000) to the date of death, the date of emigration, or December 31, 2008, whichever came first. We adjusted for age by using age as the time scale in the models. We compared the residents of ground floors to those living on the eighth floor or higher. We used two models with different levels of adjustments:

1. Adjusted for age and sex
2. Adjusted for age, sex, civil status, nationality, language, religion, education, professional status, type and ownership

of household, and crowding (fully adjusted).

Models were stratified by building, thus allowing the baseline hazard to differ between different buildings. Stratification by building also meant that analysis were controlled for degree of urbanization, language region, and socioeconomic position of the neighborhood.

In additional analysis, we examined whether the association between mortality and floor of residence was modified by the socioeconomic standing of the area. We used the Swiss neighborhood index of socioeconomic position (Swiss-SEP) (Panczak et al. 2012) for this purpose. Swiss-SEP is a composite measure based on four domains (income, education, occupation, and housing) which describes the socioeconomic position of 1.27 million overlapping neighborhoods. We also explored whether the observed associations might be due to reverse causality, where sicker individuals choose to live on lower floors, whereas healthier people tend to live on higher floors.

Firstly, we narrowed the study population to individuals who had lived on the same floor for five years or longer prior to the census, thus excluding those who moved to the high-rise more recently. Secondly, we assessed whether the association of floor of residence with all-cause mortality differed between the first four years of follow-up

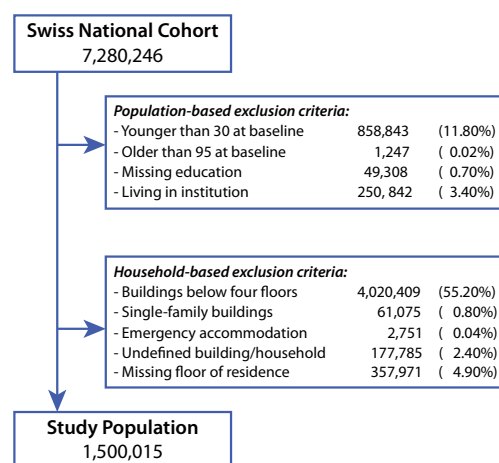


Figure 1. Flowchart of selecting the eligible study population

“Mortality decreased with increasing floors: residents on the ground floor had a 22% greater hazard of death from any cause compared to residents of the eighth floor and above... mortality from cardiovascular and respiratory diseases declined with higher floors of residence.”

(December 5, 2000–December 5, 2004) and the second four years (December 6, 2004–December 31, 2008). The results are reported as hazard ratios (HR) with 95% confidence intervals (CI).

## Results

Our study population consisted of 1,500,015 persons living in 1,008,190 households and 160,629 buildings with four or more floors. The identification of eligible individuals is summarized in Figure 1.

Women, older people, and divorced and widowed individuals were more likely to be residents of higher floors than younger individuals and married people (see Table 1). These differences were also reflected in the composition of households: there were more single-person households and households consisting of couples without children on higher floors compared to lower floors.

Characteristic	Ground Floor		Fourth Floor		Eight Floor		Total	
	N	%	N	%	N	%	N	%
Total	218,529	100.0	158,605	100.0	42,246	100.0	1,500,015	100.0
<b>Gender</b>								
Male	105,694	48.4	74,308	46.9	19,257	45.6	703,972	46.9
Female	112,835	51.6	84,297	53.1	22,989	54.4	796,043	53.1
<b>Age (years)</b>								
Mean (SD)	50.4	(14.9)	53.0	(15.5)	56.7	(15.2)	52.3	(15.4)
30–39	68,098	31.2	40,843	25.8	7,340	17.4	410,355	27.4
40–49	53,303	24.4	34,188	21.6	7,585	18.0	334,038	22.3
50–64	56,114	25.7	44,950	28.3	13,821	32.7	411,497	27.4
65–94	41,014	18.8	38,624	24.4	13,500	32.0	344,125	22.9
<b>Civil status</b>								
Single	35,041	16.0	31,347	19.8	6,255	14.8	262,071	17.5
Married	143,024	65.4	94,795	59.8	26,212	62.0	940,662	62.7
Widowed	16,127	7.4	13,719	8.6	4,453	10.5	127,488	8.5
Divorced	24,337	11.1	18,744	11.8	5,326	12.6	169,794	11.3
<b>Nationality</b>								
Switzerland	158,602	72.6	117,958	74.4	32,828	77.7	1,104,671	73.6
Rest of Europe	53,734	24.6	35,732	22.5	8,057	19.1	351,856	23.5
Other/unknown	6,193	2.8	4,915	3.1	1,361	3.2	43,488	2.9
<b>Religion</b>								
Protestant	70,769	32.4	45,956	29.0	14,277	33.8	460,813	30.7
Catholic	93,286	42.7	69,418	43.8	16,021	37.9	653,289	43.6
No affiliation	29,466	13.5	25,384	16.0	7,069	16.7	213,598	14.2
Other/unknown	25,008	11.4	17,847	11.3	4,879	11.5	172,315	11.5
<b>Language</b>								
German	124,531	57.0	81,358	51.3	20,756	49.1	813,135	54.2
French	46,436	21.2	44,120	27.8	14,732	34.9	371,097	24.7
Italian	19,193	8.8	13,910	8.8	1,879	4.4	126,893	8.5
Other	28,369	13.0	19,217	12.1	4,879	11.5	188,890	12.6
<b>Education</b>								
Primary or less	62,214	28.5	42,926	27.1	11,747	27.8	424,767	28.3
Secondary	110,182	50.4	78,688	49.6	22,183	52.5	750,850	50.1
Tertiary	46,133	21.1	36,991	23.3	8,316	19.7	324,398	21.6
<b>Professional status</b>								
Top management, independent professions	4,820	2.2	3,524	2.2	645	1.5	31,453	2.1
Other self-employed	11,728	5.4	7,866	5.0	1,371	3.2	71,920	4.8
Professionals, senior management	12,096	5.5	10,351	6.5	1,897	4.5	86,855	5.8
Lower management, skilled labor	61,493	28.1	39,401	24.8	9,477	22.4	391,552	26.1
Unskilled labor	20,299	9.3	12,629	8.0	3,157	7.5	129,790	8.7
Other employment	32,434	14.8	21,217	13.4	4,955	11.7	205,891	13.7
Unemployed, seeking work	6,707	3.1	5,068	3.2	1,178	2.8	45,819	3.1
Not in paid employment	68,952	31.6	58,549	36.9	19,566	46.3	536,735	35.8
<b>Type of household</b>								
Single person household	54,994	25.2	48,704	30.7	12,651	29.9	416,550	27.8
Couple without children	65,190	29.8	53,881	34.0	16,477	39.0	496,043	33.1
Household with children	82,648	37.8	44,469	28.0	10,398	24.6	479,328	32.0
Single parent household	10,647	4.9	6,716	4.2	1,698	4.0	68,520	4.6
Other	5,050	2.3	4,835	3.0	1,022	2.4	39,574	2.6

N = Number, SD = Standard Deviation

Table 1. Characteristics of the study population across first, fourth, eighth, and higher floors of residence. Source: Swiss National Cohort 2000.

Furthermore, the percentage of Swiss nationals, French-speaking residents, and persons with no religious affiliation increased with the number of floors. There were few differences in the distribution of educational level or professional status across floors, however, the percentage of persons not in paid employment increased from 31.6% on the Ground Floor to 46.3% on the eighth floor and above.

As expected, the rent increased with the number of floors (see Table 2). The size of flats decreased with increasing number of floors but the average number of persons per room was nevertheless lower at higher floors: it decreased from 0.72 persons per room on the ground floor to 0.63 persons per room on the eighth floor and above. Of note, almost half (44.7%) of our study population lived in buildings with four floors, compared to 14.0% living in buildings with eight or more floors

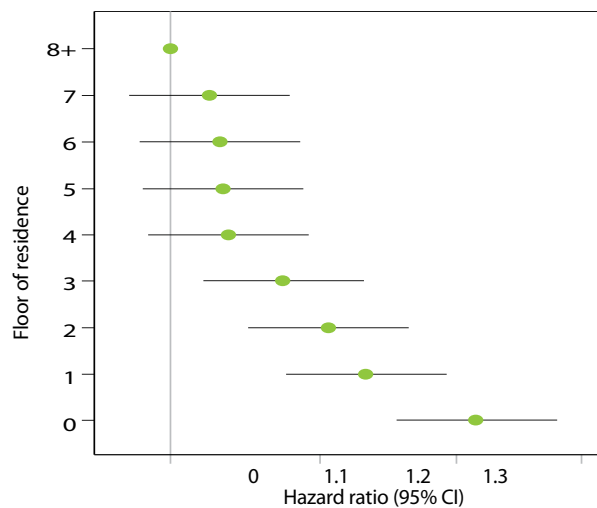


Figure 2. Hazard ratios of death from all causes comparing residents of the eighth floor or higher with residents living on lower floors, Switzerland 2001–2008.

Floor	No. of households		Size of flats (m <sup>2</sup> ) <sup>a</sup>		Crowding (persons/room)		Rent (CHF/m <sup>2</sup> ) <sup>a</sup>	
	N	%	Mean	SD	Mean	SD	Mean	SD
Ground	144,839	14.4	83	(37)	0.72	(0.43)	13.65	(4.99)
1	215,727	21.4	82	(32)	0.68	(0.40)	13.66	(4.92)
2	222,057	22.0	83	(32)	0.66	(0.38)	13.79	(5.01)
3	190,437	18.9	82	(33)	0.66	(0.38)	13.96	(5.12)
4	108,493	10.8	81	(34)	0.66	(0.40)	14.32	(5.35)
5	53,230	5.3	79	(33)	0.67	(0.40)	14.64	(5.24)
6	28,500	2.8	79	(33)	0.67	(0.41)	14.44	(4.86)
7	16,494	1.6	79	(31)	0.65	(0.39)	14.47	(4.77)
8+	28,413	2.8	78	(30)	0.63	(0.37)	14.14	(4.26)
Total	1,008,190	100.0	82	(33)	0.67	(0.40)	13.92	(5.04)

<sup>a</sup> Information on rent and size of flats was available for 681,902 (67.6 %) flats  
CHF = Swiss Franc

Table 2. Characteristics of households and flats across floors of residence in high-rise buildings. Source: Swiss National Cohort 2000.

(see Table 1). The majority of the buildings included in our study were located in urban (46.8%) and semi-urban (35.4%) communities.

A total of 142,390 deaths were recorded among the study population between December 5, 2000 and December 31, 2008, during a total of 11.4 million person-years of follow-up. Of these 132,942 (93.4%) deaths could be linked to a census 2000 record and were included in the analysis.

The floor of residence was associated with all-cause and cause-specific mortality. Figure 2 shows fully adjusted hazard HR of death from all causes, comparing residents of the eighth floor or higher with residents living on lower floors. Mortality decreased with increasing floors: residents on the ground floor had a 22% greater hazard of death from any cause compared to residents of the eighth floor and above. The gradient was steepest between ground floor and fourth floor, and leveled off from the fourth floor upwards.

Table 3 shows the number of deaths included in the analysis and age- and sex-adjusted and fully adjusted HR for all causes and specific causes comparing residents on floors eight and above to ground floors. The association was strongest with transport accidents (fully adjusted HR 2.79; 95% CI 1.16–6.69), followed by respiratory diseases (fully adjusted HR 1.40;

95% CI 1.11–1.77), stroke (fully adjusted HR 1.36; 95% CI 1.07–1.74), cardiovascular diseases (fully adjusted HR 1.35; 95% CI 1.22–1.49) and lung cancer (fully adjusted HR 1.22; 95% CI 0.99–1.50). There was little evidence of an association with other causes of death, except for suicide by jumping from a high place. The fully adjusted HR was 0.41 (95% CI 0.17–0.98)

overall (see Table 3) and 0.33 (95% CI 0.11–0.96) in men compared to 0.46 (95% CI 0.16–1.32) in women ( $p = 0.59$  for difference).

Figure 3 shows the distribution of methods across floors among the 2,697 suicides recorded during the study period. The percentage of suicides by jumping was higher

Cause	No. of deaths	Age- and sex-adjusted		Fully adjusted <sup>a</sup>	
		HR	95% CI	HR	95% CI
All causes	132,942	1.21	(1.15–1.28)	1.22	(1.15–1.28)
Cardiovascular diseases	47,356	1.37	(1.24–1.51)	1.35	(1.22–1.49)
Myocardial infarction	6,535	1.15	(0.90–1.47)	1.15	(0.90–1.47)
Stroke	7,571	1.37	(1.08–1.74)	1.36	(1.07–1.74)
Respiratory diseases	8,440	1.44	(1.15–1.81)	1.40	(1.11–1.77)
Alcohol related deaths	2,576	0.93	(0.65–1.33)	0.87	(0.59–1.27)
Stomach cancer	1,326	1.30	(0.74–2.29)	1.23	(0.69–2.18)
Lung cancer	7,842	1.25	(1.02–1.53)	1.22	(0.99–1.50)
Breast cancer <sup>b</sup>	3,330	0.89	(0.63–1.26)	0.93	(0.65–1.32)
Prostate cancer <sup>c</sup>	2,773	0.94	(0.59–1.51)	1.01	(0.62–1.63)
Transport accidents <sup>d</sup>	593	2.57	(1.10–6.01)	2.79	(1.16–6.69)
Suicide by any means	2,697	0.71	(0.50–1.00)	0.81	(0.57–1.15)
Suicide by jumping from a high place	336	0.39	(0.17–0.89)	0.41	(0.17–0.98)

Note: Analysis based on 1,500,015 Swiss adults residing in buildings with four and more floors. All models were stratified by building.  
HR = Hazard Ratio  
<sup>a</sup> Adjusted for age, sex, civil status, nationality, language, religion, education, professional status, type of household, household ownership, and crowding  
<sup>b</sup> Based on 796,043 women  
<sup>c</sup> Based on 703,972 men  
<sup>d</sup> Including 524 deaths from road traffic accidents (87 %)

Table 3. Hazard ratios of death from all causes and selected causes comparing residents of ground floor flats to residents of flats on the eight floor or higher, Switzerland 2001–2008. Source: Swiss National Cohort 2000.

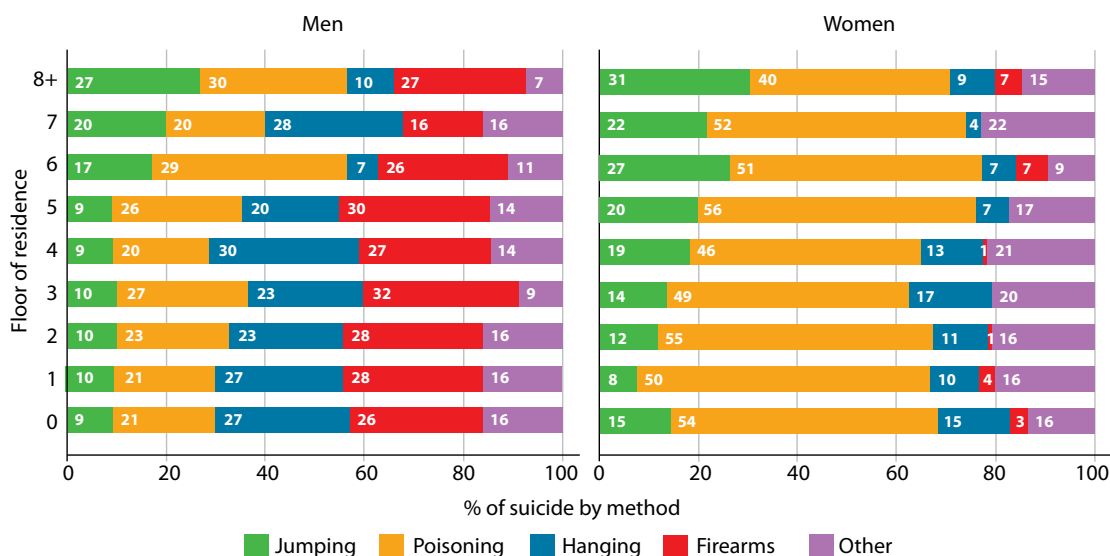


Figure 3. Distribution of method of suicide across floor of residence among 2,697 suicides recorded among 1.5 million residents of buildings with four or more floors, Switzerland 2001–2008.

in women than in men. It increased above the third floor in women and above the fifth floor in men. Among the other means of suicides, it was mainly suicide by hanging that became less common on the higher floors.

There was little evidence for an interaction between floor of residence, socioeconomic position of the neighborhood (measured as quintiles of the Swiss-SEP index) and all-cause mortality ( $p$  from test of interaction = 0.58). A total of 902,600 individuals (60.2% of the study population of 1,500,015) had lived at the same address for at least five years prior to the beginning of the observation time. The results from the analysis restricted to these individuals were closely similar to the main analysis: the fully adjusted HR comparing all-cause mortality in ground-floor residents with those living on floors eight and above was 1.22 (95% CI 1.13–1.30). Similarly, the corresponding HR was 1.22 (95% CI 1.15–1.30) during the first four years of the observation period, and 1.21 (95% CI 1.14–1.29) for the second four-year period.

## Discussion

### Summary of Main Findings

We examined the association of the floor of residence with all-cause and cause-specific mortality in the Swiss National Cohort (SNC). We included just over 1.5 million people living

in buildings with four or more floors, and found that mortality from all causes was higher in people living on the ground floor compared to those living on higher floors. An association with floor of residence was evident with causes associated with socioeconomically patterned behaviors, such as smoking or diet. For example, mortality from cardiovascular and respiratory diseases declined with higher floors of residence, whereas no association was evident for prostate cancer. Indeed, the pattern of mortality differentials across floors was similar to that found across neighborhoods of lower and higher socioeconomic position (Panczak et al. 2012). A trend in the opposite direction was observed for suicide by jumping: this method of suicide was more common among residents of higher floors. However, there was no association between suicide by any means and floor of residence.

### Strengths and Weaknesses

To our knowledge, this is the first large-scale longitudinal study examining the effect of floor of residence on all-cause and cause-specific mortality. The national scope of the study allowed us to include many high-rise buildings of diverse standards that were located in neighborhoods of different socioeconomic standing. We stratified analysis by building and thus accounted for the socioeconomic position of the neighborhood, level of urbanization,

language region and other characteristics of the area. In further analysis, we found little evidence that the effect of the floor of residence on mortality was modified by the socioeconomic position of the neighborhood, or that reverse causality might have affected our results. The census collected only limited information about social and economic characteristics of residents, and no information on the health status of residents. Most importantly, the census does not include information on individual or household income, which

directly measures material resources, or on behavioral and biological risk factors such as smoking, lack of physical activity or blood lipids. We cannot, therefore, exclude with certainty that reverse causality played a role. Probabilistic record linkage had to be used to assign mortality to census records. We excluded individuals younger than 30 years at the beginning of the study and persons with missing information on highest achieved education. The highest level of achieved education was used to account for individual socioeconomic position in the analysis. Furthermore, although enumeration in the 2000 census was near-complete (Renaud 2004), we had to exclude the 4.9 % of individuals who were missing information on the floor of residence. Finally, the place of death is not recorded on the death certificate. It therefore remains unclear to what extent suicides by jumping were linked to the respective high-rise buildings.

### Associations with Specific Causes of Death

The association of floor of residence with causes of death such as stroke or lung cancer may be explained by differences in health-related lifestyles and behaviors – for example diet, smoking, and levels of physical activity – with healthier lifestyles on higher floors. One contributing factor could be a higher level of physical activity, due to regularly climbing the stairs to the apartment.



The classic study by Morris et al., (1953a, 1953b) showed that bus conductors who climbed up and down the stairs of the English double-decker buses had half the coronary mortality of the sedentary drivers. In a recent meta-analysis of cohort studies, we found that as little as 20 minutes of daily moderate to vigorous activity each day was associated with a reduction in all-cause mortality (relative risk 0.86; 95% CI 0.80–0.92) (Samitz et al. 2011). The use of elevators in higher buildings will reduce levels of physical activity, which might explain the steeper gradient below five floors (see Figure 2). Environmental exposures may also play a role, for example, the higher levels of airborne pollutants, including particulate matter, polycyclic aromatic hydrocarbons, or carbon monoxide (Jo & Lee 2006, Jung et al. 2011) or higher levels of road traffic noise at lower floor levels (Mak et al. 2010). Of note, a previous analysis of the SNC found that aircraft noise was associated with mortality from myocardial infarction, with a dose–response relationship for level and duration of exposure (Huss et al. 2010).

The increased risk of death from transport accidents in the residents of lower floors is more difficult to explain. A previous study of mortality from road traffic accidents in Switzerland found that the risk of a fatal accident was higher in individuals with low educational attainment, with more pronounced educational differences in pedestrians than in motor vehicle drivers (Spoerri et al. 2011).

The risk was also higher among single, widowed and divorced individuals, compared to married persons. In the present study, we found no important educational gradient across floors, whereas single and widowed individuals tended to live on higher floors. The association between deaths from transport accidents and floor of residence remained when adjusting analysis for these and other variables.

A limitation of our study is the lack of data on individual exposure to road traffic across sociodemographic groups and different transportation modes. Participation in traffic is not assessed in the census, and could

therefore not be considered in the present analysis. The association with floor of residence might thus simply be due to differences in exposure to traffic, i.e., mileage or time spent in traffic (Parmentier et al. 2005). Some age groups are more exposed to traffic-related risks than others, in particular middle-aged people who are part of the work force, and the amount of miles driven decreases with age (Dellinger, Langlois & Li 2002; Kweon & Kockelman 2003). The older age of the residents of higher floors supports the notion that differences in exposure to traffic may at least partly explain the association with floor of residence. Furthermore, households with children were more likely to reside on lower floors, and these families were perhaps also more likely to be exposed to traffic and its risks.

Suicide by jumping from a high place was substantially increased among residents of the eighth floors and higher compared to those living on the ground floor, which appears to support the claim that “high buildings make people crazy.” The classic study by Fanning (1967) of the wives of British and Canadian servicemen who were randomly allocated to floors in three- to four-story buildings in Germany found that levels of psychological distress in women living on the fourth floor were twice that of women living on the ground floor. Similarly, Gillis (1977) reported higher levels of emotional strain among women living on higher floors. A review of studies on housing and mental health found that six out of eight studies showed poorer mental health among residents of higher floor levels (Evans et al. 2003).

The increased risk of suicide by jumping is of interest to the debate on whether the availability or restriction of access to a method impacts on rates of suicides. Suicide by jumping is the fourth-most common method of suicide in Switzerland, and only three countries – Germany, Austria, and Japan – have a similar share of this method (Reisch et al. 2007). There was little evidence of an increased rate of suicide overall among those living higher up compared to ground-floor residents, which argues against the notion that ready access to a method, in this case jumping from a high place of residence, increases the overall

“There was little evidence of an increased rate of suicide overall among those living higher up compared to ground-floor residents, which argues against the notion that ready access to a method, in this case jumping from a high place of residence, increases the overall rate of suicide.”

rate of suicide. Confidence intervals around the adjusted hazard ratio were, however, wide, and we cannot exclude an increase or a reduction in the risk of suicide in those living on floors eight and above. A previous study from Geneva, Switzerland estimated that 62% of suicides by jumping took place at the home (Perret et al. 2003). This method was also found to be more common among women and the elderly (Reisch et al. 2008). In the present study, 13% of suicides were by jumping from a high place, compared to 35% by poisoning and 18% by use of firearms.

#### Generalizability

In many countries the effects of living on different floors in high-rise buildings are likely to be highly contextual and dependent on cultural and socioeconomic characteristics of neighborhoods, levels of crime, traffic, and physical characteristics of buildings. Interestingly, in the present study the

association between mortality and floor of residence was not modified by the socioeconomic position of the area. The housing situation in Switzerland is fairly unique in comparison to other countries: Switzerland is one of the most affluent nations in the world but has the lowest percentage of home ownership in Europe (Bourassa & Hoesli 2010).

## Implications and Conclusions

We observed an inverse gradient of all-cause and selected cause-specific mortality across floors among residents of high-rise buildings in Switzerland, with the exception of suicide by jumping. The pattern of mortality differentials across floors is compatible with the notion that in Switzerland levels of floors are an indicator of socioeconomic position, with higher floors reflecting higher socioeconomic position, and that the floor of residence is a proxy for social, behavioral, and environmental exposures. Floor of residence may thus also act as a confounding factor in studies of mortality or other health outcomes that focus on or include residents of high-rise buildings. Mortality from suicide by jumping was a notable exception to the mortality gradient observed across floors. Further research is needed to better define the characteristics of these suicides. ■

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