# CHAPTER 4

# "Readmitted Under Urgent Circumstance": Uniting Archives and Bioarchaeology at the Royal London Hospital

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## 4.1 INTRODUCTION

Contemporary documentary evidence is of immense value in historical bioarchaeological studies. There are, however, limitations and challenges inherent in the use of past records that must be addressed. The Royal London Hospital, a voluntary hospital founded in 1740 in London, United Kingdom, provides an engaging case study in which multiple lines of evidence are examined to investigate the frequency of fractures during the mid-18th to early 19th centuries (c.1760–1805). Both the skeletal remains of individuals who were admitted to, and subsequently died in, the hospital, and a limited set of hospital admission records are extant. This study addresses the key query: what body areas did the working poor, admitted to the Royal London Hospital, fracture most frequently? Hospital admission records provide one dataset, while the bones of individuals excavated from 18th-century and early 19th-century burial grounds provide another.

This paper explores how the archival and human skeletal remain datasets, in spite of their biases and limitations, intersect to provide a complex view of fractures and medical intervention in 18th- and early 19th-century London (Fig. 4.1).

## 4.2 THE ROYAL LONDON HOSPITAL

The 18th century has been referred to as the Age of Hospitals in reference to the expansion of medical care during this period (Dainton, 1961). Enlightenment ideals encouraged charitable giving

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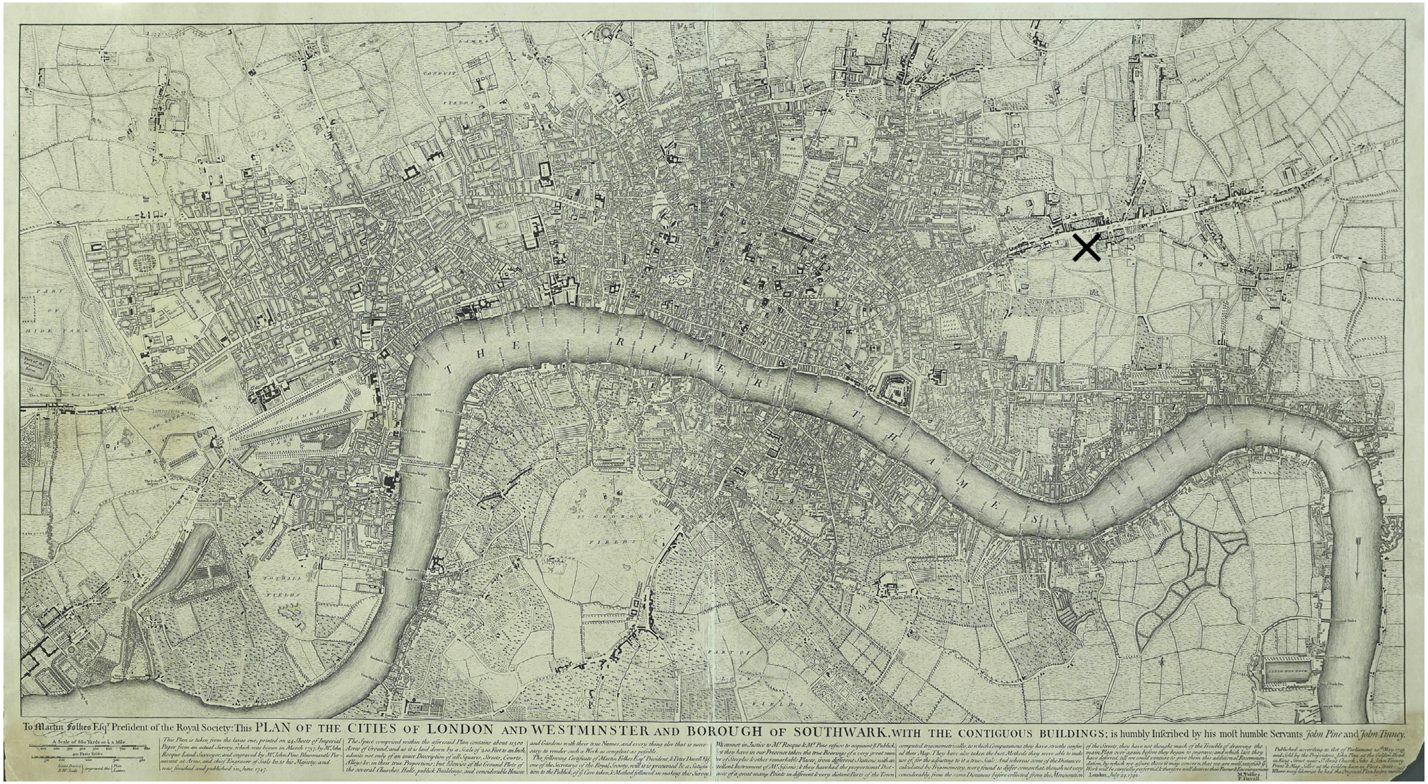


*Figure 4.1 Map of London, 1746 by John Rocque. The Royal London Hospital site is marked with an X.* Source: Image © Museum of London.

and London became a focus of charity since it was a place where "the middle and professional classes were particularly in evidence, where funds were most easily gathered, and where social problems were most visible" (Levene, 2006, p. xiii; Langford, 1989). The Royal London Hospital, founded in 1740, located on Whitechapel Road, was one of four voluntary hospitals operating in London during the 18th century, institutions dependent upon donations, subscriptions, and fund-raising events to provide charitable care for London's poor. The hospital received its royal designation in 1990 at its 250th anniversary. The voluntary hospitals were founded upon "a wave of philanthropy by those who wished not merely to alleviate distress but to restore the afflicted to respectable and independent citizenhood" (Rivett, 1986, p. 25). These hospitals were designed to care for the working poor, a group that depended upon wage labor and could not afford to pay for their medical treatment (Dyson, 2014). The Royal London Hospital, in particular, was likely to admit a large number of accident cases due to its location, "which is placed in the centre of one of the densest and poorest districts, and in close proximity to the Docks" (Bristowe and Holmes, qtd. in Woodward, 1974, p. 130).

Generally patients were admitted once each week; however, accident cases were admitted at any time (Clark-Kennedy, 1962). Prospective patients were required to obtain a letter of recommendation by a hospital governor, an individual who had given a charitable donation to the hospital and was thereby given the right to recommend a certain number of individuals for hospital admission (Howard, 1791; Lawrence, 1996). If an individual died in hospital and friends or family did not retrieve their body, they would be buried at the hospital's expense.

### 4.2.1 Dataset Challenges: Age Estimation

The ages recorded or estimated in the two datasets, the skeletal remains and archival records, have different implications. In skeletal studies the estimated age is the individual's age at death, whereas the hospital records provide information on the chronological age of an individual when they arrived at the hospital with a fracture. Age-specific rates for nonfatal antemortem fractures are impossible to calculate (Waldron, 1991) since it is unclear at what age a fracture was incurred. Fractures observed in a skeleton reflect the cumulative number of fractures acquired over the individual's lifetime.

Age estimation limitations are a chronic plague upon bioarchaeological studies. The ability to correlate osteological and clinical data is hindered by this challenge (Glencross, 2011; Glencross and Sawchuk, 2003) and much attention has been paid to exploring the limitations in determining age distributions from skeletal samples (eg, Hoppa and Vaupel, 2002). The broad age categories used in skeletal studies are necessary since aging adult individuals involves the imprecise categorization of macroscopic degenerative changes present in the skeleton. Chronological age in the hospital records is more easily accessible. If a patient's age was not recorded, the categories were even broader than those of skeletal estimations: an individual could only be labeled as a juvenile, an adult, or unknown. When the age of the patient was listed; however, the hospital admissions dataset offers exactitude that a skeletal dataset cannot approach.

### 4.2.2 Dataset Challenges: Human Error and Representation in Documentary Sources

The largest limitation in consulting archival records, as referenced above, is that the data collected are limited to which records have survived and are available for study. As Chodorow wryly observed, "the cultural record will be just what got saved because someone put it in a safe place" (2006, p. 373). Further, the hospital admissions do not record which side a fractured element came from or the location of the fracture on the bone. This fact complicates the possible comparisons to be made with the skeletal data. For example, a "fractured humerus" found in the archival records could be an antemortem fracture inferior of the surgical neck of the left humerus or a crush fracture of the right olecranon fossa, but that level of detail is simply unattainable in the admissions records. This lack of detail in the hospital admission records necessitates the use of broad anatomical groupings when seeking to investigate meaningful comparisons with the skeletal data.

Fowler and Powers (2012a), in their elegant study of the excavation of the Royal London Burial Ground by Museum of London Archaeology, note that no admission registers exist for the temporal period matching the dates of the burials; this limitation complicates any attempt to compare the records and remains from a single site. The authors employ the 1841 census to provide a "snapshot" of patients that were in the London Hospital on Jun. 6, 1841. In the present case, the extant hospital admission registers are utilized as part of an exercise to illustrate the potential rewards and inherent limitations of drawing upon multiple lines of evidence to approach a historical research question.

Humans make mistakes. Risse (1986) details how the expansion and consequent increased registration at the Royal Infirmary of Edinburgh caused the hospital clerks to become overwhelmed. Certain admission papers went missing or information was not transferred due to the clerks having "too much business" (Royal Infirmary of Edinburgh, Minute Books, Vol. 4, 1770, p. 227). Grauer characterizes human record keeping as "overwhelmingly erratic" (1995, p. ix). Allowing adequate time to untangle the threads of historical documentation is key to catching possible errors. Mitchell (2012) emphasizes the importance of studying primary documents to understand "who wrote them, why they were written, for whom they were written, and exactly when they were written" (p. 316). Thankfully, the motivation of hospital record keepers is clear and the documents consulted in this research were dated. Reasonable expectations for how accurately historical documentation reflects historical reality are necessary. Various authors have characterized the historian or user of the archives as a detective (eg, Ginzburg, 1989; Winks, 1969), emphasizing that the "probative value of evidence in a particular setting" (Turkel, 2006, p. 260) requires careful reflection.

There are limitations to both historical and contemporary clinical reports concerning fracture frequencies; primarily, individuals admitted to hospital are self-selecting (eg, Court-Brown and Caesar, 2006; Koval and Cooley, 2006; Lane, 2001). There have been valiant attempts to quantify the commonness of different fractures through analyses of modern hospital data from the United Kingdom (eg, Buhr and Cooke, 1959; Court-Brown and Caesar, 2006; Singer et al., 1998), but ultimately the data depend upon individuals choosing to seek medical attention. In addition, data are derived from particular hospitals, ensuring that the results are geographically specific (eg, Donaldson et al., 1990; Johansen et al., 1997; Sahlin, 1990; van Staa et al., 2001). The same was true in London during the 18th and early 19th centuries. Admission was complicated by a variety of unfamiliar factors to a modern observer, such as official admissions being allowed only once a week in certain institutions, and the necessity of campaigning for a hospital governor's permission for admittance (Carruthers and Carruthers, 2005; Dainton, 1961; Lane, 2001; Lawrence, 1996).

### 4.2.3 Diagnostic Labels: A Paean for Fractures as a Connection to the Past

Ensuring that terms are clearly defined aids in the comparative use of skeletal and documentary data (eg, Howell, 1986; Petersen, 1975). Risse (1986) refers to physicians' diagnoses as diagnostic labels, or reasons for admission/death as medical practitioners understood them at the time. Rosenberg and Golden (1992) and Cunningham (2002) among others (eg, Arrizabalaga, 2002; Hays, 2007; Metcalfe, 2007; Mitchell, 2011) discuss the complex nature of studying disease in the past; one must consider the modern biological diagnosis and the social diagnosis used by individuals in the past. Information gleaned from surgeons' casebooks and the catalogues of contemporary anatomical collections suggests that surgeons had an understanding of fracture causes and treatments that is comparable to modern understandings. Eighteenth-century physicians conceived of disease diagnoses as a form of taxonomy including classes, orders, genera, and species, following the example of botanists (King, 1958). Fractures, according to William Cullen (1792), were defined as "bones broken into large fragments" (p. 80). This definition is similar to both current clinical and palaeopathological definitions of fracture, suggesting that fractures are reasons for hospital admission that transcend time more easily than, for example, diagnoses of "foul" diseases that may encompass many venereal complaints or conditions that are unfamiliar to modern eyes, such as St Vitus's Dance.

Medical students during the 18th century were certainly exposed to education concerning fractures. A surgical student at St Thomas' Hospital recorded in his notebook, covering the years 1725 and 1726, detailed descriptions of the causes and treatments of cranial, femoral, tibial, and fibular fractures (King's College London, 1725–1726, GB 0100 TH/PP44). An indirect source of evidence suggesting that physicians and surgeons at the voluntary hospitals would be well-versed in the appearance of fractures are the pathological collections at institutions such as St Bartholomew's and Westminster hospitals and the Royal College of Surgeons. The Westminster Hospital pathology collection, which was started in the 18th century, was 39% comprised of fracture specimens by the 19th century (19/49 total specimens) (Mitchell and Chauhan, 2012, p. 143). Mitchell and Chauhan (2012) posit that the proportion of specimens representing fractures may be so high because surgeons thought they were particularly important, or perhaps fractures were among the most common conditions affecting bone at the time. Another possibility is that fractures were relatively simple to observe and identify in living patients (Mitchell and Chauhan, 2012) and that surgeons were curious to observe fractures at various stages of healing. Almost exactly half of the Royal College of Surgeons anatomy and pathology collection (pre-1886) were fracture specimens (1016/2036 = 49.9%). The St Bartholomew's Anatomical Museum descriptive catalogue (Paget, 1846) includes over 200 descriptions of fracture specimens, ranging from relatively minor metacarpal fractures to devastating long bone and skull fractures. Many specimens are healed antemortem fractures, and include patient histories, such as a male individual who suffered a midshaft humeral fracture four years before death. He was "so little impaired by the fracture that [he] worked as a sailor to the time of his death" (1846, p. 116). These sources of evidence suggest that fractures were a relatively common sight in medical education and that a diagnosis of "fracture" or "broken" accurately refers to a broken bone.

## 4.3 MATERIALS AND METHODS: RECORDS AND REMAINS

### 4.3.1 Hospital Admission Records

Hospital admission books have survived from 1760, 1791, 1792, and the latter half of 1805 and are curated by the Royal London Hospital Museum. The records note the name, date of admittance, place of abode, occupation, age, reason for admission, and result of hospital stay for each individual. Sex of the admitted individuals was determined through examination of their given names. Additional clues to an individual's sex were provided under the occupation column, since many women were recorded as being a "Sailors Wife," "Labourers Wife," or a "Washerwoman." Individuals for whom sex could not be confidently assigned were removed from the final study sample. The records for 1760, 1791, and 1792 list the age of the admitted individual. Whipple's index (Siegel and Swanson, 2004) was calculated for this sample and found to be 167.9 for the male sample and 167.3 for the females. Whipple's index is a summary index calculated by taking the sum of the number of individuals reporting their age as 25, 30, 35, 40, 45, 50, 55, and 60, multiplying this total by 5, dividing the result by the number of individuals in the age categories 23–62 inclusive and multiplying the result by 100. An index below 105 indicates that the dataset is highly accurate, between 105–110 the data are relatively accurate, 110–125 the data are approximate, 125–175 the data are poor, and 175+ the data are very poor (United Nations, 1955; Newell, 1988). Individuals in the past often did not know their exact age and estimated when asked, meaning that ages ending with zero or five were more likely to be stated and recorded. The Whipple results indicate that there is a substantial inaccuracy in the reporting of ages.

This research was conducted exclusively on adult individuals; an adult was defined as an individual aged 18 years or older. Adults were chosen as the focus in order to make meaningful comparisons between the skeletal findings and contemporary archival evidence of hospital admissions. Though children do appear in the archival hospital records, it is overwhelmingly adult individuals who received treatment at London's voluntary hospitals. Skeletal sex estimation techniques do not allow for confident sex estimations to be made for individuals under about 18 years of age. Further, adults would have been responsible for securing their own admission (Risse, 1986; Wilde, 1810) or that of their family members.

A total of 3703 individuals formed the study sample from the London hospital admission registers: 2285 males and 1418 females. Age was recorded for 3160 of these individuals, 1910 males and 1250 females. The ages of the admitted individuals are displayed in Table 4.1 and Fig. 4.2 by decade; the majority of records fall in the 18- to 30-year-old category (38.0% of males and 48.5% of females) with the number of admissions decreasing in the upper age categories. Fisher's Exact Test was performed to compare the number of male and female admissions by age category; there is a statistically significant ($p < 0.0001$) larger proportion of females in the 18–30 age group and males in the 31–40 age group.

**Table 4.1 Age Distribution of Individuals in Hospital Admission Records by Sex**

| Age Category | Males | Females |
|---|---|---|
| 18–30 | 726 (38.0) | 606 (48.5) |
| 31–40 | 519 (27.2) | 230 (18.4) |
| 41–50 | 345 (18.1) | 241 (19.3) |
| 51–60 | 215 (11.3) | 119 (9.5) |
| 61–70 | 85 (4.5) | 40 (3.2) |
| 71–80 | 14 (0.7) | 13 (1.0) |
| 81–90 | 6 (0.3) | 1 (0.1) |
| Total | 1910 | 1250 |

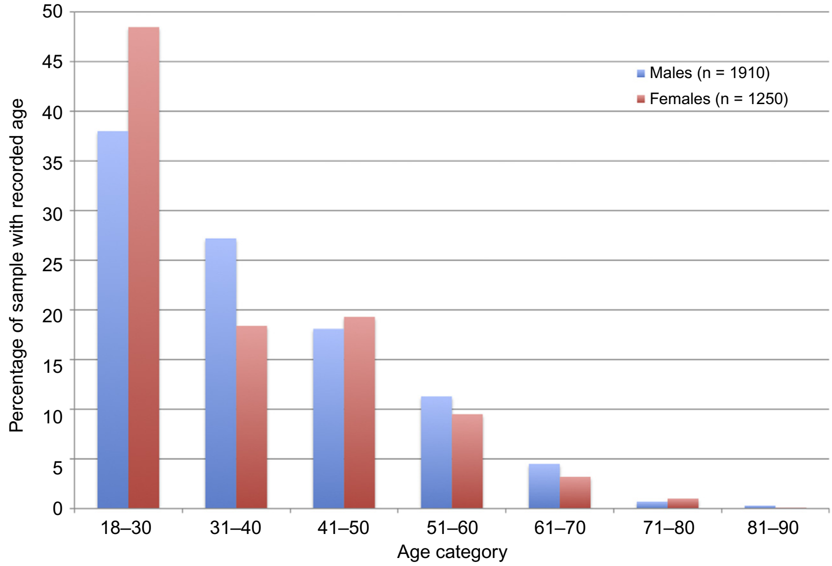


*Figure 4.2 Age distribution of adult individuals in hospital admission records.*

When assessing the reasons for admission, entries that stated an individual had a "fracture" or a "broken" body element were counted as fractures, while elements that were recorded as "bruised," "hurt," or "injured" were disregarded. It is possible that an individual may have been admitted to hospital with an injury that appeared as a bruise or laceration but was actually a fracture; therefore, the fracture frequencies reported may underestimate the number of fractures treated in the voluntary hospitals.

To assess the quality of the archival dataset, Michael Drake's (1982, p. vii) algorithm concerning English parish records was adopted. Drake (1982) examines the quality and reliability of vital record datasets (eg, birth, death, and marriage certificates) to aid the researcher in deciding which records to consult. The present research sample fulfills Drake's (1982) criteria for acceptable data quality: the admission records contain more than 100 entries per year, there is no obvious evidence of underregistration in the records, and the gaps present in the records are not a deterrent since the case study aims to explore the potential limitations of engaging with multiple datasets rather than investigating temporal trends in hospital fracture registration.

### 4.3.2 Human Skeletal Remains

Individuals from the Royal London Hospital burial ground are curated at the Museum of London Centre for Human Bioarchaeology under the site code RLP05. The 2006 excavation by Museum of London Archaeology uncovered burials dating from between 1825 and 1841. In addition to individuals in standard wooden coffins, burials comprising skeletal elements from multiple individuals were also discovered, many of which showed evidence of autopsy or anatomization. Graves generally contained between one and five stacked burials, though there were outliers with as many as eight (Fowler and Powers, 2012b).

Individuals were selected for this study if at least 30% of the skeleton was present. The Wellcome Osteological Research Database (WORD) maintained by the Museum of London was consulted to determine how many adult individuals of greater than 30% skeletal completeness were present. The aim was to exclude as few individuals as possible while minimizing the number of individuals for whom it would be impossible to assess sex and estimate age due to poor overall completeness. A total of 110 individuals, 80 males and 30 females, formed the final study sample.

Individuals were assessed for sex by examining the skeletal remains macroscopically following the example set by Buikstra and Ubelaker (1994). Individuals were assigned to one of five categories: male, probable male, undetermined, probable female, and female. Individuals in the probable categories were combined with the male and female categories and the adults of indeterminate sex were removed from the final study sample. Age was estimated by examining four features of specific areas of the skeleton: the pubic symphysis (Brooks and Suchey, 1990), the auricular surface of the ilium (Lovejoy et al., 1985), the sternal end of ribs (Işçan and Loth, 1986a,b), and tooth wear (Brothwell, 1981). Individuals were assigned to one of five age categories, based upon those outlined by Powers (2012): young adult (18–25 years old); middle adult 1 (26–35 years old); middle adult 2 (36–45 years old); old adult (46+ years old); and adult (18+ years old). These categories were employed to allow for interobserver comparisons to be made between age estimations and those recorded in the WORD by Museum of London Archaeology observers. The age distribution of the skeletal sample is displayed in Table 4.2 and Fig. 4.3. The largest proportions of the sample were assigned to the two middle adult age

**Table 4.2 Number of Individuals in Skeletal Sample Organized by Age Category and Sex**

| Age Category (Years Old) | Males | Females |
|---|---|---|
| 18–25 | 8 (10.0) | 5 (16.7) |
| 26–35 | 23 (28.8) | 10 (33.3) |
| 36–45 | 27 (33.8) | 9 (30.0) |
| 46 + | 9 (11.3) | 3 (10.0) |
| Adult | 13 (16.3) | 3 (10.0) |
| Total | 80 | 30 |

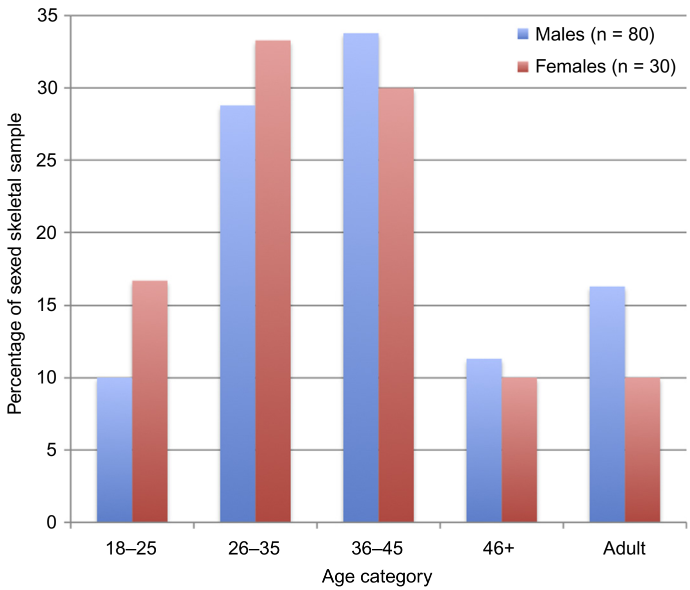


*Figure 4.3 Age distribution of adult individuals in skeletal sample.*

categories in both the males (28.8% and 33.8%) and females (33.3% and 30.0%). There were no statistically significant differences found between the male and female groups for any age category.

Fractures were observed macroscopically and with the aid of a Keyence VHX-2000 digital microscope. The location (by bone segment), stage of healing, and, where possible, the angle of injury were recorded. It was not possible to X-ray the remains; therefore, assertion of the angle of injury was only made when the fracture line was clearly observable macroscopically or there were radiographs available from previous studies. All observed fractures were recorded and the total number of elements present was noted. For the purposes of this case study involving affected elements, the antemortem and perimortem fracture results were combined.

## 4.4 RESULTS

The overall crude prevalence of individuals with one or more fractures is displayed in Table 4.3 by sex. A chi-square test was performed, revealing no significant difference between the datasets (chi-square statistic 2.9117, $p$-value: 0.087941, $p < 0.05$). Males make up a higher proportion of the individuals with fractures in both the hospital admission records and the skeletal sample, differences which were significant in both the records at $p < 0.05$ (chi-square statistic: 32.9061, $p$-value: 0) and the skeletal datasets (chi-square statistic: 8.5482, $p$-value: 0).

The bones were divided into anatomical groups in order to compare the two datasets, as outlined in Table 4.4.

Figs. 4.4 and 4.5 display the fracture data as proportions of the total number of fractures observed in the skeletal sample or admitted to hospital. A z-test for two proportions was performed upon these data. The proportion of skull, torso, hand, and foot fractures is significantly higher ($p < 0.05$) in the skeletal dataset for the males, while the admission records have a significant higher proportion

**Table 4.3 Number of Individuals With Fractures by Sex and Dataset**

| Dataset | Male n (%) | Female n (%) | Total |
|---|---|---|---|
| Records | 275 (74.1) | 96 (25.9) | 371 |
| Skeletons | 49 (84.5) | 9 (15.5) | 58 |

**Table 4.4 Anatomical Groups for Dataset Comparison**

| Anatomical Group | Skeletal Elements |
|---|---|
| Skull | Cranium, facial skeleton, mandible |
| Torso | Sternum, ribs, vertebrae, sacrum, os coxae |
| Arm | Scapula, clavicle, humerus, radius, ulna |
| Hand | Carpals, metacarpals, manual phalanges |
| Leg | Femur, tibia, fibula, patella |
| Foot | Tarsals, metatarsals, pedal phalanges |

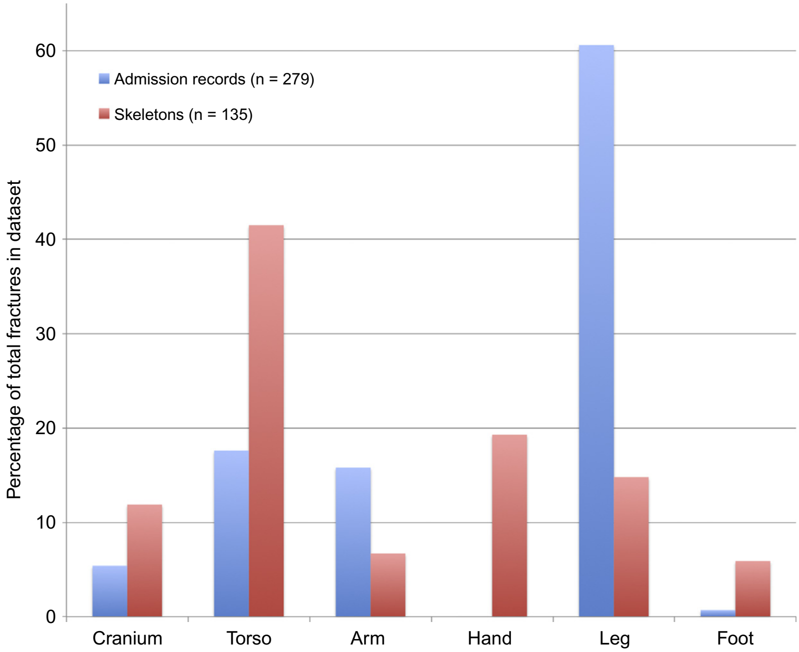


*Figure 4.4 Male fracture distribution by anatomical group in skeletal and admission record datasets.*

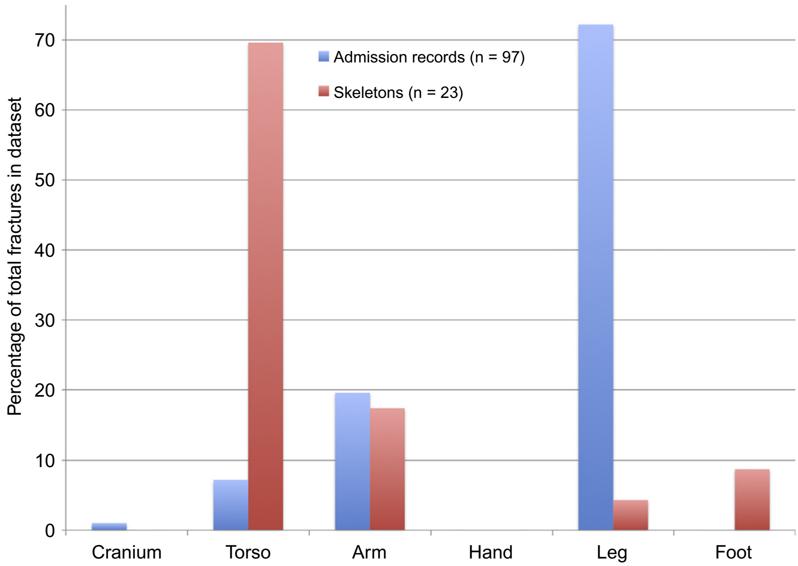


*Figure 4.5 Female fracture distribution by anatomical group in skeletal and admission record datasets.*

of arm and leg fractures recorded.[1] The female group showed a significantly higher proportion of torso fractures in the skeletal sample, and a significantly higher proportion of leg fractures in the admission records.[2]

The frequency of the fractured elements, grouped into anatomical areas, was compared between the two datasets for each sex and the results are displayed in Tables 4.5 and 4.6. Spearman's rank-order correlation was calculated for the data in Tables 4.5 and 4.6. The $r_s$ value for Table 4.5 was 0.0429, indicating a weak positive correlation between the male and female datasets. The $r_s$ value for Table 4.6 was 0.9286, indicating a strong positive correlation between the male and

**Table 4.5 Rank Orders of Fractures by Sex and Anatomical Group in the Skeletal Dataset**

| Anatomical Group | Males | | Females | |
|---|---|---|---|---|
| | #Fractured Elements | Rank | # Fractured Elements | Rank |
| Skull | 16 | 4 | 0 | 5 |
| Torso | 56 | 1 | 16 | 1 |
| Arm | 9 | 5 | 4 | 2 |
| Hand | 26 | 2 | 0 | 5 |
| Leg | 20 | 3 | 1 | 4 |
| Foot | 8 | 6 | 2 | 3 |
| Total | 135 | | 23 | |

**Table 4.6 Rank Order of Fractures by Sex and Anatomical Element in the Admission Records**

| Anatomical Group | Males | | Females | |
|---|---|---|---|---|
| | #Fractured Elements | Rank | # Fractured Elements | Rank |
| Skull | 15 | 4 | 1 | 4 |
| Torso | 49 | 2 | 7 | 3 |
| Arm | 44 | 3 | 19 | 2 |
| Hand | 0 | 6 | 0 | 5 |
| Leg | 169 | 1 | 70 | 1 |
| Foot | 2 | 5 | 0 | 5 |
| Total | 279 | | 97 | |

[1]Male significant z-scores: Skull (z-score: −2.3466, *p*-value: 0.01878), Torso (z-score: −5.2437, *p*-value: 0), Arm (z-score: 2.599, *p*-value: 0.00932), Hand (z-score: −7.5719, *p*-value: 0), Leg (z-score: 8.7623, *p*-value: 0), Foot (z-score: −3.2362, *p*-value: 0.0012).
[2]Female z-scores: Torso (z-score: −6.83, *p*-value: 0), Leg (z-score: 5.9491, *p*-value: 0).

female datasets. These results suggest that the relationship between the reasons for which males and females were seeking admission to the hospital is stronger than the relationship between the types of fractures observed in the skeletal datasets.

The ages of individuals admitted to the Royal London Hospital with the three most frequently fractured categories (leg, arm, and torso/ribs) from 1760, 1791, and 1792 are displayed graphically in Figs. 4.6 and 4.7 divided by age category. In the male sample, leg

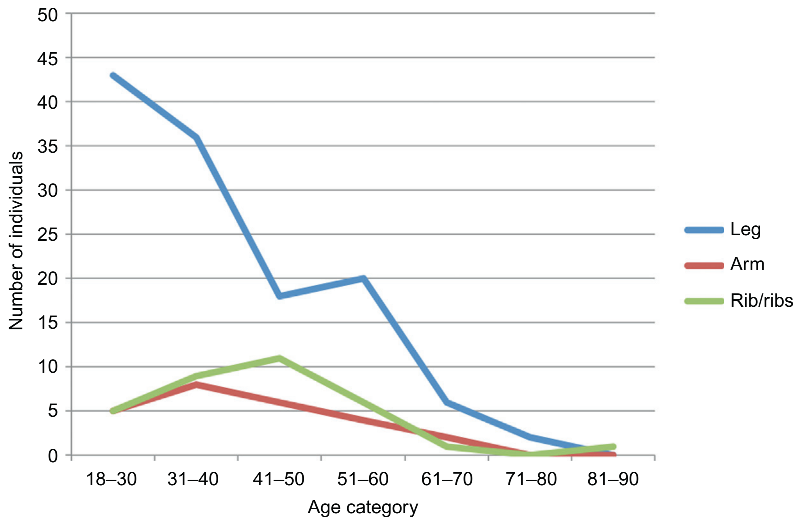


*Figure 4.6 Most frequently fractured anatomical groups in male admission record sample over time.*

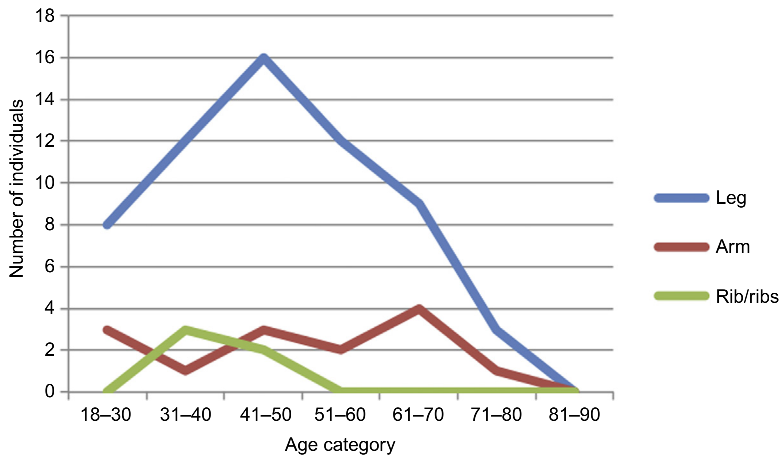


*Figure 4.7 Most frequently fractured anatomical groups in female admission record sample over time.*

fractures (including admissions for leg, thigh/femur, and knee/patella fractures) are the most frequent in the 18–30 age category; the admissions drop from age 31 to 50 and increase slightly in the 51–60 age group before dropping with increasing age. In contrast, the female leg fracture admissions steadily increase from age 18 to 50 before dropping off in frequency with increasing age.

## 4.5 DISCUSSION

It is evident that fractures to elements of the leg are common in both sexes in the admissions record, but are underrepresented in the skeletal sample. Simple sampling bias may be the culprit; the small skeletal sample may not be representative of the individuals profiled in the admission records. The ultimate fate of individuals suffering leg fractures also has an impact on these results. Individuals who successfully convalesced and were discharged from hospital, or those who died and were claimed by family or friends would not be buried at the Royal London Hospital. In addition, individuals who died in hospital during the period under investigation may have been subjected to autopsy and anatomization (Chamberlain, 2012; Chaplin, 2012; Mitchell et al., 2011). Mitchell and Chauhan (2012) posit that conditions such as severe fractures would have been relatively simple to identify in living patients; surgeons, therefore may have chosen in advance of an individual's death to include a particular anatomical specimen in the collection. There is ample evidence for anatomization at the London Hospital (Fowler and Powers, 2012b) such as "non-survivable interventions" (p. 90), including perimortem craniotomies.

The common nature of rib fractures is clear from both the skeletal and archival data. Ribs are the most frequently fractured element for both males and females in the skeletal sample; in the admissions sample ribs are the fourth most frequently fractured element for males and the fifth for the female sample. Roberts and Cox (2003) compiled data on 32,865 individuals from 201 different archaeological sites covering the Roman to the post-medieval period. In each time period (Roman, early medieval, late medieval, post-medieval), rib fractures were the most frequently fractured element. As many bioarchaeological studies have noted (eg, Brickley, 2006; Jurmain, 1999; Warden et al., 2002), underreporting of rib fractures is an issue in modern epidemiological studies, though rib fractures are the most common clinically reported injury to the thorax (Kramaker and Anthony, 2003; Tekinbas et al., 2003) and clinical studies have revealed that even a single rib fracture can cause enough pain to lower an individual's quality of life and affect their ability to work (Kara et al., 2003). The datasets each have strengths: the skeletal data provides more detail on the location and side of the fracture, which may provide clues as to the etiology of the injury, while the archival data provide a tighter age estimate for individuals suffering a rib fracture. Rib fractures are described in surgeons' notebooks from the mid-18th to early 19th centuries as a common injury. Benjamin Brodie, surgeon at St. George's Hospital, noted that "the yielding motion of the ribs prevents their being fractured so often as they would else be, but from their being so much exposed to injury, the fracture is nevertheless very frequent" (1805–1807, no page number). Patients admitted to hospital with rib fractures would be treated with "a bandage, passed several times round the thorax, so as to compress the ribs, and prevent their motion in respiration" (Brodie, 1805–1807, no page number). This simple remedy could be effected in the home, possibly explaining why the proportion of rib fractures in the skeletal sample was significantly higher than that in the admission results.

The fractures observed frequently in the skeletal sample, such as those to the metacarpals, nasals, and proximal phalanges are relatively minor injuries that would minimally impede an individual's ability to move and work. Contemporary surgeons referred to fractured fingers as trivial cases (Bristowe and Holmes, 1864). Lay first-aid was often adequate; Roy Porter asserts that "experienced and careful lay people could handle most accidents, even serious-sounding conditions such as fractures" (1997, p. 96). William Buchan, in his landmark publication *Domestic Medicine*, in reference to fractures, notes that

> *there is in most country villages some person who pretends to the art of reducing fractures. Though in general such persons are very ignorant, yet some of them are very successful; which evidently proves, that a small degree of learning, with a sufficient share of common sense and a mechanical head, will enable a man to be useful in this way*
>
> ***(1769, p. 722).***

Buchan does, however, caution that "we would however advise people never to trust such operators, when an expert and skillful surgeon can be had; but when that is impracticable, they must be employed" (1769, p. 722). In cases where a fracture was deemed minor, or the hospital admissions procedure was too laborious, or a governor's recommendation was unprocurable, or the fees charged by the local physician were too expensive, "every man is in some measure a surgeon whether he will or not" (Buchan, 1769, p. 695). It must be considered that "medicine was a business as well as a vocation" (Digby, 1994, p. 19) and the medical marketplace served individuals who could afford to pay for their care. The working poor often could not afford the services of a physician and therefore relied upon lay medical knowledge or the voluntary hospitals of London.

The patterns displayed in Figs. 4.6 and 4.7 suggest that male and female risk factors for leg fractures may be age-related. The lack of fracture location data limits the comparability of these data with many clinical and epidemiological studies. Clinically, the relationship between increasing age and increasing incidence of hip fractures has been documented (Poole et al., 2010) with females sustaining hip fractures at an average age of 77 and males at an average age of 72 (Baumgaertner and Higgins, 2002). Age-related bone loss and increased bone fragility may be possible complicating factors in the hospital admissions sample, but this supposition remains necessarily speculative. The relatively small sample group of individuals in the older adult age groups (61–90 years; males n = 105/1910; females n = 54/1250) may indicate that fewer older adult individuals were suffering fractures in the past, but it is more likely that older individuals may not have sought hospital care for fractures due to decreased mobility and senescence. Alternatively, age bias may have been present in the original admissions. Various contemporary sources note that individuals accepted into the general hospitals should be "deserving" or "worthy objects of charity" (Woodward, 1974, p. 40), since the hospitals were serving to "[recover] future wealth potentially lost to the nation" (Lawrence, 1996, p. 45). The potential of individuals in these older age groups to contribute meaningfully to the economy was likely viewed as limited.

The intangible notion of human choice is represented in the results of this case study. Minor injuries to the fingers and toes, as well as myriad rib fractures, outrank major femoral fractures in the skeletal remains; essentially the opposite result is found in the hospital admissions registers. These results reveal personal choices made in the past in reference to an individual's health; the results suggest that males and females were seeking hospital admission for similar reasons. In some cases individuals did not make their own choice to go to hospital, perhaps because they were injured in a public place, particularly in the case of accidents involving vehicles, and were rushed to a hospital by friends or bystanders. These victims were often unconscious or "found quite insensible," such as John West, admitted to St. George's, having been "thrown from off a stage coach and pitched upon his head" (Royal College of Surgeons, 1805–1851, MS0470 62, p. 31).

In most cases, however, individuals dealt with the situation described by Wilde (1810), the actor and poet, who, upon arriving at the Devon and Exeter hospital, found "himself amongst a crowd/Of wretched candidates to gain admission;/Each recommended by some kind subscriber" (p. 6). Wilde was nearly rejected due to his lack of governor or subscriber's recommendation, "alas! [he] had fail'd through lack of forms / And now, his long, and agonizing journey / Had all abortive prov'd" (1810, p. 6). Thankfully, Wilde managed to connect with "a friend—and one more true, / Or swifter to obey the call of pity, / Ne'er trod the earth...So should the name of PEAR, the parish clerk, / Descend to ages" (1810, p. 5); this individual secured Wilde the appropriate recommendation paperwork.

## 4.6 CONCLUSIONS

This research reveals distinct differences between the lives of working poor males and females who lived and died in London during the 18th and early 19th centuries. The skeletal results demonstrate that males suffered more fractures than females overall and in different areas of the body, suggesting that males and females were at differential risk for various types of fracture. Overall, leg fractures appear in abundance in the admission records, while rib fractures are the most numerous in the skeletal dataset. Evidence of decision-making regarding health care in the past is accessible through this research. The results demonstrate that males and females were seeking hospital admission for fractures to similar anatomical groups (ie, leg, arm, rib/ribs), despite the fact that fracture frequencies differ significantly between males and females in both the skeletal and admission records datasets and the age at which these fractures occurred differs between the sexes.

The decision to seek hospital admission depended upon a complex nexus of factors including: securing transport to the hospital's location, weighing the hospital's reputation for curing patients, acquiring a governor's guarantee, weighing of the effect of possible wages lost during convalescence, and determining whether or not an alternative practitioner could effectively treat the fracture at home. This bioarchaeological study lends credence to historians' examinations of attitudes concerning 18th-century hospital care (eg, Porter, 1997) and provides evidence to further studies of alternative medicine. Identifying which fractures were not commonly recorded in the hospital admission records provides a picture of which injuries were most commonly being treated in the home or with the assistance of other members of the medical marketplace. These disparate lines of data speak in concert to provide insight into the vibrant and vital world of 18th-century health care, its stakeholders, and their choices.

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