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Better Disaster Statistics: The Lisbon Earthquake

Major disasters are characterized by significant loss of life and property, injuries, mental distress, and the problem of numbers. Collecting information on such events and determining their effects is of critical importance in organizing social responses and in devising programs to ameliorate and mitigate the impact of future disasters. Developing good statistics on such matters is important because local, state, and federal spending is prioritized and allocated according to these numbers and because life-and-death decisions are based on, or influenced by, this information. The accurate identification of the effects of disasters is also valuable to international agencies in their attempt to determine the security of their investments in developing countries.

For these reasons, statistics and figures about death and property loss from disasters, both in general and in particular, abound in research, policy statements, professional and operational literature, and news reports. The abundance of quantitative estimates and data documenting effects is due in part to the considerable pressure from legislators and lending agencies, overwhelmingly peopled by policy personnel keen to know how any proposed program fits into a cost-benefit framework. Unfortunately, however, despite the obvious importance of this information, and the call by governmental and professional committees to optimize it, the disaster and emergency field is plagued by dubious statistical data and widespread conceptual disagreement.¹

Inaccurate published statistics are often due to faulty information about a disaster, to the different accounting methods used by

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1 Aguirre and Ernesto L. Quarantelli, "Phenomenology of Death Counts in Disasters: The Invisible Dead in the 9–11 WTC Attacks," *International Journal of Mass Emergencies and Disasters*, XXVI (2008), 19–40.

organizations, and to the lack of consensus among researchers and agencies about such central concepts as *disaster*, *hazard*, and *risk*. For example, the European databases on hazards and disasters maintained by a number of different organizations in different countries show no agreement in definitions and protocols. According to Buckley, none of the existing databases provides a satisfactory framework for the global analysis of disasters.²

Given this predicament, improving the effectiveness of disaster, emergency, and crisis management faces serious challenges, especially since practitioners and the lay public alike appear unwilling to consider such matters. Specialists are of two persuasions. Alongside the significant number of scholars who have called attention to the problem and voiced the need for prompt solutions in recent years are many others (sometimes even the same ones) who are content to make claims about disaster-related demands and the increasing frequency, severity, and etiology of disasters on the basis of doubtful statistics. More often than not, the first numbers and statistics issued about disasters—particularly regarding injured and discomfited people and the extent of economic loss—are hyperbolic, only to be scaled down later.³

The long-standing problem of what constitutes an injury, as discussed in the medical disaster literature, has no simple solution. There are major differences between injuries that require a prolonged hospital stay and those that need only emergency-room treatment. Added to that uncertainty is the problem of whether those injured in the aftermath of a disaster—for example, while undertaking repair or recovery services—should be counted

2 Philip Buckley, *Preliminary Regional Stocktaking of Natural Hazard Risk and Disaster Management Capacity* (New York, 2007).

3 On the issue of dubious statistics, see Susan K. Tubbesing (ed.), *Natural Hazards Data Sources: Uses and Needs* (Boulder, 1979); Claire B. Rubin et al., *Summary of Major Natural Disaster Incidents in the U.S. 1965–85* (Washington, D.C., 1986); Christopher Arnold, “Presentation: Loss and Damage,” in Committee on Earthquake Engineering (eds.), *Proceedings of a Forum, The Economic Consequences of a Catastrophic Earthquake* (Washington, D.C., 1992), 36–48; Debarti Guha Sapir, “Health Effects of Earthquakes and Volcanoes: Epidemiological and Policy Issues,” *Disasters*, XVII (1993), 255–262; Erik K. Noji, “Analysis of Medical Needs during Disasters Caused by Tropical Cyclones: Anticipated Injury Patterns,” *Journal of Tropical Medicine and Hygiene*, XCVI (1993), 1–7; Sapir and Regina Below, *The Quality and Accuracy of Disaster Data: A Comparative Analyses of Three Global Data Sets* (Brussels, 2002); Dennis Mileti, *Disasters by Design: A Reassessment of Natural Hazards in the United States* (Washington D.C., 1999); National Academy of Science, *Facing Hazards and Disasters: Understanding the Human Dimensions* (Washington, D.C., 2006); National Center for Environmental Health, *Surveillance and Data Collection Methods* (Washington, D.C., 2003).

among the victims of a disaster and in the documentation about place of treatment, which is not always easy to establish. These vagaries are also true of claims about the psychological effects of disasters, especially the often-exaggerated claims about posttraumatic stress syndrome.

Statistics about death tend to be the most reliable, but even these figures are plagued by questions about the cutoff date for fatalities directly attributable to a disaster (days, weeks, or months afterward?), as well as by cultural differences about how deaths are to be counted. Arnold opines that the estimation of deaths and injuries caused by earthquakes is “even vaguer than the dollar-loss aspect (for it is usually done) in a smoke-filled room by a small number of people.” Sapir, in her analysis of the injuries and deaths associated with volcanoes and earthquakes, writes, “It is rare to find systematically recorded statistics on the cause, place, and characteristics of death and injury in disasters.” Noji states that in the aftermath of hurricanes, the response of the medical community is often hampered by the absence of accurate information about deaths and injuries: “The most striking feature of data from tropical cyclone epidemiologic literature is its variable quality and nature.” Systematic historical studies have shown racism to be a factor in masking the number of people from minorities who die in disasters, as was the case for Chinese victims in the 1906 San Francisco earthquake. Moreover, until the 1960s, the Australian government refused to count Aborigines as persons, thereby ensuring that their deaths in cyclones would not be recorded.⁴

The collection of disaster data involves at least four challenges: (1) distinguishing between direct and indirect effects, (2) reconciling secondary data sources, (3) accessing private databases, and (4) compensating for systemic oversights in the counting process. In many cases, the statistics serve the needs of the entity collecting the data. For example, the information that insurance agencies collect about disaster-related losses may be useful for their needs but pose difficulties for scientific inquiry or general policy development. “Numbers” incorporate the values of the people who create them, and data collection begins with the col-

4 Arnold, “Presentation: Loss and Damage,” 43; Sapir, “Health Effects of Earthquakes and Volcanoes,” 257–258; Noji, “Analysis of Medical Needs During Disasters,” 5. The source of the information about the Australian government’s treatment of Aborigines was a personal communication from Quarantelli, September 6, 2009.

lector's interests or concerns. Resolving inconsistencies necessitates identifying such organizational interests and accommodating their needs, even as the numbers and statistics are adjusted to suit a broader category of interested parties. Such is the complicated background against which this article evaluates the different claims regarding the number of deaths caused by the Lisbon earthquake of 1755.

THE EARTHQUAKE AND THE CITY The Lisbon earthquake of 1755 was centered on the Atlantic Ocean, 200 km west-southwest from Cape St. Vincent. Most of its devastation occurred in Lisbon, but other areas suffered as well. The earthquake was accompanied by a fire that destroyed important sections of Lisbon and by a large tsunami that ravaged the riverine coast of Lisbon and Algarve in southern Portugal as well as Seville, Cadiz, and Huelva in Spain and Tangiers on the northern coast of Morocco. Apart from the physical devastation, the earthquake is remembered for transforming Portugal into a modern state, for helping to launch the modern science of seismology, and for coloring the European understanding of nature during the Enlightenment.⁵

At the time of the earthquake, Lisbon was arguably the wealthiest city in Europe. If Kendrick is to be trusted, Lisbon was not a beautiful city, but it numbered among its admirable features magnificent governmental and religious structures, palaces, and the colorful Moorish quarters near the Castle of St. George in Rossio—the main square of the city and its commercial and administrative hub. Nearby were the Estatus Palace, the Saint Dominic Church, and the All Saint's Royal Hospital. Lisbon's greatness was the result of the growth of the Portuguese Empire, roughly from the fifteenth to the seventeenth century, when the Portuguese economy grew increasingly dependent on the mineral wealth of Brazil. The first decades of the long reign of King João V (1706–1750) marked the height of its prosperity.⁶

By the time of the earthquake, however, the kingdom had stagnated, and its economic dependence on Britain had become

5 Thomas Downing Kendrick, *The Lisbon Earthquake* (London, 1956), 29–33; Susan E. Hough and Roger G. Bilham, *After the Earth Quakes* (New York, 2006), 41–51; Nicholas Shrady, *The Last Day* (New York, 2008).

6 Kendrick, *Lisbon Earthquake*; José Augusto França, *Lisboa Pombalina e o Iluminismo* (Lisbon, 1987).

onerous. José I (1750–1777) who inherited these troubles had the good fortune to be served by Minister Sebastião José de Carvalho e Melo, Count de Oeiras and Marquês de Pombal. Pombal became best known for his inspired leadership in the immediate aftermath of the earthquake, guiding the recovery and reconstruction of the city. These effective measures earned him the trust of the king and allowed him to act as the king's representative. He created various governmental agencies to take charge of the manufacture and trade of sugar, diamonds, silk, fishing, wine, hats, and other items. He eventually curtailed the influence of Britain on Portugal's commerce and diminished the power of the nobility and the Church, while enhancing the importance of individual competence for social mobility and facilitating the economic efforts of Portuguese merchants and capitalists. He laid the foundation for the change from absolutism to constitutional monarchy in 1826.⁷

THE OVERSTATEMENT OF CASUALTY NUMBERS Not surprisingly, given the important short- and long-term impacts of the Lisbon earthquake, the literature about it is voluminous, amounting to thousands of documents. Shrady divides his many references to it under the subheadings of architecture and urbanism, seismology, theological and philosophical debates, empire and commerce, and histories and testimonies. Significant for our purpose, however, is the absence in this literature of any sustained interest about the number of people that the earthquake killed or injured—perhaps understandable in view of its other worthy considerations. So far as this article is concerned, however, attention to the number of casualties is important not only for what it reveals about the earthquake per se but also for what it might contribute to present-day controversies regarding the difficulties of establishing valid figures about worldwide disaster-related losses.⁸

An examination of competing estimates of the number of people who died in the Lisbon earthquake illustrates the lack of

7 Russell R. Dynes, "The Lisbon Earthquake of 1755: The First Modern Disaster," in Theodore E. D. Braun and John B. Radner (eds.), *The Lisbon Earthquake of 1755: Representations and Reactions* (New York, 2005), 34–49; Malcolm Jack, "Destruction and Regeneration: Lisbon, 1755," *ibid.*, 7–20.

8 Shrady, *Last Day*; Braun, "Poetic Reactions of Voltaire and Le Franc de Pompignan to the Lisbon Earthquake," available at <http://www.udel.edu/flt/faculty/braun/Lisbon.html> (accessed March 8, 2011); Aguirre and Quarantelli, "Phenomenology of Death Counts in Disasters."

reliability in disaster statistics. It aptly demonstrates the difficulty of obtaining valid statistics about fatalities. Even though deaths are, in principle, much easier to quantify in the aftermath of disasters than injuries or psychological effects are, accuracy in Lisbon's case is hindered by sources that did not discriminate the deaths caused by falling debris, fires, tsunamis, and social unrest. The evidence indicates that most of the deaths occurred in Lisbon, not in the other cities and regions affected by the earthquake and tsunamis. Although it is impossible to know how various writers came up with their estimates of deaths in Lisbon, most of them probably used a loose definition of what constituted a casualty of the earthquake. This article follows a more restricted definition, based on the number of dead from falling debris, with various adjustments proposed to refine this figure.

The first casualty estimate was the official assessment by the Marquês de Pombal that between 6,000 and 8,000 people died—numbers that guided the subsequent reconstruction of the city and ultimately the transformation of the entire country. Araújo recently argued that Pombal was trying to downplay the real impact of the disaster to protect Portugal's stature as an ally of Britain on the eve of the Seven Years' War (1756–1763).⁹

Other accounts by well-placed contemporary Portuguese witnesses gave higher estimates, but still well within the range offered by Pombal. Mendonça, however, estimated 10,000 dead; Portal 12,000 to 15,000; Sacramento 18,000; and Pedegache 25,000. The Portuguese Papal Nuncio's estimate of 40,000 deaths, probably the highest for this time period, most likely reflects the ongoing bitter controversy between the Portuguese Catholic Church and Pombal that culminated in the expulsion of the Jesuits in 1759 and the subsequent drastic curtailment of the wealth and influence of the Church.¹⁰

9 J. S. Bração Farinha, "Acção dos sismos sobre as construções: Simpósio sobre a acção dos sismos e a sua consideração no cálculo das construções," *Memória n.º 112 Boletim da Ordem dos Engenheiros* (1955); *idem*, "Construção da Baixa Pombalina," *Cadernos do Metropolitano de Lisboa*, VI (1997); Ana Cristina Araújo, "The Lisbon Earthquake of 1755 Public Distress and Political Propaganda," *European Journal of Portuguese History*, IV (2006), available at http://www.brown.edu/Departments/Portuguese_Brazilian_Studies/ejph/html/issue7/pdf/aarajujo.pdf (accessed December 16, 2011).

10 França, *Lisboa Pombalina*, 65–66; Joaquim Moreira de Mendonça, *História Universal dos Terremotos* (Lisbon, 1758); Manuel Portal, *História da ruína da cidade da Lisboa causada pelo espantoso terramoto e incêndio* (Lisbon, 1758); Antonio do Sacramento, *Exhortação Consolatoria de Jesus Christo Crucificado na Cruz, Ao povo Lusitano, por se ver minimamente conturbado por causa do*

From the start, the number of fatalities was part of a larger religious and cultural narrative involving Catholic and Protestant orthodoxies and Pombal's government. Father Gabriel Malagrida interpreted the earthquake as divine retribution for the city's lack of devotion, urging Lisboans to repent and renounce Pombal's Enlightenment philosophy. Eventually Malagrida paid with his life; Pombal was famous for holding grudges. Dutch Calvinists and other Protestants used the same religious logic to draw different conclusions. According to Wesley, God was displeased and offended by the cruelty of the Portuguese Inquisition and widespread idolatry. Both religious narratives inflated the numbers of the dead and the suffering of the people.¹¹

In the twentieth century, the number of estimates proliferated. Pereira de Sousa, a Portuguese geologist, discovered material in the National Archives convincing him that between 15,000 and 20,000 people had perished. He found a number of questionnaires circulated by Pombal to parish priests—probably the first post-disaster seismic questionnaires in history—to ascertain the effects of the earthquake on their parishes. Portuguese historians made their own calculations. Portugal later calculated 12,000 dead. França, in his study of Lisbon's reconstruction and recovery after the earthquake, accepted the 10,000-dead figure of Mendonça. Oliveira accepted Pombal's high estimate of 8,000. Marques is known to have surmised that 5,000 people died in the city immediately from falling debris and 5,000 later from heart attacks and injuries. Other well-informed scholarly books are those by Kendrick, Maxwell, and Leidner. The official position of the Portuguese government is that between 7,000 to 10,000 people died, and 20,000 were injured.¹²

Terremoto de primeiro de Novembro de 1755 (Lisbon, 1757); Miguel Tibério Pedegache, *Nova e fiel relação do terramoto que experimentou Lisboa, e todo o Portugal no 1 de Novembro de 1755 com algumas observações curiosas, e a explicação das suas causas* (Lisbon, 1756); Dynes, "Lisbon Earthquake," 34–43.

11 Gabriel Malagrida, *juízo da verdadeira causa do terramoto* (Lisbon, 1756); John Wesley, *Serious Thoughts Occasioned by the Great Earthquake at Lisbon* (London, 1755); Shradly, *Last Day*, 113–146; Kendrick, *Lisbon Earthquake*, 72–118.

12 Francisco Luis Pereira de Sousa, "O terramoto do 1 de novembro de 1755 em Portugal," *Serviços Geol'ógicos*, I (1919), 1–277 (a special issue of the journal devoted to Sousa's findings); Fernando Portugal, *Lisboa em 1758: memórias paroquiais de Lisboa* (Lisbon, 1974); França, *Lisboa Pombalina*, 66; Carlos Sousa Oliveira, "Descrição do Terramoto de 1755, Sua extensão, causas e efeitos: O sismo, O tsunami. O incêndio," in Fundação Luso-Americana para o Desenvolvimento (ed.), *O Grande Terremoto de Lisboa. I. Descrições*. (Lisbon, 2005), 23–86; A. H.

The majority of writings today reproduces, or even embellishes, the most outlandish claims of the eighteenth and nineteenth centuries. For example, Pereira states that deaths in Lisbon alone numbered 30,000 to 40,000. Braun mentions that 30,000 died, and 100,000 were injured. Continuing with the inflation of numbers, the Pacific Disaster Center, Levin, Rée (writing for the *Times Literary Supplement*), and the *Encyclopædia Britannica* set the number of fatalities at 60,000; the Institute of Computational Mathematics and Mathematical Geophysics of the Siberian Division of the Russian Academy of Sciences at 80,000; Warnes at 90,000; and NOAA's National Geophysical Data Center (NGDC) at 60,000 to 100,000. Most recently, Hough and Bilham, among others, in their recent and otherwise excellent monograph on earthquakes, estimate close to 100,000 dead. The inflation in the number of people who are said to have perished in Lisbon because of the quake is impossible to ignore.¹³

REASONS FOR OVERSTATING, AND DOUBTING, THE CASUALTY CLAIMS
The present-day tendency is to assume a much greater number of dead in the Lisbon earthquake than the relevant facts can accommodate. If, as Rodrigues argues, the population of Lisbon at the

Oliveira Marques, *Breve História de Portugal* (Lisbon, 2006), 391; Kenneth Maxwell, *Pombal, Paradox of the Enlightenment* (New York, 1995); Allison Leidner, "The Lisbon Earthquake of 1755," available at <http://water.stanford.edu/nur/GP50/allison.pdf> (accessed July 16, 2009). Serviço Nacional de Protecção Civil, Lisboa, *Programa de acções para minimização do risco sísmico: Fase I: Primeiro Relatório final Plano Nacional de Emergência. Presidência do Conselho de Ministros* (Lisbon, 1983).

13 S. Álvaro Pereira, "The Opportunity of a Disaster: The Economic Impact of the 1755 Lisbon Earthquake," available at <http://www.york.ac.uk/res/cherry/docs/Alvaro3.pdf> (accessed July 16, 2009); Braun, "Poetic Reactions of Voltaire"; Pacific Disaster Center, History of Great Earthquakes, available at http://74.125.47.132/search?q=cache:K2LevoWg9VcJ:www.pdc.org/iweb/earthquake_history.jsp+lisbon+earthquake+Pacific+Disaster+Center&cd=1&hl=en&ct=clnk&gl=us&client=firefox-a (accessed July 17, 2009); Boris Levin, "Tsunamis: Causes, Consequences, Prediction, and Response," available at www.undl.org/undoc/EOLSS/E4-06-01-06-TXT.aspx (accessed March 8, 2011); Jonathan Rée, "A Mean and Rootless Fungus," *Times Literary Supplement*, XVIII, 18 Oct. 2002, available at <http://www.susan-neiman.de/docs/book05.html> (accessed July 17, 2009). Another high estimate came from the Institute of Computational Mathematics and Mathematical Geophysics of the Siberian Division Russian Academy of Sciences. See also Kathy Warnes, "The 1755 Lisbon Earthquake—Pombal Uses Science to Rebuild," Suite 101, available at <http://www.suite101.com/content/the-1755-lisbon-earthquake—pombal—uses-science-to-rebuild-a259781> (accessed March 7, 2010); NGDC, "November 1, 1775, Lisboa, Portugal," available at http://www.ngdc.noaa.gov/hazard/tsu_travel_time_events.shtml (accessed June 12, 2008); Hough and Bilham, *After the Earth Quakes*, 265.

time of the earthquake was approximately 191,000 persons, the higher estimates of 40,000 to 100,000 dead would mean that approximately one-quarter to more than one-half of the city's population perished, a level of mortality that finds no support in the contemporary record.¹⁴

An important question derived from this case study, and other similar ones, is why the number of dead and injured victims, economic losses, and psychological impairments caused by disasters have a tendency to increase over time. One reason is pecuniary. Albala-Bertrand writes that distortions are often introduced by "local or national government, reflecting their vested interest in profiting from outside assistance, by magnifying all categories of loss, especially death tolls, so as to elicit a higher inflow of response resources, less pressure from international creditors, and better longer-term borrowing conditions." Many of the figures advanced, especially for technological disasters and increasingly for natural disasters, derive from interest and advocacy groups that usually have a vested concern to make situations look worse than they actually are. Most of the quantitative figures produced in the United States overstate deaths, injuries, economic losses, and other presumed consequences of disasters, such as looting and criminal behavior, volunteering, longer-run divorce rates, and persistence of psychological problems.¹⁵

In certain cases, officials from governments and nongovernmental organizations inflate the numbers for their own advantage. But another contributing factor is that people like big numbers, and news outlets, bureaucrats, scientists, and academicians have all been known to enjoy delivering the "big" story. The emphasis of the mass media on extraordinary and unusual circumstances and reporters' general ignorance of what actually happens in communities in the aftermath of disasters is well documented. Yet, these popular outlets are often responsible for sustaining disaster myths. Alexander documents many of these misrepresentations in his detailed examination of the Haitian earthquake of January 2010. In-

14 Teresa Rodrigues, "Lisboa: Das longas permanências demográficas à diversidade social," available at http://geo.cm-lisboa.pt/fileadmin/GEO/Imagens/GEO/Demografia_historica/Jornadas_demografia_2008/Demografia_doc1.pdf (accessed December 16, 2011); see also *idem*, *Cinco Séculos de Quotidiano: A vida em Lisboa de Século XV aos nossos dias* (Lisbon, 1997).

15 José M. Albala-Bertrand, *The Political Economy of Large Natural Disasters* (New York, 1993), 41.

cluded in the news about this disaster was erroneous information about the health hazard of bodies left unburied, the occurrence of disease epidemics, survivors emerging dazed and apathetic from long periods under rubble, and the need for military intervention to reduce the likelihood of looting and social chaos. Alexander also discusses the ways in which the mass media misunderstood the need for humanitarian aid, medicines, and field hospitals, more intent on creating villains and heroes.¹⁶

The exaggerations with which survivors and their communities often describe their ordeals reflect a certain “pride of place” and an inflated sense of their ability to handle adversity, born of immense relief. In many instances, as the Lisbon earthquake demonstrates ideology and pre-judgment play a part in distorting the effects of disasters. The overstatements that attended the Lisbon earthquake are an example of *sedimentation*—the creation, repetition, and accumulation of unverified claims over time that at some point become self-sustaining facts. Although the goal of scientific discovery is to avoid the dangers of replication, cumulative error is always a possibility.

A METHODOLOGY FOR CALCULATING RELIABLE CASUALTY ESTIMATES
Given the importance of the effects of the earthquake on Lisbon’s development, Portuguese engineers and seismic scientists in the twentieth century studied the earthquake from the perspective of modern plate tectonics and the characteristics of Lisbon’s housing stock when the disaster struck. Coelho examined the engineering principles employed in the reconstruction of the city, and Oliveira

16 David E. Alexander, “News Reporting of the January 12, 2010, Haiti Earthquake: The Role of Common Misconceptions,” *Journal of Emergency Management*, VIII (2010), 15–27. The estimate of the number of people who died in the 2010 Haiti earthquake went from 40,000 to 50,000 in the first days after the quake to approximately 100,000 by the end of the first two or three weeks, and to 230,000 months later. In January 2011, the estimate reached 300,000, as given by Robert Maguire in “Rebuild Haiti, Not Just Its Capital,” *Contemporary History*, CX (2011), 81–82. Among the many examples of unverified claims that are often considered factual is the number of people who died in the firestorm that destroyed large parts of Dresden, Germany, on February 13 and 14, 1945. At the time of the air raid, the British estimated that the attack killed around 16,000. By 1948, however, two German generals had raised the number to 250,000; in the 1950s and 1960s, scholars settled on numbers near 100,000. Apparently, the true number is 25,000 to 30,000 victims; the number of people buried after the attack in municipal cemeteries was 21,271. Details are presented by Rebecca Grant in “The Dresden Legend,” *Airforce Magazine* (October 2004), available at <http://www.airforce-magazine.com/MagazineArchive/Pages/2004/October%202004/1004dresden.aspx>.

studied the source and spread of the seismic forces and its differential effects on the built environment. This important line of scientific investigation culminated in the work of Sousa, which borrowed engineering formulas proposed by The Federal Emergency Management Agency (FEMA), Coburn, Spence, and Pomonis and Tiedemann, to estimate ranges of numbers of fatalities.¹⁷

Sousa adopted a range for the total population for Lisbon at the time of the earthquake that agrees with the best historical writings on the city, from a low of 150,000 to a high of 260,000. If Rodrigues' well-regarded analysis of Portugal during the eighteenth century is correct, Lisbon at the time of the earthquake had a population of 191,052; the city would not reach that size again for half a century. Sousa's computer simulations created a seismic scenario similar to that of 1755. For different housing damage and casualty models based on various assumptions, the seismic death toll varies between 0.3 percent and 3.3 percent of the population. For the low estimate of 150,000 people, the number of fatalities ranges from 450 to 4,950; for the high estimate of 260,000 people, it ranges from 780 to 8,580.¹⁸

Given these comparatively low estimates in the face of the much higher ones already noted, this article reproduces Sousa's findings via a different approach—applying standard demographic methods to the Catholic Church's death rate in Lisbon to determine the total number of people who died in the city on the day of the earthquake. Although the requisite information about the Catholic Church in Lisbon is not complete at this time, the discussion clearly displays the reasoning behind the results permitted by the current data, laying the foundation for future refinement.

Calculating death rates in an afflicted population requires knowing the number of dead and the population at risk. When the information does not cover the entire population, as in this

17 A. Gomes Coelho, "Do 'inquérito do Marquês de Pombal' Ao Estudo de Pereira de Sousa sobre o Terramoto de 1 de Novembro de 1775," in Fundação Luso-Americana para o Desenvolvimento (ed.), *A Grande Terramoto de Lisboa. I. Descrições* (Lisbon, 1985), 143–187; Sousa Oliveira, "Descrição do Terramoto de 1755, 41–66; Maria Luísa Sousa, "Risco Sísmico em Portugal Continental," unpub. Ph.d. diss. (University of Lisbon, 2008), 236; Andrew W. Coburn, Robin J. S. Spence, and Antonios Pomonis, "Factors Determining Human Casualty Levels in Earthquakes: Mortality Prediction in Building Collapse," *Proceedings of the Eleventh World Conference on Earthquake Engineering, Madrid, X* (1992), 5989–5994; Herbert Tiedemann, *Earthquakes and Volcanic Eruptions: A Handbook on Risk Assessment* (Zurich, 1992).

18 Rodrigues, *Lisboa: Das longas permanências*.

case, there is always some question concerning the extent to which the death rate of a sub-population can represent that of the general population. Portugal's list of the 266 officials of the Catholic Church who died in Lisbon as a result of the earthquake is credible, corroborated by other sources. Many of the churches and monasteries in Lisbon were destroyed. França and Sousa Oliveira document that only eleven of the sixty-five convents in the city survived: fewer than ten of the forty churches were able to escape severe damage. Leonor Ferrão listed the hundreds of large religious buildings in Lisbon at the time of the earthquake, as well as the many that were destroyed. The earthquake happened on All Saints' Day, November 1, during 9 A.M. mass—a time when a large proportion of church personnel would have been present at religious services.¹⁹

The membership numbers of Lisbon's Catholic Church in 1755 would be difficult to obtain without extensive research in the Arquivo Histórico do Patriarcado de Lisboa. The Perilongue Census of 1765, however, established the number of parishioners in the national Church at 42,200. Higgs estimated its size to be half of the Spanish Catholic Church, or 91,389 persons. Whichever of these two numbers is more accurate, the exact percentage of Church officials in Lisbon on the day of the earthquake remains a mystery, but certain educated guesses are possible.²⁰

According to Higgs, the Pino Manique Census published in 1789 found 477 religious houses in the country for 1739. Estremadura, the region of Portugal in which Lisbon is located, accounted for 38.2 percent of them. A good many of these buildings were probably located in Lisbon, which at the time of the earthquake had thirty-seven parishes, thirty-two monasteries, and eighteen nunneries. Assuming that the proportion of these houses in the city is a good proxy for the size of the Portuguese Church in Lisbon, and given the absence of any other viable information, this article establishes that 19 to 38 percent of Estremadura's Church personnel resided in Lisbon. Although the highest percentage is

19 Portugal, *Lisboa em 1758*, 307, 310; França, *Lisboa Pombalina*, 67; Sousa Oliveira, "Descrição do Terramoto de 1755," 56, 60; Leonor Ferrão, "Desenvolvimento urbanístico: Os palácios e os conventos," in Irisalva Moita (ed.), *O Livro de Lisboa* (Lisbon, 1994), 239–282.

20 Nicholas Atkin and Frank Tallett, *Priests, Prelates & People: A History of European Catholicism since 1750* (New York, 2003); David Higgs, "The Portuguese Church," in William J. Callahan and idem (eds.), *Church and Society in Catholic Europe of the Eighteenth Century* (New York, 1979), 51–65.

highly unlikely, it provides an effective top range nonetheless. Yet, the numbers of Church personnel must have been unusually large. Foreigners visiting the city often remarked about the size and growth of the Catholic Church in Lisbon, and the Portuguese Crown even tried to limit the swelling number of Church personnel in Lisbon by denying their requests for more religious houses throughout the seventeenth and eighteenth centuries.²¹

Results Table 1 shows the death rates of the Catholic Church in Lisbon for various sets of assumptions. If 38 percent of the Catholic Church's personnel resided in Lisbon at the time of the earthquake, the death rate for the two Church population estimates are .016667 and .007660, respectively. Assuming the more probable distribution, according to which only half of the Catholic Church's personnel in Estremadura resided in Lisbon, the death rates for the two Church population estimates are .033333 and .015319, respectively. Using these death rates and the two population estimates of the city, the table presents the estimated number of people who died in Lisbon. If half, or 19 percent, of the religious personnel in Estremadura were inside Lisbon's city walls, deaths for the low population figure numbered 2,298 and 5,000. For the high population figure, the corresponding numbers are 3,983 and 8,867. Assuming that all religious personnel in Estremadura were inside the city walls, the corresponding numbers of dead people are 1,149 to 2,500 when the population size of the city is 150,000, and 1,992 to 4,334 when it is 260,000.

It is reassuring to find that the results of this study conform in almost all respects with Sousa's earlier findings. Although her lower estimations of 450 and 780 are artifacts of her methodology without historical validity, her upper numbers are close to the findings of this study given the assumption that 19 percent of the Portuguese Catholic Church personnel resided in Lisbon. Her estimate of 4,950 fatalities falls inside the range of 2,298 to 5,000 dead found in this study for a population of 150,000, and her estimate of 8,580 fatalities falls within the range of 3,983 to 8,667 deaths for a population of 260,000. The combined findings of both studies indicate that falling debris during the Lisbon earthquake probably killed between 5,000 and 8,700 people in Lisbon.

21 Shradly, *Last Day*, 9; Braga et al., *Lisboa Setecentista Vista por Estrangeiros* (Lisbon, 1992), 38–82; Fernando Castelo Branco, *Lisboa Seiscentista* (Lisbon, 1990), 67–69.

Table 1 Number of Dead from Earthquake, as Calculated by Death Rate, Proportion of Catholic Church Personnel in Lisbon, and the Size of Lisbon's Population

| PERSONNEL IN PORTUGAL'S CHURCH (UPPER AND LOWER ESTIMATES) | | | |
|---|--------|--------|--------|
| 42,000 | | 91,389 | |
| PROPORTION OF PERSONNEL IN LISBON (UPPER AND LOWER ESTIMATES) | | | |
| 19% | 38% | 19% | 38% |
| DEATH RATE (BASED ON 266 DEATHS) | | | |
| .03333 | .01667 | .01532 | .00766 |
| TOTAL DEATHS IN LISBON BASED ON POPULATION OF 150,000 | | | |
| 5,000 | 2,500 | 2,298 | 1,149 |
| TOTAL DEATHS IN LISBON BASED ON POPULATION OF 260,000 | | | |
| 8,667 | 4,334 | 3,983 | 1,992 |

NOTES AND SOURCES The upper and lower estimates of Portugal's Church personnel derive, respectively, from Nicholas Atkin and Frank Tallett, *Priests, Prelates & People: A History of European Catholicism since 1750* (New York, 2003); David Higgs, "The Portuguese Church," in William J. Callahan and *idem* (eds.), *Church and Society in Catholic Europe of the Eighteenth Century* (New York, 1979), 51–65. The upper and lower estimates of the total population in Lisbon derive from Maria Luísa Sousa, *Risco Sísmico em Portugal Continental* (Lisbon, 2008). The number of Church officials who died in the earthquake, 266, used to calculate the death rate, derives from Fernando Portugal, *Lisboa em 1758: memórias paroquiais de Lisboa* (Lisbon, 1974), 307, 310.

For a complete picture of the devastation, we can add to these deaths the victims of subsequent fires, tsunamis, and civil unrest, whom neither Sousa's work nor this study included in its estimates. Personnel of the Catholic Church (the only group about which demographic analysis about the earthquake can be done at this point) probably comprised one of the most decimated sub-populations in Lisbon during the earthquake. Other groups also at high risk but without documentation were dock workers and other laborers in the port area of the River Tagus, as well as children and the elderly, who usually suffer severely in earthquakes, and the poor. Due to the lack of reliable information, we cannot even speculate about their plight.

Antunes recently discovered that young people predominated among the mortal remains of victims found in the graves at the Convento de Jesus in Lisbon. The injuries, deep cuts, and burns

evident in their bones reveal the difficulty of separating the effects of the falling debris from the ensuing tumult that engulfed the city and its environs in those fateful days. By way of contrast, few members of the nobility and the more well-to-do families died in the earthquake; these people generally left the city on Sundays and attended religious services in the chapels of their mansions.²²

Although no data are available to substantiate the number of people who died as a result of the fires, tsunamis, and civil unrest that accompanied the earthquake, roughly the same number of people might well have died due to these causes as from falling debris, bringing the total fatalities to a range of 10,000 to 17,400, close to Pereira de Sousa's estimate of 15,000 to 20,000.

Whether or not the Marquês de Pombal underreported the effects of the tragedy depends on whether the deaths caused by catastrophes after the quake are included in the estimate. Our findings support his initial claims only if they count deaths from falling debris. However, Pombal's early estimates might not have been high enough because the full scale of the disaster was not yet evident. Hopefully, future historical research will shed light on these matters.

Much more attention needs to be placed on the problem of faulty disaster statistics to facilitate initiatives for mitigation and resilience in the aftermath of disasters. The creation of a worldwide network of national centers for disaster statistics would help to ameliorate, if not solve, this problem. Indeed, as far back as 1966, a committee of the Division of Medical Sciences of the National Academy of the Sciences (NAS) recommended the development of a national center in the United States to "document and analyze types and numbers of casualties in disasters, to identify by on-site medical observation the problems encountered in caring for disaster victims, and to serve as a national educational and advisory body . . . to meet the needs imposed by disaster or national emergency."²³

Certainly historians should become more interested in the

22 Miguel Telles Antunes, "Victims of the Great 1755 Earthquake at the Convento de Jesus," *E-Terra*, III (2006), available at <http://e-terra.geopor.pt>; Shradý, *Last Day*, 52.

23 Committee on Trauma and Committee on Shock, Division of Medical Sciences, National Research Council, *Accidental Death and Disability, The Neglected Disease of Modern Society* (Washington, D.C., 1966), 29. See also the more recent effort to create a national center in Quarantelli, *Possibilities and Problems in Developing a Global Disaster Information Network (GDIN)* (Newark, 1998).

study of disasters and the lessons that can be learned from them. For example, a little attention to history could have helped to anticipate, and even obviate, the problems created by the recent militarization of emergency management in the United States (as reflected in the downgrading of FEMA and the ascendance of the Department of Homeland Security [DHS] after the terrorist attacks of 9/11). After all, emergency management replaced the military intervention that had been in vogue during the Cold War for good reason. During the decades after the war, the military proved incapable of handling the demands that disasters generated, such as early warning, evacuation, sheltering, reconstruction, and recovery. Nor could it foster the necessary change in culture to mitigate the risks associated with disasters and increase the resilience of social institutions in their wake.²⁴

While we await a new era of disaster preparation and response, we should learn to take with a grain of salt the reports of news organizations, the popular press, and even scientific publications that either do not have the technical proficiency to make claims or the fact-checking capacity to confirm them. As the experience of the Lisbon earthquake of 1755 attests, the effects of disasters are frequently inflated to mythic proportions.

24 For an example of recent historical research about disaster, see Gerrit Jasper Schenk and Jens Ivo Engels (eds.), "Historical Disaster Research: Concepts, Methods and Case Studies," introduction to a special issue of *Historical Social Research*, XXXII (2007), 9–31; Monica Juneja and Franz Mauelshagen (eds.), *Coping with Natural Disasters in Pre-Modern Societies* (New Delhi, 2007).