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Asher Colombo and Rocco Molinari

Displacement of Death from Home to Hospital in Historical Perspective: The Case of Italy, 1883–2013

THE RESEARCH PROBLEM The progressive displacement of the site of death from home to hospital settings, far from both public and domestic eyes, has been one of the most important changes in the experience of death throughout the twentieth century. Historically, in Europe people died at home (and often, if male, on the battlefield). Until the beginning of the twentieth century, hospitals were more shelters for the destitute than institutions for the sick. These institutions were under the management of religious orders, not physicians, and their meaning was associated less with the opportunity to receive treatment and therapies than charity. Hospitals were clearly perceived as places to be avoided. Progress in medical knowledge and techniques since the eighteenth century slowly challenged this situation. During the nineteenth century, hospitals began to play the role of institutions for the sick, firmly placed under the guide of physicians.

Slowly a shift in the place of death emerged. Due to a lack of accurate time series, the timing is not completely clear, but in Scandinavian countries, deaths in hospitals had reached 10 percent by the first decade of the twentieth century, 30 percent in the 1950s, and 50 percent in the 1960s. In Norway, more than 70 percent

Asher Colombo is Professor of Sociology at the University of Bologna and President of the Carlo Cattaneo Research Institute in Bologna. He is author of "Why Europe Has Never Been United (Not Even in the Afterworld): The Fall and Rise of Cremation in the Cities (1876–1939)," *Death Studies*, XLI (2017), 22–33; co-author, with Eleonora Vlach, "Why Do We Go to the Cemetery? Religion, Civicness, and the Cult of the Dead in Twenty-First Century Italy," *Review of Religious Research*, LXIII (2021), 217–243; co-author, with Gianpiero Dalla-Zuanna, "Immigration Italian Style, 1977–2018," *Population and Development Review*, XLV (2019), 586–615.

Rocco Molinari is Research Fellow in the Department of Political and Social Sciences at the University of Bologna.

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of deaths occurred in hospitals during the 1970s. This shift started a little later in Mediterranean countries and never achieved the level registered in northern and central Europe or the United States. In Italy slightly more than 10 percent of deaths occurred in hospitals during the 1930s and 30 percent was reached only in the 1970s. The peak was registered in 2010, when 45 percent of all deaths occurred in hospitals. The pace of Spain and Portugal was even slower.[1]

The process is at the center of many competing but partially overlapping concepts in social science, like "medicalization," "institutionalization," or "sequestration." But while there are many concepts to define the process, empirical research is lacking as to the long-term change in the site of death from home to hospital.[2]

The aim of this Research Note is to investigate further the historical correlates of this emerging hospitalization of death, that is, the shift in the place of death from home to hospital, in one country—Italy—over more than a century, so as to cover the entire relevant period. Four sociological schemas are considered to explain the change: the "forbidden death" thesis, the civilization process, institutionalization, and everyday practices.

According to the first explanation, the twentieth century saw the birth and development of a new attitude toward death, whereby it was hidden from public places and confined to the private sphere. A wide range of changes embodied this shift. People began to avoid showing grief in public and began to follow certain rules of bereavement; far more deaths occurred in hospitals than at home, compared to the past; physicians started to share less

1 These data come from administrative printed sources collected by one of the authors. For the historical perception of hospitals as places to be avoided, see Glennys Howarth, *Death and Dying: A Sociological Introduction* (Cambridge, 2007), 115–131; Roslyn Lindheim, "Birthing Centers and Hospices: Reclaiming Birth and Death," *Annual Review of Public Health*, II (1981), 1–29.

2 For the interference of medicine on social life, see Howarth, *Death and Dying*; Lindheim, "Birthing Centers"; Ivan Illich, *Limits to Medicine: Medical Nemesis: The Expropriation of Health* (London, 1976); Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (London, 1973); Irving K. Zola, "Medicine as an Institution of Social Control," *Sociological Review*, XX (1972), 487–504. For the sequestration of death, see Howarth "Whatever Happened to Social Class? An Examination of the Neglect of Working Class Cultures in the Sociology of Death," *Health Sociology Review*, XVI (2007), 425–435, 427; Clive Seale, *Constructing Death: The Sociology of Dying and Bereavement* (Cambridge, 1998); Philip A. Mellor and Chris Shilling, "Modernity: Self-Identity and the Sequestration of Death," *Sociology*, XXVII (1993), 411–431; Anthony Giddens, *Modernity and Self-Identity: Self and Society in the Late Modern Age* (Stanford, 1991).

information with their patients on serious illness; rapid changes in the funeral industry deeply affected rites and the ways people honored the dead; and in Western Europe and the United States the number of cremations increased as a way of disposing of the dead and as a funeral rite, even to the point of exceeding burials, hence the diminishing of the cult of graves, cemeteries, and the dead. In short, the main idea underlying this line of reasoning is that anything to do with death became more and more hidden and private, a process that Ariés called "forbidden death."[3]

Within the context of this general turn, the place of death moved from home to hospital due to two main processes. First, dying at home became increasingly harder in twentieth-century Europe's big cities, which were devoid of the social networks of friends, neighbors, and kinship typical of the countryside. Additionally, growing urbanization had spread the urban condition beyond the cities. Second, changes in family structure, with the fading of the extended household and the growth of nuclear

3 Geoffrey Gorer, *Death, Grief, and Mourning in Contemporary Britain* (London, 1965). For ethnographic research on the pattern of denial of death, see Marco Marzano, *Scene Finali. Morire di Cancro in Italia* (Bologna, 2004); David Sudnow, *Passing On: The Social Organization of Dying* (Englewood Cliffs, 1967); Barney G. Glaser and Anselm L. Strauss, *Awareness of Dying* (Chicago, 1965). For changes in the awareness of patients, see Marzano, *Scene Finali*; Robert Beilin, "Social Functions of Denial of Death," *OMEGA–Journal of Death and Dying*, XII (1982), 25–35; Avery D. Weisman, *On Dying and Denying: A Psychiatric Study of Terminality* (New York, 1972); Glaser and Strauss, *Time for Dying* (Chicago, 1968); *idem*, *Awareness of Dying*; Jessica Mitford, *The American Way of Death* (New York, 1963). For changes in the funeral industry, see Brian Parsons, *The Evolution of the British Funeral Industry in the 20th Century: From Undertaker to Funeral Director* (Bingley, 2018); *idem*, "Change and Development in the British Funeral Industry during the 20th Century, with Special Reference to the Period 1960–1994" unpub. Ph.D. thesis, (Univ. of Westminster, 1997); Gary Laderman, *Rest in Peace: A Cultural History of Death and the Funeral Home in Twentieth-Century America* (Oxford, 2003); *idem*, *The Sacred Remains: American Attitudes toward Death, 1799–1883* (New Haven, 1996); Peter L. Berger and Richard Lieban, "Kulturelle Wertstruktur und Bestattungspraktiken in den Vereinigten Staaten," *Kölner Zeitschrift Für Soziologie und Sozialpsychologie*, XII (1960), 224–236. For changes in disposal practices, see Robert Redeker, *L'éclipse de la Mort* (Paris, 2018); Marco Breschi, Gabriele Ruiu, and Marco Francini "'Ashes to Ashes…': Could the Recent Evolution of the Cremation Practice in Italy Be Interpreted as an Indication of Secularisation?" *Review of Religious Research*, LX (2018), 519–533; Breschi and Francini, "Il Lungo Lento Inesorabile Affermarsi del Rito Crematorio in Italia," *Popolazione e Storia*, XVIII (2017), 81–98; Colombo, "Why Europe Has Never Been United (Not Even in the Afterworld): The Fall and Rise of Cremation in Cities (1876–1939)," *Death Studies*, XLI (2017), 22–33; Peter C. Jupp, *From Dust to Ashes: Cremation and the British Way of Death* (New York, 2006); *idem*, "The Development of Cremation in England 1820–1990: A Sociological Analysis" unpub. Ph.D. thesis, (Univ. of London, 1993); Stephen Protero, *Purified by Fire: A History of Cremation in America* (Berkeley, 2001).

families, made it harder to give proper care to the elderly and to accept the lower level of privacy typical of an extended household. Growing secularization did the rest, pushing the sick out of the home and into the hospital.[4]

A different explanation comes from the field of historical sociology. According to Elias, the rise in the number of deaths in hospitals is part of a wider, centuries-long historical process. This process has gradually moved death to the backstage of social life (the hospital). Elias mentions four preconditions of that process: (1) increasing average life expectancy; (2) the experience of death as the final stage in a natural process, mainly due to progress in medical science; (3) the high degree of internal pacification within modern society, with the decrease in deaths due to interpersonal violence and consequent development of a new personality structure based on "repression of affections," that is, anti-social emotions and attitudes; and (4) a high degree of individualization.[5]

The third main hypothesis comes from sociology. According to Parsons and colleagues, the shift from home to hospital was to be considered merely part of the success of a specific, modern, "active" attitude aimed at gaining more technical control over death. The search for complete control over death also underlies the classic analysis of the place of death in traditional and modern society as developed by Blauner. According to Blauner, modern society is more able to control death, so the power and status of dying people decreases, and they are moved from a preferred place, home, to an unwelcome one, hospital, where the physicians' power resides.[6]

4 Michel Vovelle, *La Mort et l'Occident: De 1300 à Nos Jours* (Paris, 1983); Philippe Ariès, *L'Homme Devant la Mort* (Paris, 1977); *idem*, *Western Attitudes Toward Death: From the Middle Ages to the Present* (Baltimore, 1974), 85–87.

5 Norbert Elias, *The Loneliness of the Dying* (London, 2001; orig. pub. 1979), 43–45; Liz Stanley and Sue Wise, "The Domestication of Death: The Sequestration Thesis and Domestic Figuration," *Sociology*, XLV (2011), 947–962.

6 Talcott Parsons, "Death in the Western World," in *idem* (ed.), *Action Theory and the Human Condition* (New York, 1978); *idem*, "Death in American Society—A Brief Working Paper," *American Behavioral Scientist*, VI (1963), 61–65; *idem*, Renée C. Fox, and Victor M. Lidz, "The 'Gift' of Life and Its Reciprocation," *Social Research*, XXXIX (1972), 367–415; Talcott Parsons and Lidz, "Death in American Society," in Edwin S. Schneidman (ed.), *Essays in Self Destruction* (New York, 1967), 133–170; Robert Blauner, "Death and Social Structure," *Psychiatry*, XXIX (1966), 378–394. For the scientific construction of death, see Seale, *Constructing Death: The Sociology of Dying and Bereavement* (Cambridge, 1998), 54. For science as a driver of the hospitalization of death, see Howarth, *Death and Dying*, 117.

Finally, the last explanation argues that the management of dying people in Europe has historically been performed by women at home. The growth of women's participation in the labor market resulted in a retreat from informal care work and sometimes in entry into the formal labor market of caregiving, given that the majority of hospital nurses, hospice personnel, and caregivers in residential homes are female. This process has intertwined with long-term changes in household structure and size. The long demise of the extended household and the spreading of nuclear families in the Western world resulted in a sharp reduction in the number of elderly persons living with relatives or with family members from the younger generation. This meant there were fewer opportunities to keep the sick at home and strong organizational pressure to move them to hospitals. Reduction of space in modern dwellings tended toward the same end.[7]

Place of Death in Empirical Research Empirical studies investigating where people die have generally been driven by two objectives, describing the location-of-death composition and its changes over time, and identifying which individual and (less frequently) which environmental factors are mostly associated with the place of death.

The large prevalence of hospitalized death emerges from these research studies as a common trait in many different contexts. Furthermore, as the few studies adopting a long-term perspective have shown, throughout the second half of the twentieth century, many countries experienced a pattern of growing hospitalization and a decline in the home as the site of death.[8]

7 For implications of changes in household structure, see Michael C. Kearl, *Endings: A Sociology of Death and Dying* (Oxford, 1989), 127–128; Lindheim, "Birthing Centers," 18. For the importance of the changing role of women, see Howarth, *Death and Dying*, 116.

8 Barbara Gomes and Irene J. Higginson, "Where People Die (1974–2030): Past Trends, Future Projections and Implications for Care," *Palliative Medicine*, XXII (2008), 33–41; Limin Yang, Naoko Sakamoto, and Eiji Marui, "A Study of Home Deaths in Japan from 1951 to 2002," *BMC Palliative Care*, V (2006), 1–9; Donna M. Wilson, Herbert C. Northcott, Corrine D. Truman, Susan L. Smith, Marjorie C. Anderson, Robin L. Fainsinger, and Michael J. Stingl, "Location of Death in Canada: A Comparison of 20th-Century Hospital and Nonhospital Locations of Death and Corresponding Population Trends," *Evaluation & the Health Professions*, XXIV (2001), 385–403; Roger W. Hunt, Malcolm J. Bond, Robyn K. Growth, and Penny M. King, "Place of Death in South Australia: Patterns from 1910 to 1987," *Medical Journal of Australia*, CLV (1991), 549–553. For a cross-country comparison, see Joanna B. Broad, Merryn Gott, Hongsoo Kim, Michal Boyd, He Chen, and Martin J. Connolly, "Where Do People Die? An International Comparison of the Percentage of Deaths Occurring in Hospital and Residential Aged Care Settings in 45 Populations, Using Published and Available Statistics," *International Journal of Public Health*, LVIII (2013), 257–267.

Nonetheless, studies that narrowed the analysis to recent years also noticed a slowdown in the more-than-century-long process of displacement of death. This downturn was due mainly to the recent emergence of hospices and nursing homes as replacements for hospitals in end-of-life welfare management. In some cases, this trend combines with a small resurgence of the home as the place of death.[9]

One strand of empirical research at variance with this descriptive picture has been devoted to understanding the factors associated with the place of death, typically distinguishing between home, hospital, and other institutions. One of the most common findings is that causes of death are relevant to the place of dying. Terminally ill patients with cancer or other chronic diseases are generally observed to die in hospitals more frequently. Furthermore, some studies support the idea that a cohesive household structure and solid family resources affect the place of death. This has been observed through environmental-level indicators, showing that territories with a larger average household size and fewer families in which the elderly live alone are more likely to be associated with higher home death rates. This finding is also supported by individual-level indicators. Having a partner, being married, or living in a multi-person household is indeed associated with higher probability of dying at home and a lower chance of a hospitalized death. Moreover, elderly people having a close family member as first caregiver, as opposed to a social worker, are more likely to die

9 Burkhard Dasch, Klaus Blum, Philipp Gude, and Claudia Bausewein "Place of Death: Trends Over the Course of a Decade: A Population-Based Study of Death Certificates from the Years 2001 and 2011," *Deutsches Ärzteblatt*, CXII (2015), 496–504; Wei Gao, Yuen K. Ho, Julia Verne, Emma Gordon, and Higginson, "Geographical and Temporal Understanding in Place of Death in England (1984–2010): Analysis of Trends and Associated Factors to Improve End-of-Life Care (GUIDE_Care)—Primary Research," *Health Services and Delivery Research*, II (2014), 1–104; Gomes, Natalia Calanzani, and Higginson, "Reversal of the British Trends in Place of Death: Time Series Analysis 2004–2010," *Palliative Medicine*, XXVI (2012), 102–107; Dirk Houttekier, Joachim Cohen, Johan Surkyn, and Luc Deliens, "Study of Recent and Future Trends in Place of Death in Belgium Using Death Certificate Data: A Shift from Hospitals to Care Homes," *BMC Public Health*, XI (2011), 1–10; Wilson, Truman, Roger Thomas, Fainsinger, Kathy Kovacs-Burns, Katherine Froggatt, and Christopher Justice, "The Rapidly Changing Location of Death in Canada, 1994–2004," *Social Science & Medicine*, LXVIII (2009), 1752–1758; James Flory, Yinong Young-Xu, Ipek Gurol, Norman Levinsky, Arlene Ash, and Ezekiel Emanuel, "Place of Death: U.S. Trends since 1980," *Health Affairs*, XXIII (2004), 194–200.

at home than in hospitals or other institutions, which suggests the relevance of family care.[10]

Many studies have found that people living in urban areas are more likely to die in hospitals than are those in rural areas. This aspect is also associated with the higher availability of medical facilities for those living in cities, generally measured as hospital beds per person, a factor that is observed positively to affect the chance of dying in hospitals. Some studies also observe that the recent decrease in death-in-hospital rates is more marked in urban areas, where new institutions and practices are more common.[11]

RESEARCH DESIGN AND METHODOLOGY The aim of this Research Note is to shift our understanding of the displacement-of-death-from-home-to-hospital process from a cross-sectional and individual perspective to a longitudinal framework accounting for the macro historical forces in play.

First, the process of the hospitalization of death in Italy since the late nineteenth century is investigated, adopting territorial-level statistical units, that is, using provinces, as we follow their dynamics over time.

Second, changes in the rate of deaths in hospitals are located within the framework of other processes varying through time. These are demographical forces (mortality reduction, changes in the causes-of-death structure, aging), socio-structural variables

10 Danang Gu, Guangya Liu, Denese Ashbaugh Vlosky, and Zeng Yi, "Factors Associated with Place of Death among the Chinese Oldest Old," *Journal of Applied Gerontology*, XXVI (2007), 34–57; Gao et al., "Geographical and Temporal Understanding"; Houttekier, "Place of Death in Belgium"; Yang, Sakamoto, and Marui, "Home Death in Japan"; Hunt et al., "Place of Death in South Australia." For the association between chronic diseases and place of death, see Sophie Pennec, Joëlle Gaymu, Alain Monnier, Françoise Riou, Régis Aubry, Silvia Pontone, and Chantal Cases, "In France, Where Do People Live in Their Last Month of Life and Where Do They Die?" *Population*, IV (2013), 503–531; Gao et al., "Geographical and Temporal Understanding"; Gomes, Calanziani, and Higginson, "Reversal of the British Trends"; Flory et al., "U.S. Trends since 1980"; Yang, Sakamoto, and Marui "Home Death in Japan"; Wilson et al. "Location of Death in Canada." For a review of factors affecting cancer patients' location of death, see Gomes and Higginson "Factors Influencing Death at Home in Terminally Ill Patients with Cancer: Systematic Review," *British Medical Journal*, CCCXXXII (2006), 515–521.

11 Jyothi Jayaraman and K. S. Joseph, "Determinants of Place of Death: A Population-Based Retrospective Cohort Study," *BMC Palliative Care*, XII (2013), 1–9; Dasch et al., "Place of Death"; Gao et al., "Geographical and Temporal Understanding"; Houttekier, "Place of Death in Belgium"; Wilson et al., "Location of Death in Canada, 1994–2004"; Gu et al., "Place of Death Among the Chinese Oldest Old"; Yang, Sakamoto, and Marui, "Home Death in Japan."

(urbanization, changes in household structure and size), medicalization (mostly due to the increasing availability of hospital facilities), and cultural factors (the spread of the "process of civilization" in Elias' meaning, and the growth of secularization, meaning declining adherence to religious rites and practice in the Western world).

Specifically, considering the importance of demographic forces and the availability of medical facilities that are supposed to affect the hospitalization-of-death process and its geographical distribution, we formulate three hypotheses. First, growing urbanization and changes in the household structure (with fewer family members at home as informal caregivers) increase the number of deaths in hospitals over deaths at home. Second, according to one of the preconditions of the "civilization process" theory, the lower the level of deaths due to interpersonal violence (that is, the drop in the homicide ratio), the higher the rate of deaths in hospitals. Third, the higher the level of secularization, the higher the degree of hospitalized death.

Finally, the analysis aims to investigate specific territorial aspects of the process of hospitalization of death by considering whether the impacts of the aforementioned processes are geographically differentiated.

Data To explore these issues, registry data at the province level in post-unification Italy were combined from various administrative sources, all published by the National Institute of Statistics. The deaths-in-hospitals count was collected from the *Statistics of Patients Movements* and *Causes of Death* registers, available by province for 1883, 1955, 1963, 1974, 1981, 1987, 1997, 2004, and 2013. This information was subsequently merged with data obtained at corresponding years from *Vital Statistics* and *Causes of Death*. Finally, further indicators at the provincial level were collected from the *Italian Population Census*, which has been conducted every ten years since 1861 (thus data from this source are slightly asynchronous with that of the other sources).[12]

12 The *Statistics of Patients' Movements* register collects the number of deaths occurring in public and private hospitals, and only occasionally provides province-level statistics. Data come from the tables "Movimento degli infermi curati negli ospedali" and "Movimento dei ricoverati" (deaths occurring in hospitals) published in various volumes of the "Annuario statistico italiano." Since 2004 the same information has been provided from the *Causes of Deaths* registers, which also include other places of death. The years considered for census variables generally anticipate the timing of other indicators. Census years were 1881, 1951, 1961, 1971, 1981, 1986, 1996, 2001, and 2011. Indicators for 1986 and 1996 were estimated by linear interpolation from the data in the 1981, 1991, and 2001 censuses.

A panel dataset referring to ninety-two Italian provinces over nine points in time from 1883 to 2013 was the result. Provinces were standardized in terms of size and shape by aggregating territories and administrative borders as originally set in 1955. The only exception is the year 1883 where some provinces are missing because they were not part of Italy (Trento, Bolzano, Trieste, and Gorizia), belonged to different and larger provinces, or had different (larger or smaller) boundaries that are impossible to adjust to 1955. Hence, whereas for the remaining years there are ninety-two provinces, in 1883 only sixty-nine are reported. The resulting dataset has an unbalanced panel structure with 802 observations.[13]

Measures All variables considered are time-varying indicators at the provincial level, although they were also measured in larger aggregates for descriptive purposes. Most of them are proportional to either the absolute number of deaths in the year-province (obtained from the vital statistics registers) or the year-province population (measured in the census year). Putting this information together with that collected from other registers, several indicators were constructed.

Our dependent variable is the hospitalization of death, measured as the percentage of deaths in public or private hospitals out of total deaths, excluding other non-strictly hospitalized welfare facilities. Since in our data deaths in hospices can only be considered since 2011 and nursing homes since 2004, focusing only on hospitals guarantees comparability over time. It must therefore be noted that this study does not directly address the emergence of other institutions responsible for the organization of death, though in Italy these institutions represent relatively recent and locally based phenomena, involving a small percentage of total deaths, as seen from descriptive results.

Because a key focus of this research is the implications of structural factors on the displacement of death to hospital, data on household structure changes and urbanization processes from population censuses were collected first. The average number of household components, computed with the ratio between the total population and the number of families was included as an indicator of family

13 Most relevant territorial changes between 1883 and 1955 occurred in the provinces of Rome, Genoa, and Livorno, but all indicators used in the analysis refer to relative rather than absolute values, which attenuates the bias of territorial changes.

size. Furthermore, to account for changes in the household structure, three categories following the Laslett classification scheme were considered: solitaries, nuclear families, and complex families (including either extended, multiple, indeterminate, and no families). The percentage of each of these categories over total families was measured and a complex/nuclear household index was computed, accounting for the incidence of complex families on nuclear families (multiplied by 100). The level of urbanization was measured as a percentage of people living in cities larger than 20,000 inhabitants. This index was also divided by ten in the analysis, every one-unit increase meaning a 10 percent increase.[14]

To account for the epidemiological transition that has occurred since the late nineteenth century and the growing importance of long-convalescence diseases as causes of death, the malignant cancer mortality rate (expressed in units of deaths per 1,000 individuals) and the percentage of deaths from malignant cancer were measured from the causes-of-death registers. It is worth noting that the cancer mortality rate is affected by the age structure of the population, its dynamics reflecting the process of aging over time. An indicator of aging—the percentage of people over seventy—was also collected. To account for the availability of medical facilities, implying the medicalization of various aspects of social life, including the organization of death, the rate of beds in hospitals per 1,000 people was considered. Furthermore, because the emergence of hospitals as sites of death might be influenced by other changing attitudes associated with the process of civilization—according to Elias' hypothesis—the homicide rate per 100,000 individuals was considered as one possible indicator of this process, thus accounting for the spread of violent deaths.[15]

14 For the Laslett classification scheme, see Peter Laslett and Richard Wall, *Household and Family in Past Time* (Cambridge, 1972). Unfortunately, information on the household structure is only been available from the 1951 population census on, so this variable is missing in 1883. Furthermore, the only possibility of achieving comparability over the years 1951–2011 is by aggregating extended, multiple, indeterminate, and no families, as these were in pre-1981 censuses.

15 The homicide ratio is able to account for only one component in the whole process of civilization, leaving other important aspects aside. Causes-of-death statistics were first collected at the provincial level for the entire Italian territory in 1887, which we used as the first reference year. The causes-of-death classification has been subjected to many changes since, but it is possible to reconstruct the time-series of malignant cancer.

Other potential determinants of site-of-death changes were also measured. As a measure of economic growth, we collected the added per capita value. One indicator of secularization is the percentage of civil marriages over total marriages. This is the only indicator of attitude toward religion available before the introduction of social surveys. As a control variable for education level, we considered the rate of illiteracy among the population over six years old. This is a minimum educational requirement that accounts adequately for the educational stratification in Italy before World War II.[16]

Methods The statistical analysis was designed primarily to investigate how long-period location-of-death changes are affected by social processes that change over time. In this framework, we also aimed at observing whether the influence of these social processes changed in different sub-periods across history. As a secondary purpose, the analysis explored territorial variations in the process of hospitalization of death by considering how far the influence of the aforementioned social processes is geographically differentiated. Given these purposes, we developed a random intercept model allowing for different "within" and "between" effects. The model was run both for the whole period (1883–2013) and for different sub-periods (1883–1955, 1955–1981, and 1981–2013). For each province i and year t our model was

$$y_{it} = (\alpha + \zeta_i) + \beta_1 year_t + \beta_2 macro\_area_i + \boldsymbol{\beta_3}(\bar{\boldsymbol{X}}_{i\cdot} - \boldsymbol{x}_{it}) + \boldsymbol{\beta_4}\bar{\boldsymbol{X}}_{i\cdot} + u_{it}$$

where y is the percentage of deaths in hospitals, α is the constant term, *year* is the observed year dummies (from 1883 to 2013) that account for cluster-invariant time trends, *macro_area* is a set of time-constant macro regional dummies, ζ_i is the random intercept, u_{it} represents time-varying unobservables, and $\boldsymbol{x}$ is a vector of time-varying variables indicating availability of medical facilities (expressed in hospital beds); malignant cancer mortality rate; average household components (or, alternatively, complex/simple household index—in this case the model exclusively refers to the period 1955–2013); urbanization index; violent deaths index; secularization index; and education index. The aging index and the added

16 According to census information, the illiteracy rate in 1881 Italy was still higher than 67%, while in 1951 it was 13%.

per capita value were excluded from the analysis because of collinearity (see the Appendix). Each time-varying variable was included as both a cluster mean and a deviation from the cluster mean to account for between-provinces and over-time effects respectively.[17]

Two rationales are offered for a random-effects approach with this kind of configuration. The first one is cluster confounding. On one hand, our model allows us to consider to what extent the percentage of deaths in hospitals changed according to time-invariant differences among provinces in the observed indicators, suggesting factors responsible for territorial variation ("between" effects). On the other hand, it allows us to study, both for the whole period and for specific sub-periods, how the deaths-in-hospitals rate curve is affected by processes that change over time ("within" effects). The two effects can potentially show a different direction or intensity and separating them improves the substantial interpretation of our estimates. Furthermore, although random-effects models assume level-two exogeneity, "within" estimates are free from bias by construction due to correlation with time-fixed unobservables.[18]

The second argument is that random-effects models accommodate the inclusion of time-invariant characteristics. This allows us to investigate territorial differences including macro-area dummies in the analysis (Northwest, Northeast, Central, South, and Islands). This aspect was further explored through specification of models with interaction terms, designed to show how much long-term ("within") effects of urbanization and household size change according to different macro-areas of Italy.

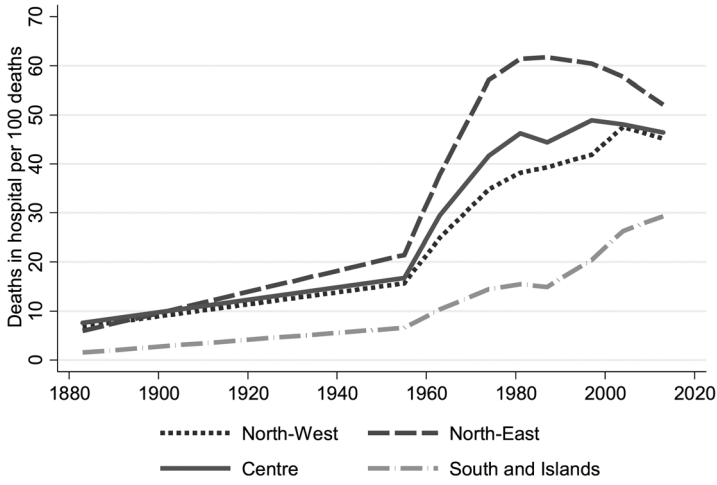
RESULTS

Processes Observed from 1883 to 2013 Changes in the place of death over time have been characterized in Italy by strong territorial differences (Figure 1). Between 1883 and 1981 the share of deaths in hospitals grew faster in Northeast Italy than elsewhere

17 Sophia Rabe-Hesketh and Anders Skrondal, *Multilevel and Longitudinal Modeling Using Stata* (College Station, 2012), I; John M. Neuhaus and John D. Kalbfleisch, "Between- and Within-Cluster Covariate Effects in the Analysis of Clustered Data," *International Biometric Society*, LV (1998), 638–645.

18 For cluster confounding, see Brandon L. Bartels, "Beyond Fixed versus Random Effects: A Framework for Improving the Substantive and Statistical Analysis of Panel, Time-Series Cross-Sectional, and Multilevel Data," *Society for Political Methodology* (2009).

Fig. 1 Percentage of Hospital Deaths Observed for Different Macro-Areas of Italy, 1883–2013



(especially after the 1950s). Since the 1980s it has stabilized and has even decreased in recent years. The same pattern, at lower growth rates, is also seen in Northwest and Central Italy. In southern provinces the percentage of deaths in hospitals had even lower levels of growth, though the deaths were more homogeneous over the whole period and only reached 30 percent in 2013.

Importantly, in the last years observed (2004 and 2013), central and northern areas show a slightly decreasing trend. This is partly explained by the growing relative incidence of nursing homes and hospices as sites of death in the period 2004 to 2013. The emergence of these institutions was much more marked in the central and northern regions than in the southern ones, though only accounting for about 10 percent of deaths in 2013 for the whole territory.

Table 1 provides a concise descriptive overview of processes observed throughout the 130-year period considered, showing values at the national level for all of our collected variables. Different and interrelated macro-dimensions emerge, potentially associated with the hospitalization of death. The former entails demographical and epidemiological change. Crude mortality rates are observed to decline sharply between 1883 and 1955 due to major medical innovations and to stabilize from the 1950s on,

Table 1 Observed Values at the National Level, 1883–2013

	1883	1955	1963	1974	1981	1987	1997	2004	2013
Percentage of hospital deaths	4.6	13.9	23.5	34.3	37.6	37.1	40.1	42.9	41.6
Percentage of hospice deaths									5.3
Percentage of nursing home deaths								4.4	6.2
Hospital beds per 1,000 people	2.0	8.1	9.7	10.8	9.3	7.7	5.9	4.1	3.8
Mortality rate	27.4	10.6	9.8	9.9	9.3	9.4	9.9	9.6	10.0
Malignant cancer mortality rate	0.4	1.2	1.5	1.8	2.0	2.3	2.4	2.5	2.6
Percentage of malignant cancer deaths	1.6	11.5	15.2	18.5	21.9	24.4	24.4	26.6	25.5
Percentage of over-70s	3.1	5.0	6.1	7.1	8.6	9.4	11.7	13.3	15.5
Average household components	4.6	4.0	3.6	3.4	3.0	2.9	2.7	2.6	2.4
Percentage (over total families) of									
solitaries		10.6	11.5	13.5	18.3	19.5	22.8	24.9	31.2
simple families		67.0	69.1	69.6	70.4	69.0	67.1	66.6	60.5
complex families		22.4	19.4	16.9	11.2	11.5	10.1	8.5	8.4
Total		100	100	100	100	100	100	100	100
Complex/simple household index		33.5	28.0	24.3	15.9	16.7	15.0	12.8	13.9
Percentage living in cities >20,000 inhab.	21.3	41.7	47.6	52.3	53.0	52.5	52.0	52.1	52.2
Murders per 100,000 people	5.4	1.5	0.9	1.1	1.9	1.6	1.2	0.9	0.8
Percentage of civil marriages	2.7	2.2	1.3	8.1	12.7	14.5	20.8	31.6	42.5
Percentage of illiterates[a]	64.0	13.5	8.9	5.7	3.4	2.8	1.9	1.5	1.1
Added per capita value (thousands)	0.4	0.2	0.5	1.3	7.9	15.7	29.9	36.4	44.3

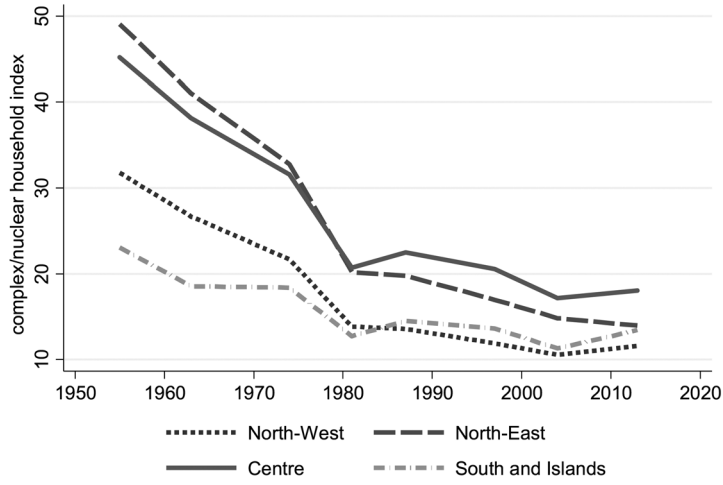
[a]Province-level mean estimates, where absolute values for this indicator are missing.

with few territorial differences. In the meantime, the Italian population has continued to age. These processes imply a changing causes-of-death composition throughout the period, with the declining prominence of infectious diseases and observed increasing rates of deaths from malignant cancer (approaching 25 percent in 2013, and higher in the North). In this context, the availability of medical facilities has followed a reverse-U-shape trend. The number of hospital beds, which reflects the reception capacity of hospitals (always larger in the North), reached its peak in the 1970s and later decreased.[19]

A second aspect regards family dynamics in the demographic transition. The average household size markedly and continuously decreased throughout the whole period observed, reaching about 2.5 components in 2013. In 1883 slightly higher average components were observed in the north-central regions than in southern Italy (Figure 4). Other changes in the household structure for the period 1955–2013 also appear geographically differentiated. Complex households (meaning extended, multiple, and no family) are observed to lower their incidence rapidly over time (mainly due to industrialization and urbanization processes). The percentage of complex households observed in 1955 and 1981 is substantially higher in north-central Italy than in the South. In particular, variations over time of the complex/nuclear household index by macro-area show that the central and northeastern regions at the beginning of the period were characterized by a much larger relative importance of complex families (Figure 2). In later years, Central and Northeast Italy experienced the sharpest decline in family systems based on multiple and extended households. In fact, in these areas (and particularly in Northeast Italy) industrialization implied a radical change in residential patterns of farming households that had remained much more stable in previous centuries. By contrast, the Northwest, characterized by great urban centers, and the South, where salaried workers in agriculture were more common, in the 1950s appeared much less dominated by complex

19 For causes-of-death changes between the nineteenth and twentieth centuries in Italy, see Lucia Pozzi, *La Lotta per la Vita: Evoluzione e Geografia della Sopravvivenza in Italia fra '800 e '900* (Udine, 2001); *idem*, "La Mortalità per Cause nelle Province Italiane dal 1890 al 1950: Differenziazioni Geografiche e Fattori Esplicativi," unpub. Ph.D. thesis, (Università di Firenze–Padova–Roma, 1990).

Fig. 2 Complex/Nuclear Household Index Observed for Different Macro-Areas of Italy, 1955–2013

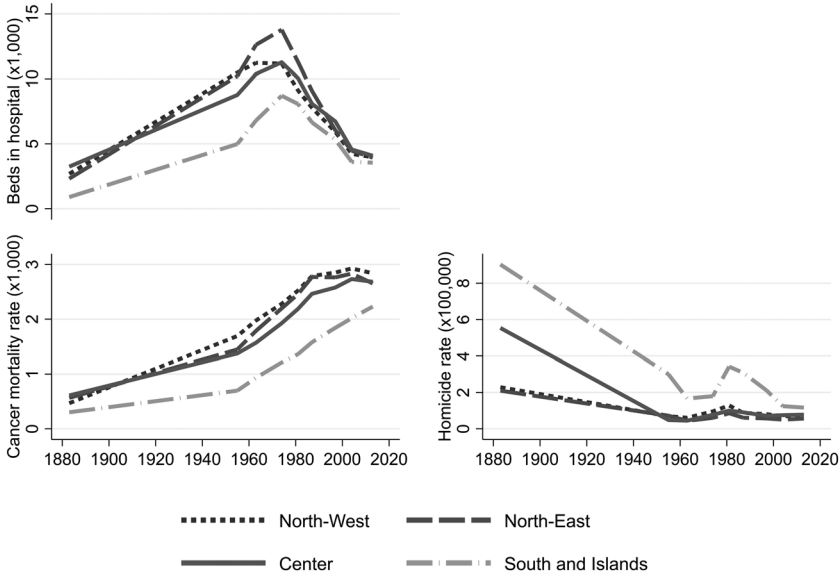


household structures than by nuclear ones. Thus, in these areas (and especially in the South) the relative decrease in multiple and extended household structures was significantly less pronounced.[20]

The number of people living in large urban centers grew considerably in number up to the 1980s, especially between the end of the nineteenth century and the 1950s, with lower levels observed in the Northeast, where big cities are less common (Figure 4). The emergence of civil marriages, starting from the 1960s, was particularly strong in the last years observed, with large differences between central/northern and southern areas. The homicide rate, which decreased in the post-war period, grew faster during the 1970s and 1980s, but subsequently declined even in the South (where the highest levels are observed, Figure 3). Finally, due to the emergence of mass educational programs, there was a sharp decrease in the illiteracy rate (Table 1), especially in the first half of the twentieth century. Thereafter, variations in this indicator are much less marked.

20 Marzio Barbagli, *Sotto lo Stesso Tetto: Mutamenti della Famiglia in Italia dal XV al XX Secolo* (Bologna, 1984); *idem* and David Kerzer, *Storia della Famiglia Italiana* (Bologna, 1992).

Fig. 3 Beds in Hospitals (per 1,000 Inhabitants), Cancer Death Rate, and Homicide Rate Observed for Different Macro-Areas of Italy, 1883–2013



Multivariate Analysis Table 2 shows the results of three models. Model 1 reports only time trends and macro-area dummies; model 2 considers other additional variables; model 3 includes our indicator of household structure instead of the average household components and thus exclusively refers to the period 1955–2013.

Comparing year and macro-area estimates between models 1 and 2 reveals that territorial differences and time-trend variations reduce considerably when the other variables are included in the analysis, although they are not completely eliminated. Differences in the hospitalization rates between Central (reference category), Northeast, and South Italy persist, as well as time-trend effects. However, our covariates partially help to explain territorial time invariant differences and common dynamic changes over time.

Model 2 provides an overview of aspects associated with place-of-death changes in the period 1883–2013. Figures 1–4 can help the broad interpretation of unitary changes in the indicators included. Only the availability of medical facilities and the secularization index show significant (and positive) "between" effects on the hospitalization rate. It means that these two aspects partially

Table 2 Random Intercept Model Estimates on the Percentage of Hospital Deaths, Allowing for Different "Between" and "Within" Effects

	Model (1)		Model (2)		Model (3)	
Year						
1955	ref.		ref.		ref.	
1883	−7.66[c]	(1.23)	−4.98	(3.91)		
1963	8.53[c]	(1.13)	3.20[a]	(1.26)	4.95[c]	(1.18)
1974	18.36[c]	(1.13)	7.55[c]	(1.83)	11.40[c]	(1.89)
1981	21.87[c]	(1.13)	7.22[b]	(2.39)	12.11[c]	(2.58)
1987	22.62[c]	(1.13)	6.19[a]	(2.73)	13.22[c]	(2.94)
1997	26.19[c]	(1.13)	7.80[a]	(3.18)	18.88[c]	(3.43)
2004	29.93[c]	(1.13)	9.67[b]	(3.73)	24.44[c]	(4.06)
2013	28.97[c]	(1.13)	6.67	(4.23)	26.32[c]	(4.55)
Macro-area						
Central	ref.		ref.		ref.	
Northwest	−0.81	(2.46)	−1.90	(2.46)	1.44	(2.87)
Northeast	13.97[c]	(2.46)	8.50[c]	(2.18)	12.03[c]	(2.40)
South and Islands	−17.69[c]	(2.21)	−7.19[a]	(3.14)	−8.08[a]	(3.41)
Availability of medical facilities						
Beds in hospitals (between)			1.00[a]	(0.40)	1.16[b]	(0.41)
Beds in hospitals (within)			0.32[a]	(0.13)	0.74[c]	(0.13)
Epidemiological change						
Cancer death rate (between)			−1.91	(3.92)	−6.53	(3.40)
Cancer death rate (within)			6.64[c]	(1.49)	7.77[c]	(1.42)
Household size						
Avg. household components (between)			3.64	(4.43)		
Avg. household components (within)			−7.40[c]	(1.44)		

Household structure					
Complex/simp. house. index (between)				0.29[a]	(0.15)
Complex/simp. house. index (within)				−0.41[c]	(0.06)
Urbanization index					
Living in cities>20,000 (between)		0.40	(0.42)	0.65	(0.46)
Living in cities>20,000 (within)		2.13[c]	(0.57)	3.27[c]	(0.70)
Spread of violent deaths					
Murders (between)		−0.94	(0.67)	−0.92	(0.73)
Murders (within)		−0.28	(0.24)	0.05	(0.23)
Secularization index					
Civil marriages (between)		1.07[c]	(0.21)	1.14[c]	(0.23)
Civil marriages (within)		0.07	(0.05)	−0.18[b]	(0.06)
Education					
Illiterates (between)		−0.15	(0.23)	0.30	(0.26)
Illiterates (within)		0.24[c]	(0.06)	0.83[c]	(0.11)
Observations	805	805		736	
N of clusters	92	92		92	
sigma_u	7.32	5.71		6.24	
sigma_e	7.70	6.92		6.00	
rho	0.48	0.41		0.52	

Standard errors in parentheses.
[a]p<0.05.
[b]p<0.01.
[c]p<0.001.

explain territorial differences, even when standardized by macro-area fixed effects; provinces (within macro-areas) with higher availability of beds in hospitals and higher levels of secularization also experience higher levels of hospitalized deaths.[21]

Conversely, many aspects are associated with changes in the percentage of deaths in hospitals ("within" effects). First, a growth in the availability of medical facilities increases the number of deaths in hospitals. Second, changes in the prevalence of deaths from cancer (an outcome associated with aging) positively and sizably affect the hospitalization rate curve.

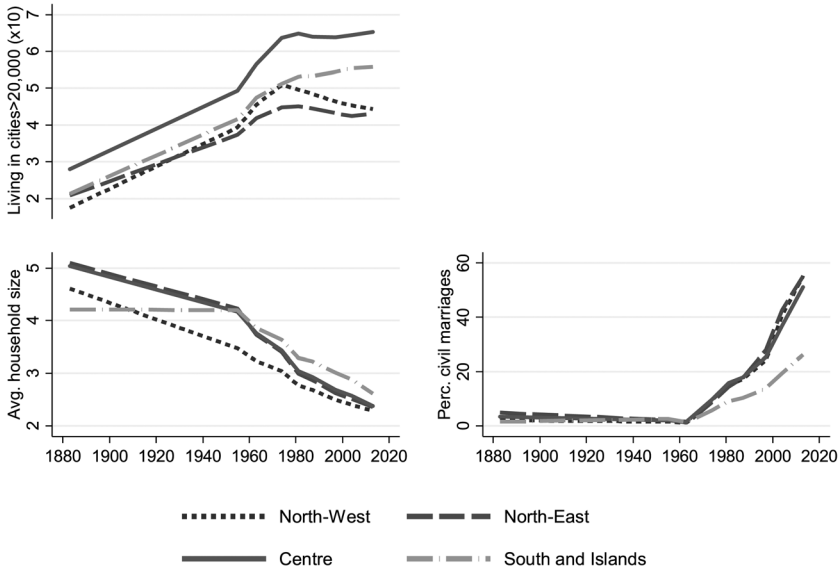
Controlling for these aspects, the indicators of household size and urbanization have a substantial impact. The decrease in average family components over time (observed in this period) implies a marked growth in the hospitalization of death, amounting to 7.4 percent per component. Over the years 1883–2013 the household size reduced by 2.6 members in the north-central regions and by 1.6 in the southern ones (Figure 4). Furthermore, the increasing urbanization, which changed by about three points over the period, positively affects the percentage of deaths in hospitals.

Finally, there are small "within" effects of other variables. Changes in the number of murders are not significant, whereas the secularization index has no effects as a long-term process, since, in comparing model 2 to model 3, these numbers turn out to be negative. The fact is that the growth of civil marriages is concentrated in the last year observed, when the hospitalization rate had already declined in some provinces.

The results of model 3 mostly confirm the findings for the period 1955–2013. Additionally, a marked household structure effect emerges. As complex household structures decrease through time compared to simple ones, a growth in the percentage of deaths in hospitals becomes evident. Note that the complex/simple household index is smaller in the period by about thirty-five points in the Northeast and ten points in the South and Islands (Figure 2). These changes imply a +14.4 and +4.1 variation respectively on the percentage of deaths in hospitals, keeping all

21 We also ran models without macro-area fixed effects. Results confirmed that beds in hospitals and civil marriages exclusively have significant "between" effects, although estimates are even larger (results are not shown, but available upon request). They confirm that these aspects are party responsible for territorial differences, including north-south variation.

Fig. 4 Urbanization Index (per 10 inhabitants), Average Household Components, and Percentage of Civil Marriages Observed for Different Macro-Areas of Italy, 1883–2013



the other variables fixed. Furthermore, this indicator shows diverging "between" and "within" effects. On average over the whole period, higher levels of complex families are observed among provinces with the largest percentage of deaths in hospitals, which subsequently experienced the sharpest decrease in such facilities.

To observe differentiated influences of covariates over time, we estimated our model for three sub-periods, 1883–1955, 1955–1981, and 1981–2013. Results, shown only for "within" estimates (Table 3), suggest several insights. First, the increase of beds in hospitals has continuously contributed to increasing the rate of death in hospitals. Among the other aspects, between 1883 and 1955, only radical changes in urbanization, which in this period have grown more strongly than ever, have affected the slow increase of the death-in-hospital rate curve. Although statistically significant, the effect of secularization in this period is substantially limited. Subsequently, the largest increase of deaths in hospitals occurred between 1955 and 1981, while other factors, such as

Table 3 "Within" Effects Estimates of Random Intercept Models on the Percentage of Hospital Deaths for Different Periods

	1883–1955		1955–1981		1981–2013	
Beds in hospitals	0.45[c]	(0.14)	1.07[c]	(0.18)	0.72[b]	(0.24)
Cancer death rate	−1.96	(2.44)	−4.21	(2.18)	6.67[b]	(2.41)
Avg. household components	−2.04	(1.72)				
Complex/simp. house. index			−0.72[c]	(0.09)	−0.41[b]	(0.15)
Living in cities>20,000	1.25[b]	(0.45)	0.9	(0.83)	2.23	(1.47)
Murders	−0.34	(0.27)	0.45	(0.36)	0.07	(0.28)
Civil marriages	−0.46[a]	(0.19)	0.31[b]	(0.12)	−0.04	(0.09)
Illiterates	0.00	(0.06)	0.93[c]	(0.13)	−1.88[c]	(0.51)

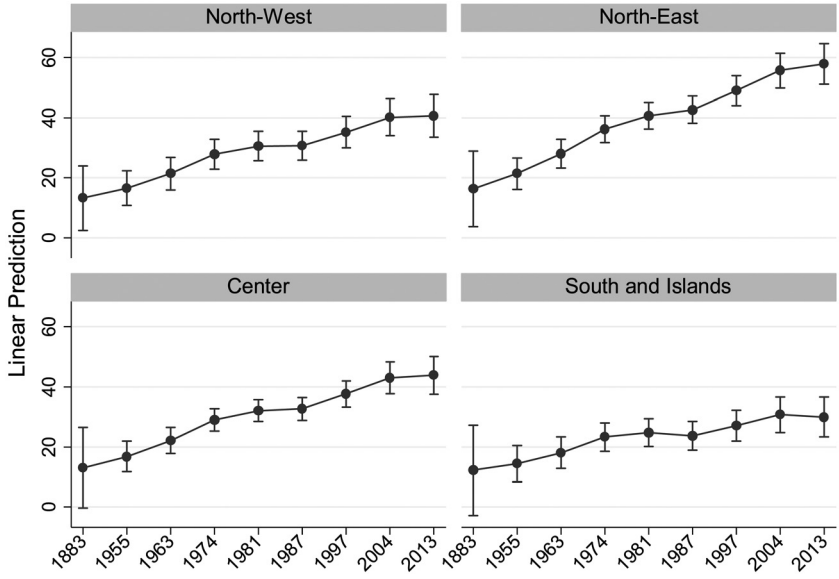
Standard errors in parentheses.
[a]$p<0.05$.
[b]$p<0.01$.
[c]$p<0.001$.

the decrease of complex households and the emergence of civil marriages were affecting the rate of growth. Whereas changes in the household structure between 1981 and 2013 have maintained their influence, variation in the cancer death rate affected the percentage of deaths in hospitals. It is likely that this aspect is mostly responsible for the growth observed in southern provinces, whereas the growth of cancer deaths stabilized in the north-central regions (as observed for the hospitalization-of-death curve).

In the models presented, all the variables express mean effects derived from the population of the whole province. The following analysis aims to study whether changes in some variables over time are clustered within different macro-areas of Italy. Specifically, we included interaction terms between macro-area dummies and the "within" coefficient of household size and urbanization index respectively (for complete estimates see the Appendix, Table A.4).

Predicted rates of deaths in hospitals in different years were estimated from models with interactions, keeping other variables at their mean values (Figures 5 and 6). We assumed a constant decrease in the average household components over time, ranging from 1.2 household size mean deviation in 1883 to −1.2 in 2013, while also assuming that the urbanization index would vary by a yearly increase from 1.6 to −1.6. Though arbitrary, these figures reflect observed ranges of the household size and urbanization index over the whole period.

Fig. 5 Predictions of Hospitalization Rates in Different Macro-Areas of Italy, Considering a Constant Yearly Decrease in Household Size Mean Deviation, Ranging from 1.2 to −1.2, 1883–2013

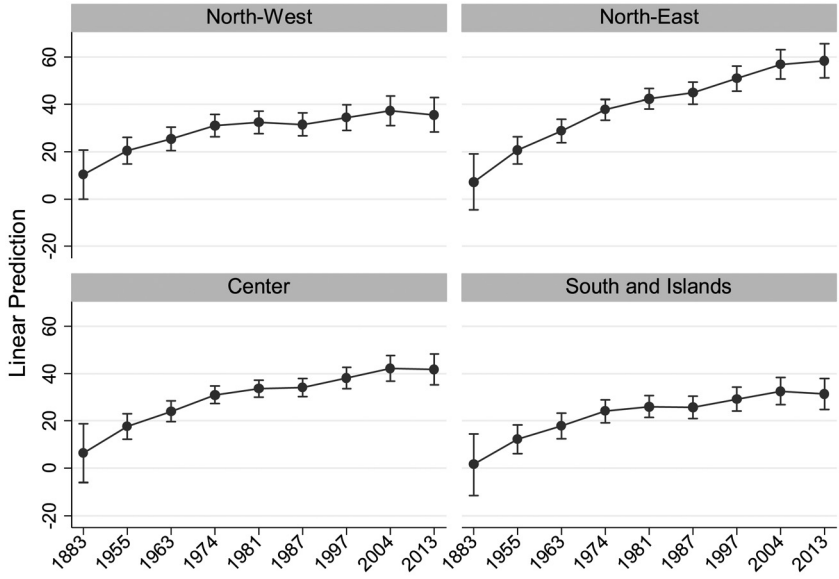


Sizable territorial differences emerge in our estimates (Figure 5). In the first years of the process, assuming a positive mean deviation in household size (hence an effect above the mean for the whole period), few differences are observable among macro-areas. However, as time marches on and the household sizes reduce in later years, the percentage of deaths in hospitals grows at a faster rate in northeastern provinces than anywhere else, reaching the highest levels. The same decrease in household size is less marked in the northwestern and central provinces, producing lower hospitalization rates. In the South the decrease in family size has no effect and the small growth in the percentage of deaths in hospitals is due only to a gradual increase over time.

Similar aspects emerge from estimates that assume changes in the urbanization index (Figure 6). Dynamics are comparable in Northwest, Central, South Italy, and the Islands. However, in the Northeast the change in urbanization produces significantly higher hospitalization rates.

These results confirm the peculiarity of the Northeast, which is observed to experience a pattern of household structure simplification

Fig. 6 Predictions of Hospitalization Rates in Different Macro-Areas of Italy, Considering a Constant Yearly Increase in the Urbanization Index Mean Deviation, Ranging from −1.6 to 1.6, 1883–2013



unlike any other territory. There the reduction in household components and the process of urbanization (strictly affected by industrialization) implies an additional effect on the dynamics beyond the hospitalization of death.

In the nineteenth century, in Italy and around the world, people commonly died at home. This pattern underwent a radical change in the 1950s. The percentage of deaths in hospitals rose from less than 10 percent at the end of the nineteenth century to 30 percent in 2013 in the South and Islands, and before the turn of the twenty-first century reached around 50 percent in the Northwest and Central Italy and more than 60 percent in the Northeast. Changes in the use of hospitals, in the organization of health facilities, in medicine, and in the causes of death have driven and shaped the rise of the number of deaths in hospitals. The institutionalization hypothesis developed in the 1960s and 1970s by Parsons and his colleagues, and later by Blauner, accounts for all of these factors. The availability of beds in hospitals is also observed to affect territorial differences in Italy. This aspect also lies at the

core of the recent wave of cross-sectional studies. But, even considering all these changes, there remain some unexplained variations. The multivariate analysis suggests that the two factors mostly at work were changes in household structure and the rising level of urbanization.

On one hand, nuclear households span no more than two generations, typically a couple with children. As lives progress within this kind of structure, younger generations are less likely to take care of elderly family members. On the other hand, complex families are characterized by the coexistence of two generations with relatives, or three generations, under the same roof. It is more common in this situation for elderly people to receive care from adult sons and daughters (or sons- and daughters-in-law), or even grandchildren. Patrilocal practices bring together both elderly people and adult caregivers. Hence, if the ratio of nuclear families over complex families rises or the average household size shrinks over time, the quota of deaths in hospitals will rise, other factors being equal.

Furthermore, social networks (including families) are not evenly distributed among different geographical areas. The possibility of receiving help from friends, neighbors, and relatives is higher in the countryside than in towns, and in towns more likely than in cities. According to Putnam, city size is one of the most important variables in social capital distribution. All forms of altruism are more common in small towns than in big cities. The analysis shows that, other things being equal, growth in the level of urbanization increases the proportion of people dying in hospitals rather than at home. The literature relates this correlation to two mechanisms. First, the number of people working far from home is higher in urban than in rural settings, where more people work in the primary sector. Second, female participation in the labor market increases with the move from rural to urban settings.[22]

The "forbidden death" theory claims that the rise of a new attitude toward death—including the hospitalization of death—is the effect of three independent processes, namely changes in household structure, urbanization, and secularization. While the

22 For the territorial distribution of social capital, see Robert D. Putnam, *Bowling Alone: The Collapse and Revival of American Community* (New York, 2000).

first two factors are certainly at work, there is no evidence of effects by the third. We only found a relatively small "between" effect by secularization, whereas no long-term changes were found regarding this process.

We found no evidence of the factors considered by Elias' theory of the "civilization process." It may well be that violent deaths had mostly declined before the historical period that we considered and caused other attitudes toward death, but we observed no implications on the process of hospitalization.

Analysis of the Italian case suggests that the effects of urbanization and family change on the rate of displacement of death from home to hospital vary within the country. The shift is most easily seen in Northeast Italy. This area was historically characterized by a higher percentage of couples following the patrilocal practice after marriage, by a larger presence of multiple and extended families, and by bigger household sizes. Household structures changed more rapidly, falling faster than in any other part of the country. Some other factor triggered by this process, and connected with the speed and depth of change, must be at work.[23]

This study is limited due to the characteristics of administrative data and the discontinuity of the time series, but the results achieved suggest that more research would be welcome, especially on other countries where data are available. But it also suggests that we need to refine the theoretical framework in order better to understand a centuries-old historical process that owes much to technological and scientific progress, but which is also based on long-term social and cultural changes.

23 Arnaldo Bagnasco, *Tre Italie: La Problematica Territoriale dello Sviluppo Italiano* (Bologna, 1977), 198–199; Barbagli and Chiara Saraceno, *Lo Stato delle Famiglie in Italia* (Bologna, 1997).

APPENDIX: DIAGNOSTICS & ESTIMATES OF INTERACTION TERMS

DIAGNOSTICS To check for the assumption of no perfect collinearity, the variance-inflation factor (VIF) was computed for all our independent variables. Results are shown in Table A1. The tolerance for the variable "percentage of over-70 people" (our indicator of aging) is below 0.1, and for the "added per capita value," it is borderline. Hence, these variables were removed from the analysis, to avoid multicollinearity problems. As already mentioned, the "malignant cancer mortality rate" variable, which likewise reflects the aging structure of the population, can produce collinearity. Estimates for regression models that include the "added per capita value" were not statistically significant (results not shown, but available upon request). Results of the VIF values for only the variables included in the models are shown in Table A2. Notice that the assumption of no multicollinearity holds.

To test for the normal distribution of the residuals, the standardized residuals for the first level are plotted in Figure A1 and for the second level in Figure A2. The plots appear normal and without outliers (std. res.<4). Therefore, the homoskedasticity assumption holds.

A TEST ON DIFFERENT BETWEEN–WITHIN ESTIMATES Since random intercept models presented in the multivariate analysis allow for different "between" and "within" effects, we performed a statistical test on equal "between" and "within" estimates. The global test on jointly equal coefficients can be considered as equivalent to the Hausman test. See Sophia Rabe-Hesketh and Anders Skrondal, *Multilevel and Longitudinal Modeling Using Stata. I. Continuous Responses* (College Station, 2012).

Table A1 VIF for All Independent Variables

VARIABLE	VIF	VIF–SQRT	TOLERANCE
Hospital beds	2.39	1.54	0.419
Malignant-cancer death rate	7.18	2.68	0.139
Average household size	7.00	2.65	0.143
Percentage of over-70s	10.51	3.24	0.095
Living in cities >20,000	1.25	1.12	0.803
Murders per 100,000	1.17	1.08	0.856
Percentage of civil marriages	7.27	2.7	0.138
Percentage of illiterates	3.01	1.73	0.332
Added per capita value	9.58	3.09	0.104
Mean VIF	5.48		

Table A2 VIF Values for the Variables Included in the Models

VARIABLE	VIF	VIF–SQRT	TOLERANCE
Hospital beds	1.89	1.38	0.528
Malignant-cancer death rate	5.84	2.42	0.171
Average household size	5.52	2.35	0.181
Living in cities >20,000	1.16	1.08	0.860
Murders per 100,000	1.16	1.08	0.862
Percentage of civil marriages	3.10	1.76	0.323
Percentage of illiterates	2.92	1.71	0.342
Mean VIF	3.08		

In Table A3, we can reject the hypothesis that "between" and "within" estimates may be jointly equal at the 1 percent level. Furthermore, statistically significant differences are observed for "average household size" and "percentage of civil marriages." We can interpret the diverging "between" and "within" estimates of our indicator of household size in substantive terms. Provinces with larger average-household sizes throughout the period observed (especially northeastern ones)—those associated with higher death rates in hospitals—also experienced a sharp decrease in household components over time, due to substantive changes

Figure A1 Standardized Residuals for the First Level

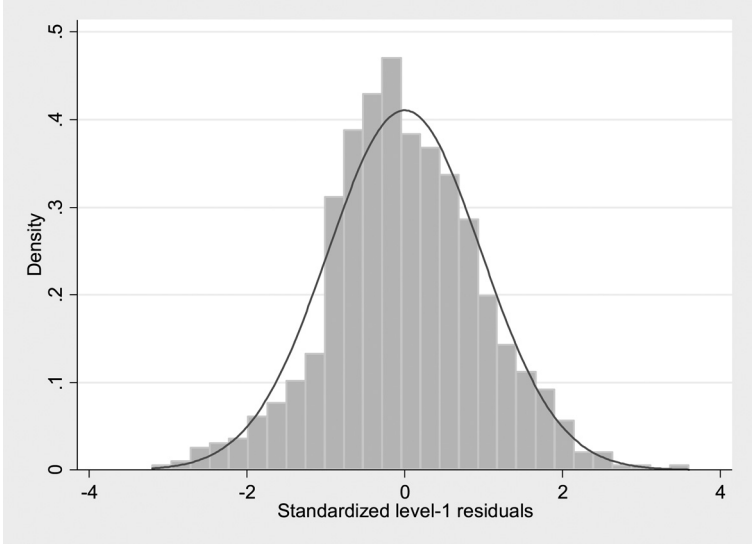
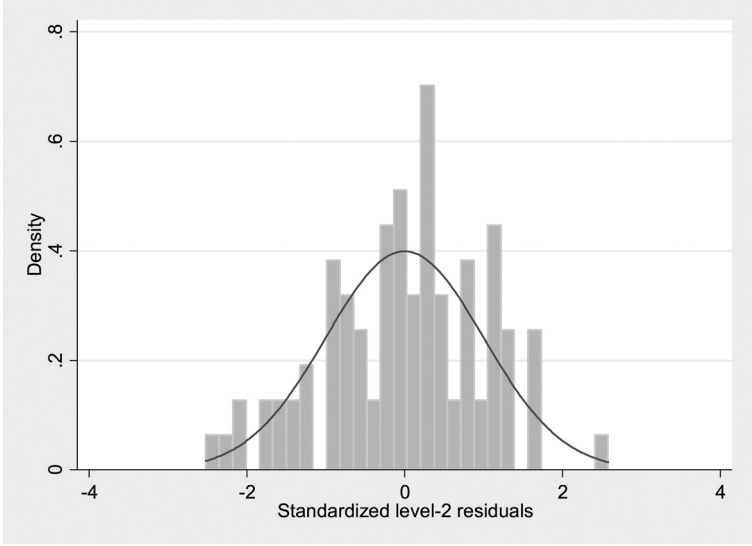


Figure A2 Standardized Residuals for the Second Level



in household structure. This decrease is more effective by virtue of the higher average levels, with implications for deaths-in-hospitals changes.

By contrast, the test statistical value observed for "percentage of civil marriages" suggests that this variable tends to be endogenous. Thus, the "within estimate," which is free from bias due to level-1 endogeneity and refers to changes over time, is non-significant. Hence, interpretation of this indicator's effects must be cautious; it may also be affected by other time-invariant characteristics of provinces that are not included in the analysis.

Table A3 Test Statistics on Equal Between–Within Coefficients

	CHI-SQ	p-VALUE
Hospital beds	0.40	0.528
Malignant-cancer death rate	0.97	0.325
Average household size	7.85	0.005
Living in cities >20,000	1.85	0.173
Murders per 100,000	0.82	0.365
Percentage of civil marriages	33.57	0.000
Percentage of illiterates	0.04	0.850
Global test	45.81	0.000

Table A4 Models with Interaction Terms

	MODEL (7)		MODEL (8)	
Year				
1955	ref.		ref.	
1883	−3.01	(5.55)	−10.18*	(4.49)
1963	4.56***	(1.31)	5.06***	(1.24)
1974	10.66***	(1.97)	10.79***	(1.84)
1981	13.03***	(2.65)	12.20***	(2.45)
1987	12.87***	(3.00)	11.42***	(2.78)
1997	17.09***	(3.55)	14.32***	(3.28)
2004	21.70***	(4.19)	17.15***	(3.84)
2013	21.85***	(4.81)	15.47***	(4.36)
Macro-area				
Northwest	ref.		ref.	
Northeast	10.17***	(2.35)	9.90***	(2.40)
Center	1.53	(2.47)	1.12	(2.51)
South and the islands	−5.84	(3.79)	−6.47	(3.85)
Household size				
Avg. family components (between)	3.98	(4.39)	4.36	(4.50)
Avg. family components (within)	−1.03	(2.26)	−2.53	(1.56)
Urbanization index				
Living in cities>20,000 (between)	0.41	(0.42)	0.43	(0.43)
Living in cities>20,000 (within)	2.74***	(0.56)	−0.12	(0.97)
Macro-areaXFamily size				
Northwest*family size (within)	ref.			
Northeast*family size (within)	−5.95***	(1.34)		
Center*family size (within)	−1.46	(1.53)		
South and the islands*family size (within)	4.01	(2.07)		
Macro-areaXUrbanization index				
Northwest*urb index (within)			ref.	
Northeast*urb index (within)			8.06***	(1.09)
Center*urb index (within)			3.17**	(1.09)
South and the islands*urb index (within)			1.44	(1.22)
Constant	−14.92	(19.32)	−14.40	(19.72)
Observations	805		805	
N of clusters	92		92	
sigma_u	5.68		5.88	
sigma_e	6.63		6.59	
rho	0.42		0.44	

*p<0.05.
**p<0.01.
***p<0.001.

NOTES Models also control for availability of medical facilities, epidemiological change, spread of violent deaths, secularization index, and education index. All indicators include both between and within effects. Standard errors in parentheses.

MODELS WITH INTERACTION TERMS This section presents estimates from models with interaction terms that can be formalized as

$$y_{it} = (\alpha + \zeta_i) + \beta_1 year_t + \beta_2 macro\_area_i + \boldsymbol{\beta_3}(\bar{\boldsymbol{X}}_{i\cdot} - \boldsymbol{x}_{it}) + \boldsymbol{\beta_4}\bar{\boldsymbol{X}}_{i\cdot} + \beta_5(\bar{Z}_{i\cdot} - z_{it}) \times macro\_area_i + u_{it},$$

where z represents either the average household size or the percentage of people living in cities with more than 20,000 inhabitants (urbanization index). Models are designed to show the extent to which the impact of the "within" component of these variables changes according to different macro-areas of Italy—northwest, northeast, center, south and the islands (see Table A4).