ANALYSIS OF PATTERNS OF INJURY AND DISEASE
BELLEVILLE, ONTARIO

ANALYSIS OF PATTERNS OF INJURY AND DISEASE IN AN HISTORIC SKELETAL SAMPLE FROM BELLEVILLE, ONTARIO

By

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ABSTRACT

ANALYSIS OF PATTERNS OF INJURY AND DISEASE IN AN HISTORIC SKELETAL SAMPLE FROM BELLEVILLE, ONTARIO

The presence of specific and non-specific infections in human skeletal remains, as well as indicators of trauma are valuable pieces of information that can be utilized to reconstruct the health status of a community. A sample of 250 adults, removed from an archaeological excavation of cemetery interments (1820-1874) associated with St. Thomas Anglican Church in Belleville, Ontario, were examined for indicators of trauma and infectious disease.

Traumatic injuries were common within the sample. Non-specific infections are also represented. Some cases exhibit specific infections, including tuberculosis and tertiary syphilis. Significant differences between males and females were found in healed fractures and traumatic injuries in general.

This data was compared to historical documentation from the period. Inferences about mortality rates and causes of death among groups of individuals or populations are frequently made on the basis of observations of pathological changes in human skeletal remains. The degree to which this is a reliable source of information was evaluated. The results of this study suggest that a <u>combination</u> of both skeletal observations and historical documentation is necessary to reconstruct the overall health status of a community, particularly with reference to infectious disease since many acute diseases of the nineteenth century are not observable in skeletal remains.

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Analysis of Patterns of Injury and Disease in an Historic Skeletal Sample from Belleville, Ontario

Table of Contents

Page No.

Page No.

Chapter 1
Introduction
I Purpose of the Study

An analysis of pathological changes in human skeletal remains offers the skeletal biologist a unique opportunity to identify some of the pressures on a specific population. Indicators of infectious disease can provide information about the overall health status of the community. The relationship between diet, sanitation and levels of disease immunity are among some of the pieces of the puzzle that can be utilized to reconstruct a profile of the community (Kelley 1989:194).

In addition to infection, the incidence of traumatic lesions in human skeletal remains may reflect external pressures on a population (Melbye 1975:2). These include trauma that is accidentally induced (i.e. fractures or deformations as the result of physical activities) as well as trauma from violent acts. Both traumatic injuries and infectious diseases may reflect the stressors that a population is subjected to during life. Goodman et al (1988:171) analyzed stress in skeletal samples representing prehistoric, historic and contemporary time periods. Stress was defined as "...the biobehavioral response to environmental conditions". The authors point out that

> If stressors are not buffered, there will be a need to respond on a biological level... The consequences of stress experienced by

> individuals depend on a number of factors such as genetic susceptibility, age, sex, and resiliency (Goodman et al 1988:177).

Infectious diseases and traumatic injuries are often chosen as the focus of analysis because they appear to best reflect the stressors that affect individuals within a community. In many cases, observations of infectious disease can provide latent information about both the nutritional and overall health status of the individual. Traumatic injuries reflect occupational and personal events within the environment.

Although historical studies and samples can test the conclusions of skeletal studies of prehistoric samples, historical documents are not foolproof. One problem in analyzing historic samples concerns the reliability of records (Owsley 1990:180). As Goodman et al note (1988:183), morbidity data for an historical sample may suffer from inadequacies in the quality and availability of records. This problem must be considered in the light of any analysis of historical documentation and this issue is addressed in Chapter Four.

The purpose of the present study is to identify skeletal manifestations of both trauma and infectious disease in an historic cemetery skeletal sample from nineteenth century Belleville, Ontario. This information was subsequently compared to historical data from the period in order to provide new insights into stress vectors for nineteenth century settlers and their descendants in Upper Canada.

Although other historical skeletal samples have been evaluated for paleopathological evidence, few of them can be compared to historical or archival documentation. Other historic sites in Canada include the Harvie Site (Saunders 1989), Snake Hill (Saunders and Lazenby 1989), Prospect Hill (Pfeiffer et al 1991) and Quebec City (Cybulski 1991). These sites, however, contain relatively little nominative data compared to the St. Thomas sample from Belleville and most is indirect; there are few known individuals that can be identified. In addition, the sample sizes from these sites are relatively small. The largest, Prospect Hill, contains the remains of 77 individuals. St. Thomas, with 595 graves, (568 individuals represented by bone) provides a unique opportunity to reconstruct the health status of the community. Supporting documentation for the St. Thomas sample includes Canada Census records (1851-52; 1860-61; 1870-71), parish records, including names and dates for births, burials, baptisms, and marriages, municipal assessment rolls, newspaper articles, and books on the History of Belleville. Epidemiological data from an historical skeletal sample of this size may assist in determining the overall patterns of disease within a demographic area and can provide data that will help us understand the state of medicine in nineteenth century Upper Canada.

Immigration from the United Kingdom and Ireland to Canada reached a peak during the mid-nineteenth century and this partly reflects the mass migrations out of Ireland during the potato famine in the 1840's (Westwood 1980), as well as periods of economic decline in Britain. The implications for the transmission of infectious disease are numerous. Ships carrying passengers infected with typhoid fever, smallpox, tuberculosis and cholera arrived in Lower Canada in large numbers. Within a short period of time, dispersing passengers transmitted these diseases throughout both Lower and Upper Canada. Quarantine stations were often inadequate in preventing the spread of disease. As Bilson (1983:89) points out, political as well as medical factors influenced the establishment of quarantine stations.

Several indicators can be used to evaluate the overall health status of a community. The occurrence of certain infectious diseases such as tuberculosis or smallpox are often indicative of what Kelley (1989:194) refers to as "...synergistic interactions". Nutritional inadequacies may predispose the individual to infectious pathogens. Thus, nutritional status may be reflected in the incidence and frequency of infectious diseases in skeletal material (Martin, Goodman and Armelagos 1985).

Infectious diseases which are manifested in the human skeleton include both non-specific and specific infections. Non-specific infections include various forms of osteomyelitis, periostitis, and abscesses (Steinbock 1976). Infectious agents can also be determined from the dentition, including caries and periodontal disease (Lukacs 1989). Specific infections include tuberculosis, syphilis, smallpox, fungal and viral infections, etc (Ortner and Putschar 1985; Kelley 1989).

Tuberculosis played a role in the mortality rates of many North American populations during the nineteenth century. According to Daniel (1981), as many as 25% of all deaths in cities in Europe and North America during the nineteenth century can be attributed to tuberculosis, although smaller centres or towns may not have been affected as extensively. It was not until the latter part of the nineteenth century that the germ theory of disease transmission became generally acknowledged. Consequently, individuals suffering from tuberculosis were not isolated in sanatorium settings until the early part of the twentieth century (Dubos and Dubos 1987). However, even this measure was relatively ineffective as a cure for tuberculosis until the introduction of streptomycin in 1948, although the isolation of affected individuals may have reduced the risk of contagion to others.

Steinbock (1976) has noted that approximately 5% to

7% of tuberculosis cases will exhibit skeletal involvement. However, this rate will vary with the population incidence of the disease and can be affected by epidemic waves of the disease. As the infectious disease reaches a peak, those individuals that are more susceptible succumb to the disease; and the survivors become resistant over a period of time (Grigg 1958; Bates 1982). Evidence of tuberculosis may be expected to be present in Ontario cemetery skeletal samples of the nineteenth century, although because of the relatively low incidence of tuberculous lesions affecting bone, the skeletal sample may not accurately reflect the true incidence of tuberculosis within the sample. For this reason, historical documentation and parish records can be useful in reconstructing the health status of the community.

It appears that smallpox, a viral infection, was re-introduced into Canada along with typhus and cholera during the middle of the nineteenth century. Ortner and Putschar (1985) note that skeletal involvement in smallpox is minimal and ranges from 2% to 5%. Unfortunately, smallpox lesions are not observable in adults who have survived the disease; in children, it presents osteomyelitic infections (Ortner & Putschar 1985:228) which are not always distinguishable from other infections. As Jackes (1983:75) notes, although the osteomyelitis variolosa of smallpox can be identified in some cases, there are few known cases over the age of 15.

Non-specific infections such as osteomyelitis and periostitis may occur as sequelae of trauma, hematogenously via a soft tissue infection or as a complication of degenerative arthritis (Steinbock 1976). These infections may be the result of trauma induced either accidentally or intentionally.

Traumatic lesions may give information regarding the stressors on individuals. Accidentally-induced trauma can result from occupational hazards and are a response to pressures imposed during certain activities (Kennedy 1989). Alternately, traumatic injuries such as fractures may be the result of weakened bone. These pathological injuries are often associated with bone that is weakened due to infection, osteoporosis, etc. (Ortner and Putschar 1985). Finally, trauma to bone may be the direct result of violent acts or may result from deliberate surgical techniques, such as autopsy or amputation (Merbs 1989). Waldron and Rogers (1987) refer to these surgical interventions as iatrogenic palaeopathology.

The hypothesis formulated at the beginning of this work is that there is a correspondence between the skeletal evidence of trauma and infectious disease, and what actually occurred as documented in historical records. This correspondence is not expected to occur in absolute numbers, but in the general distribution of trauma and infection by sex and age groups. Since inferences about mortality rates and causes of death among groups of individuals or populations are frequently made on the basis of observations of pathological changes in human skeletal remains, I have endeavoured in this study to determine whether or not this is a reliable source of information.

There are relatively few opportunities to examine skeletal samples that have corresponding historical documentation. One comparative study by Lanphear involved the analysis of 296 skeletons for tuberculosis, from the Monroe County Poorhouse in Rochester, New York (Lanphear 1989A). Lanphear's study was evaluated within the context of documentation from several sources: death records, including name, age, sex, date and cause of death, occupation and ethnic origin (Lanphear 1989:188). Some of the results of this study are discussed in Chapter 3.

Owsley (1990:171) has reviewed some of the historic cemeteries in North America. However, although the skeletal remains from a variety of sites were analyzed, the sample sizes in most cases were small. The Cypress Grove II Cemetery excavated by Owsley contained the remains of 255 "indigents" from burials dating from 1849 to 1929 (Owsley 1990:176). It appears, however, that there is no historical documentation available in the form of parish records or personal histories to correlate with the burials.

II Belleville, Ontario - A Brief Background

Belleville is located in Hastings County, Ontario, on the north shore of Lake Ontario's Bay of Quinte (see map on Page 11). The Moira River, which empties into the bay, was the site of the earliest settlers of European origin to the region, in 1785 (Mika & Mika 1986:8). In 1789, approximately 50 Loyalist families arrived in the area and founded Thurlow Village; by the early nineteenth century, the community had become a major farm market centre (Mika & Mika 1986:11).

Because of its' location between the Town of York and Kingston, Belleville's population increased rapidly in the 1820s. Early settlers in the area encouraged others to move to the region, describing Belleville as "...a place where job and business opportunities were plentiful" (Mika & Mika 1986:17). A steamship service operated between Kingston, Prescott, and Belleville, facilitating trade in items such as flour, lumber and wheat; numerous saw and grist mills were established and small businesses flourished (Mika & Mika 1986:17).

By the 1840s, Belleville had become a major centre for lumber manufacturing; iron foundries were built to supply machinery and equipment for the various manufacturing industries in the town (Mika & Mika 1986:33). In 1856, the Grand Trunk Railway began to provide service between Montreal and Toronto, passing through Belleville enroute. The arrival of the railway stimulated business; locomotive shops employed the townspeople, and manufacturing businesses could export their goods to other centres.

The 1851 census for Belleville lists the population by country of origin. Of the total population of 4,569, 2,197 were listed as natives of Canada. Of the 2,201 individuals that were not natives of Canada (Canada Census 1851-52), most were emigrants from Ireland and the United Kingdom: Ireland (1,301), England and Wales (439), and Scotland (149) (Canada Census 1851-52). Two hundred and ninety persons were emigrants from the United States, and a small number (9 in total) were from other Canadian provinces: Nova Scotia, Prince Edward Island, and New Brunswick. Other immigrants to Belleville included those from Prussia, Holland and the German States and the East Indies (Canada Census 1851-52).

from Historical Atlas of Hastings and Prince
Edward Counties, Ontario
1977 Mika Publishing: Belleville, Ontario

(1860)

Chapter 2
Materials and Methods

I The St. Thomas Skeletal Sample

In August, 1989, an archaeological crew led by Dr. Heather McKillop of Northeastern Archaeological Associates was contracted to remove and relocate an estimated sixty to ninety graves from the cemetery of St. Thomas Anglican Church, in Belleville, Ontario in order to facilitate a church expansion.

The original St. Thomas Church was built in 1818 and was in use by 1820 (Mika & Mika 1986:28). The first burial dates to 1821 (Bellstedt 1969:5). In 1855, a larger stone church was built on the same property to replace the smaller, original brick one (Mika & Mika 1986:28; Bellstedt 1969:8). A fire in 1876 gutted the interior (Weekly Intelligencer 1876; Mika and Mika 1986), but by 1879 the church was rebuilt using the original exterior walls (Mika and Mika 1986). A second fire in 1975 destroyed the church and it was again rebuilt. One consequence of both fires was the destruction and/or removal of many of the tombstones marking graves within the cemetery.

A total of 579 graves were eventually excavated from that portion of the cemetery which was in use from 1820 to 1874, and these represent not only United Empire Loyalists who settled in this region of Upper Canada, but immigrants from England, Ireland and Scotland as well (Boyce

1991:personal communication). Seventy-three of these are known individuals who were identified by grave markers and subsequently linked to parish burial records (Boyce 1990: personal communication).

The present analysis includes observations taken from 271 adult individuals in the St.Thomas sample. Of these 271, 250 have sex and age data provided by Tracy Rogers of McMaster University (Rogers 1991: personal communication). Adults were chosen for the sample since they can best provide information about trauma and infectious disease by both age group and sex.

During the course of metric observations upon the 281 subadults in the sample, taken by other researchers at McMaster University, any suspicious changes to bone were noted and the burial numbers recorded. These changes included evidence of periostitis or osteomyelitis, or obvious fractures. Of 13 subadults subsequently flagged, my examination of them revealed pathological changes to bone in 5 individuals. Thus, my final sample consisted of 271 adults and 5 subadults.

II Age Estimations of the Sample

Macroscopic evaluations were performed by Tracy Rogers using several methods currently employed for age estimation. The pubic symphysis age estimation method employed (depending upon the sex of the individual) included Suchey-Katz (1986); Suchey, Brooks and Katz (1988); McKern and Stewart (1957) and Gilbert and McKern (1973). The auricular surface method developed by Lovejoy et al (1985:A) was also utilized on 236 adult individuals. Fifty-nine individuals were examined twice by Ms. Rogers in blind tests using the Suchey and Katz (1986) or Suchey, Brooks and Katz (1988) methods.

As Ubelaker (1989) has noted, age estimates are more accurate when multiple aging methods are available. Following the procedure utilized by Lovejoy et al (1985:B), I employed a multifactorial approach in order to obtain summary age estimates. In this method, the summary age of the individual is calculated by multiplying the age estimate by weighted indicators. For the St. Thomas skeletal sample, age data were provided for pubic symphyses and/or auricular surfaces. The weighted age scores are totalled and divided by the sum of the indicators weight to give a summary age (Maat 1987). It should be noted, however that these weightings cannot be considered independent of the original study by Lovejoy et al.

In order to test the relative usefulness of the multifactorial technique developed by Lovejoy et al (1985B) the various age estimations for individuals were also combined to provide a simple average. A pair by pair visual assessment of the age estimates derived from both the multifactorial method and averaging was carried out by the author. Table 1 contains both estimates, and known ages, where available. Only 11 (4.3%) of 254 (adults with age assessments) differ more than 2 years between multifactorial age estimate and the age estimate obtained by averaging. Weightings used in the multifactorial technique were not derived from the St. Thomas sample. Other weightings derived from the St. Thomas sample have subsequently been determined (Saunders et al 1991) but were not employed in this analysis. Simple averaging was used in this analysis to provide age estimates.

For the purpose of the present analysis, the St. Thomas skeletal sample was divided into ten year age cohorts with one exception; the youngest group contains individuals from age 17 to 29 years, since 17 is the youngest adult age assessed within the sample. The remaining age cohorts include 30-39 years, 40-49 years, 50-59 years, 60-69 years, 70-79 years and 80 years and over. As age is a graded variable, it was felt that ten year cohorts would facilitate analysis of the sample.

There is a tendency to underage individuals over 30 years of age and as a result of this, there may be an underestimation of these ages in this group. This may affect the determination of the presence of trauma and/or infection. The sample of known individuals in this age group may ameliorate this effect by providing a basis for comparison.

Table 1
Comparison of Age Estimates

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
1	M	37.1	37.1	
2	M	20.3	20.3	21
11	M	36.5	36.5	
12	M	37	32	
18	F	23	27	
19	M	21.3	21.3	17
21	F	42	42	
25	F	39	39	
26	M	54.3	54.1	
28	M	50.1	48.1	
29	F	43.2	43.4	
30	F	42	42	
31	M	39.3	39.3	62
32	F	-	-	
35	M	30.2	30	35
36	M	32	32	
37	M	-	-	
39	M	48	48	
40	M	36	35.5	
42	M	44	44	
43	F	47	47	
45	M	32	32	
46	?	-	-	
47	M	40	40	
48	M	31	31	
49	M	60	60	
54	M	60	60	
56	F	42	42	
58	M	54	54.1	
59	F	54.5	55	
61	M	50.2	50.1	
67	F	37	37	
68	F	47	47	
71	M	22	22	20
74	M	42	42	
76	M	27	27	
78	F	60	60	
85	?	-	-	
86	F	37	37	
87	F	27	27	
89	M	54.5	55	
92A (600)	F	37	37	
96	F	-	-	
97	F	50.4	50.1	50
98	M	20.2	20.2	

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
100	M	38	38.1	
101	M	34.5	34.5	
102A (601)	M	37.7	37.7	
103	M	44.1	44	75
108	F	51.4	52	60
111	F	39.6	39.5	33
112	F	36.4	36.4	
114	M	46	46	
115	M	30	30	27
117	F	37	37	
121	F	50.5	50.5	
122	F	60	60	
124	F	60	60	67
128	M	–	–	
130	M	37.1	37.1	
131	M	48.2	48.1	
131A (602)	F	40.1	40.4	
132	M	37.6	37.7	
133	M	32.1	32.2	41
135	F	42	42	
136	F	–	–	
137	M	25.8	24	
138	M	34.5	34.4	
139	F	–	–	
151	F	56.8	56.9	
156	M	33.8	33.8	55
157	M	53	53	
159	F	58.6	58.6	
161	M	43.1	43.3	
165	M	47.1	47.1	
167	F	50.3	50.3	
168	M	54.0	54.1	
168A (603)	F	32.4	32.4	
169	F	31.7	31.7	
170	M	45.1	45	
171	M	35.5	35.5	
172	M	54.5	54.5	
176	F	57.2	57.3	
178	F	50.1	50.2	
179	M	33.2	33.3	
181	M	33.8	33.8	
182	F	20.2	20.1	
183	F	60	60	
188	F	60	60	67
191	M	36.1	35.5	
192	F	27	27	
193	F	42	42	
196	M	54	54.1	

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
197	F	23.7	20.4	
204	M	39.3	39.3	
210	M	52.8	53	
210A (604)	F	54.5	54.5	
211A (605)	F	58.6	58.6	
215	F	24.1	24.1	
222	M	54	54.1	
226	M	54.5	54.5	
228	M	42	42	
229	M	44.5	42	34
231	M	43.1	43.3	
234	M	22.1	21.5	
242	M	27	27	
243	M	35.4	35.5	
245	F	–	–	
246	M	–	–	
248	F	60	60	
249	F	–	–	
250	M	30.5	30.5	
251	F	–	–	
260	M	30.5	30.5	
262	F	39.7	39.7	
263	M	35.4	35.5	
268	F	42.6	42.6	
269A (606)	F	22	22	
272	M	39.6	39.8	
274	F	44.6	44.6	
277	M	33.2	33.3	
281	M	39.6	39.8	
287	M	42.5	42	48
297	M	28.3	28.3	75
298	M	31.5	31.6	
300	F	49.4	49.3	
301	M	42	42	
302	M	54	54.1	
303	M	52.3	52.4	58
304	F	42	42	57
305	M	35.4	35.5	
307	M	32.1	32.2	
309	F	50.7	50.7	60
310	F	32	32	
311	M	42	42	
312	F	39.7	39.7	
313	M	39.6	39.8	
314	F	46.7	45.7	
315	M	54	54.1	
316	M	44.9	44.9	
317	F	41.3	41.5	

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
330	M	44.9	44.9	
333	?	-	-	
334	F	50.4	50.5	
335	F	52.8	52.9	
336	M	44.4	44.6	
339	M	60	60	55
341	F	42	42	
342	F	44.3	44.3	
343	M	35.4	35.5	
345	M	47.9	48	
351	M	37.7	37.8	
351A (607)	F	21.1	21.1	22
355	M	35.4	35.5	
356	M	37	37	
361	F	32	32	19
362	F	58.6	58.6	
363	M	60	60	
365	F	46.8	46.9	
368	F	20.3	20.4	
369	F	52.4	52.4	
370	M	32.1	32.2	
372	F	36.3	36.3	
374	M	39.6	39.8	64
375	M	36.9	37	60
376	F	46	45.9	
378	F	37	37	
383	F	50.3	50.3	
385	M	39.6	39.8	35
388	M	28.3	28.3	
390	M	54.5	54.5	
395	F	60	60	88
396	M	40.9	41.3	
397	M	52.2	52.4	75
399	F	52.8	53	
400	F	49.3	49.2	29
405	M	37.9	38.1	68
406	M	34.5	34.5	
407	M	39.5	39.6	
411	M	20.4	20.4	
412	M	34.1	34.2	
413	F	33.5	33.6	
416	F	52.6	52.6	
418	M	33.3	33.3	
420A (608)	F	19.1	19.1	
422	M	39	39	
423	F	21.5	21.5	22
424	F	60	60	
426	M	43.1	43.3	

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
428	M	47	47.2	
429	M	43	47	
433A (609)	M	18	19.7	
435	F	54.5	54.5	62
436	M	39.3	39.4	66
437	F	27	27	29
442	F	34.7	34.7	
443	M	32.7	32.7	44
446	M	41.8	42	69
447	M	23.2	23.2	
449	M	35.3	35.5	
450	?	–	–	
451	M	29.1	28	28
452	M	20.4	20.4	
453	F	50.3	50.3	
461	M	30.2	30.2	
462	M	39.6	39.8	59
464	M	42	42	46
465	F	22	22	22
466	M	57.1	57.3	
467	M	35.4	35.5	54
468	M	–	–	
469	M	39.6	39.8	
470	F	47	47	53
471	M	19.8	19.8	
472	M	27	27	20
473	M	44.9	44.9	
475	M	47	47.2	
476	M	43.5	43.7	
477	M	38.9	38.9	
479	F	54.5	54.5	
480	F	27	27	
481	M	60	60	
483	M	33.8	33.8	
484	F	42	42	
485	M	39.6	41.5	
486	M	48.3	48.5	
487	M	38.5	38.8	
488	M	35.1	35.1	
491	M	–	–	
494	F	55.1	55.4	
502	M	34	34.2	
503	F	32	32	
506	F	48.6	48.6	
507	M	47	47	
510	M	52	54.1	
511	F	56.8	58.6	
512	M	22	22	76

Burial #	Sex	Multifactorial Age Estimate	Age Estimate by Averaging	Known Age
513	F	37	37	
514	F	20.8	20.8	17
516	F	55.9	55.9	69
517	M	52.2	52.4	
518	M	54	54.1	
519	F	47.9	47.9	
527A (610)	M	31.1	31.1	31
532	F	51.3	51.3	
533	M	50.3	52.6	
534	F	51.8	51.7	
537	M	24.1	22	
539	F	22	22	
540	F	39.4	39.4	
542	M	45.6	48	
544	F	47	47	71
547	F	34.9	34.9	
548	M	60	60	61

III Sex Determinations of the Sample

Sex determinations for the adults were also provided by Tracy Rogers of McMaster University and were based on morphological criteria from both the hip bones and crania.

A random sample of individuals were analyzed in two separate trials utilizing both criteria for sex determination. Documented sex of known individuals was utilized in this analysis. Sex determinations made from the hip bones have an accuracy rate of 95% or better in this sample (Saunders et al 1991).

IV Procedures

The skeletal analysis was undertaken from the end of April, 1990 to the end of August, 1991 at laboratory facilities in the Department of Anthropology at McMaster University. Data collection forms were designed to provide a maximum amount of information about each individual burial (Appendix 3). A complete inventory of skeletal parts was recorded as each burial was examined. This helped to determine the degree of completeness for purposes of analysis. Following the procedure utilized by Lovejoy and Heiple (1981), the presence or absence of traumatic lesions or infection, and the degree of completeness of each bone was recorded for each individual burial. In order to avoid possible sampling bias, only complete bones, or those with minimal damage were analyzed. As Lovejoy and Heiple (1981) note, undue attention may be focused on fragmentary remains which may subsequently result in the introduction of sampling error. However, a failure to include fragmentary skeletal remains in any analysis of pathological changes may preclude useful information about infectious disease and/or traumatic injuries. Since pathological changes to bone often render them fragile and easily damaged (Pfeiffer 1984:182), much information may be overlooked by failing to examine poorly preserved remains. For the purposes of my analysis, fragmentary remains that manifested obvious signs of pathological change were examined. Dental pathological data were collected by Carol DeVito of McMaster University and are not included in this analysis.

Data were collected via macroscopic inspection regarding the specific location of the pathological change to bone (i.e. distal, proximal, etc. with measurements in metric values), the type of pathology (i.e. lytic, sclerotic, etc.), and the extent of the pathological process (i.e. single lesions, localized, etc.). A magnifying glass was utilized to examine small details. In addition, specific regions of bone involvement were recorded (i.e. diploe, cortical bone, etc.) The presence and degree of healing (or absence of) was observed and recorded. Because only complete or nearly complete skeletons were analyzed, it was possible in many cases to reach a differential diagnosis based upon the observed pathological changes. This also permitted concomitant pathological changes to be analyzed and recorded.

The overall state of preservation of each skeleton was also noted (excellent, good, fair, poor) in order to assess whether or not the data obtained were reliable. Poor preservation may affect the appearance of bone and cause post-mortem changes that may resemble pathological processes (Ortner and Putschar 1985). These pseudopathologies are more easily differentiated from true <u>in vivo</u> pathological changes when the state of preservation is observed and recorded.

Determining the preservation quality of skeletal remains is essentially a subjective exercise. It is unlikely that paleopathologists would consistently agree among themselves about quality of preservation and the implications for skeletal analysis. However, despite this, it is possible to establish some baseline criteria for determining general preservation status. It is easier to do this when looking at large sample sizes, such as the St. Thomas sample, since comparisons are facilitated. As a result, I felt confident in assigning a value of "excellent", "good", "fair" or "poor" to each skeleton during the analysis.

"Excellent" generally meant that the skeleton was complete to nearly complete (i.e. no major skeletal components missing or damaged) and intact. "Good" was assigned to those skeletons that could not be considered to be in excellent condition, but perhaps manifested slight damage (i.e. broken processes of vertebrae or damage to proximal or distal ends of long bones). "Fair" included skeletons that had moderate damage, but were not adversely affected in terms of being able to make accurate assessments of skeletal pathology or traumatic injuries. "Poor" included skeletons that had sustained sufficient damage to render analysis somewhat less reliable. In these cases, it was often possible to glean useful information from isolated examples of trauma or lack of pathological changes to bones. However, it should be noted that a general, overall picture of the health status of these particular individuals (N =35) was not possible in light of poor preservation quality.

As illustrated in Table 2, preservation quality is generally good (40.7%) to excellent (20.9%); 25.4% of the remains were in fair condition, while only 13.1% could be deemed "poor".

During the observation process, paired bones were initially examined simultaneously. This comparative process often assists the paleopathologist to determine what is "normal" for the individual. Subsequently, each bone was examined in isolation from its counterpart. Sketches of areas of the skeleton affected by pathological changes were made on a standard archaeological recording form contained within the data form. This assisted later on during the analysis stage when trying to determine distribution patterns of trauma and infectious disease.

A random sample of 35 bones exhibiting pathological changes to bone were selected by Shelley Saunders (Thesis Supervisor) and myself and compared to my own observations in order to assess the degree of reliability of my observation techniques. There appeared to be little difference between our assessments of pathological conditions.

Skeletal elements demonstrating evidence of either trauma and/or infectious disease were photographed and the details recorded. In addition, a number of specimens were radiographed for further analysis. This proved to be especially useful in those cases of suspected trauma that were well healed (see Appendices 1 and 2 for radiographs and photos).

As noted in Chapter 1, the data obtained from the skeletal analysis was compared to historical documentation. Parish records, with causes of death (Boyce 1990: personal communication), census data (1851 - 1871) and newspaper articles from the Belleville Intelligencer (early editions were named The Daily Intelligencer and The Intelligencer), The Kingston Chronicle and the Hastings Chronicle formed the basis of the comparative analysis. In addition, numerous journal articles and books provided a glimpse of nineteenth century Belleville, including Dr. William Canniff's (a Belleville physician) account of medical practice in Upper Canada (see References Cited for a complete list).

Table 2 ;
Preservation Quality

Value Label	Value	Frequency	Percent
Excellent	1	56	20.9
Good	2	109	40.7
Fair	3	68	25.4
Poor	4	35	13.1
	TOTAL:	268 cases	100%

3 cases not included = total of 271

V Differential Diagnostics - A Brief Discussion

Differential diagnoses were attempted for each skeleton that manifested any pathological changes. This process was facilitated through gross observations and radiographic analyses. Differential diagnosis is often difficult, even for the experienced paleopathologist. Dry skeletal remains are often limited in what pathological changes are observable as the result of preservation, loss of soft tissue information and similarities in disease processes that affect bone. As Widmer and Perzigian (1981:99) remind us, we must remain aware of the limitations in paleopathological assessments. One of the problems in paleopathology is the number of fatal infectious diseases that leave no trace in skeletal remains (Birkett 1983:99). These include diseases such as certain viral infections, cholera, typhoid, dysentery, among others (Birkett 1983:99). This has implications in attempting to reconstruct a profile of infectious disease for an earlier population.

As Ortner and Putschar (1985:36) have noted, the goal of descriptive analysis in paleopathology is to identify the disease process that has caused pathological changes in human skeletal remains. More than one pathological process may produce similar lesions in bone (Ubelaker 1989:107), however, reaching a differential diagnosis is facilitated by a thorough analysis of not only the type of lesions, but their pattern and distribution throughout the skeleton. Kelley (1989:197) stresses that studies of infectious disease in human skeletal samples rely heavily on the accuracy of all of the variables involved. He notes that

> Accurate interpretation is dependent on proper methodology: adequate sample size, accurate age and sex determination, use of objective terminology for lesions, careful recording of lesion location, and distribution, and reconstruction of the physical and cultural environments as completely as is possible (Kelley 1989:197).

Of course, the preliminary step in any paleopathological analysis is a thorough understanding of what is normal in human bone in order to determine what abnormal pathological changes may be present.

Ortner, in his introduction in Mann and Murphy's (1990) Regional Atlas of Bone Disease, notes the importance of adequate description in any paleopathological analysis of human skeletal remains. This descriptive information must be supplemented by demographic data in order to properly assess and interpret what is observed (Ortner 1990).

VI Statistical Procedures

Statistical analysis was carried out using the SPSS-PC statistical program (Statistical Package for Social Sciences) which is extremely flexible and is designed to provide maximum manipulation of data. An Epson Equity II+ computer (IBM compatible) was used to generate the results.

Data from each data form were coded and input. Categories for input included burial number, estimated age and sex, location of pathological change, number of sites affected, and type of pathological process observed. Historically documented age and sex were substituted for known individuals. "Type" was divided into general categories by trauma and infectious disease. These categories included: active, non-specific infection (upper skeleton); active, non-specific infection (lower skeleton); healed non-specific infection (upper skeleton); healed, non-specific infection (lower skeleton); healed fracture (upper skeleton); healed fracture (lower skeleton); unhealed fracture (upper skeleton); unhealed fracture (lower skeleton); dislocation; spondylolysis; iatrogenic trauma; tuberculosis, and syphilis. Missing data were also assigned a specific code.

Crosstabulations were computed for each variable, by age and/or sex to provide Chi square values and significance (probability). Crosstabulation permits two or more variables to be analyzed and is well suited to this study. In those cases where the cells in a crosstabulation table contained expected frequency values that were less than 5, a Fisher's exact test was run. This test gives one tailed values for two by two tables with small expected frequencies and, although not a robust test, is suitable for small sample sizes.

One of the advantages of the SPSS-PC statistical package is that it permits new variables or categories to be created in order to facilitate analysis. Age categories, for example, can be recombined to analyze adults under or over 50 years of age, if desired. Because of this flexibility, it was possible to combine categories for analysis. The variables assigned to trauma (HLFRACUP, HLFRACLO, UNFRACUP, UNFRACLO, DIS, and SPON) were combined to form one variable, giving data regarding the total incidence of traumatic injuries within the sample. Similarly, all variables assigned to infectious disease (ACNONUP, ACNONLO, HLNONUP, HLNONLO, TB, and SYPH) were combined into one variable, giving the overall picture of the incidence of infectious disease within the sample.

Age data were analyzed on the basis of ten year age cohorts, with the exception of the first group. Age categories consisted of 17 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 years or more. Ten year cohorts were selected for analysis, although the SPSS-PC program allows age data to be manipulated into any desired age cohort. Because conclusions could not always be drawn about the relationship of age to pathological conditions, part of the analysis included computations based upon larger age categories: individuals under/over the age of 50 years.

The results of the statistical analyses are presented in Chapter 3, Section V.

Chapter 3
Results of the St. Thomas Skeletal Sample

I Overview

Both specific and non-specific infections are represented within the St. Thomas sample. Specific infections include evidence of tuberculosis and syphilis. Non-specific infection, including periostitis as a sequela of trauma, occurs within the sample, as does primary periostitis. Primary periostitis represents inflammation that is not part of a particular disease syndrome, such as syphilis or tuberculosis (Ortner and Putschar 1985:132). One difficulty in attempting to reach a differential diagnosis of infectious disease, however, concerns the appearance of non-specific changes to bone that may actually reflect a specific disease process that is otherwise undetectable. Within the sample, there is evidence of both healed and active non-specific infection in both males and females.

Traumatic injuries occur within the St. Thomas skeletal sample. Perimortem fractures are manifested in several individuals, and there is a relatively large proportion of healed fractures within the sample, especially in males. There are also cases of pseudarthrosis and spondylolysis, as well as one case of iatrogenic trauma. These are discussed in detail in the following sections.

II Infection & Trauma - Overview

There was no observable evidence of osteomyelitis within the St. Thomas sample. This is especially remarkable given the severity of some of the traumatic injuries suffered (see Section I) and the fact that Lister's theory of antisepsis was not developed until 1867 (Roland 1967:380). The general use of carbolic acid as an antiseptic did not occur until 1869, when one of Lister's students began promoting the practice (Roland 1967:380). Interestingly, one of the major opponents to the value of antiseptic treatment was William Canniff, a physician who practised in the Belleville area during the 1860's (Roland 1967:383). Whether or not there are implications with regard to medical treatments provided to individuals from the St. Thomas skeletal sample is unknown, since physicians' records regarding individual patients are not presently available from this time period. In 1856, Canniff was admitted to the Royal College of Surgeons in London, England (Hastings Chronicle: 1856). The article in the Hastings Chronicle announcing his success expressed the hope that Canniff would be returning to Canada to provide members of the community with "...the benefit of his superior attainments and experience" (Hastings Chronicle: 1856). Dr. Canniff, after resigning in 1863 from Victoria College, Toronto, retired in Belleville to continue his practice (Godfrey 1979:97).

Within the St. Thomas sample, active non-specific infection is manifested in incidences of primary periostitis. Primary periostitis, as I have treated it, is periosteal inflammation that is not a part of a specific disease syndrome, such as tuberculosis or syphilis (Ortner and Putschar 1985). All five sub-adults flagged for some pathological changes to bone exhibit evidence of non-specific periostitis. One case exhibited a slight ridge of active periostitis along the superior edge of the right mandibular alveolar border; the other cases demonstrated areas of mild, active periostitis to the femora, tibiae and in one case, radius and humerus. None of these cases, in this author's estimation, exhibited a pattern concurrent with a specific infectious disease process. These five cases are not included within the statistical analysis because both age and sex information are unavailable.

In the initial analysis of the St. Thomas sample, for purposes of simplicity, four generalized variables were created to describe the number of individuals that showed evidence of non-specific infection: a) ACNONUP (active, non-specific infection, upper) (upper includes the upper limbs and all bones superior to, and including the vertebrae); b) HLNONUP (healed, non-specific infection, upper); c) ACNONLO (active, non-specific infection, lower (lower includes the sacrum, pelvic bones and the lower limbs); d) HLNONLO (healed, non-specific infection, lower). These categories were selected to facilitate comparative analysis. In addition, the distribution of certain pathological conditions may differ between upper and lower parts of the skeleton. A bone by bone analysis was originally considered, but proved to be too unwieldy for analysis and was not useful in obtaining an overall picture of infectious disease and trauma. Reporting pathological changes to each individual bone cannot be done on a sample basis of this size. However, a summary of infectious disease and traumatic injuries by skeletal site is included in Table 3 for comparative purposes.

Tables 4 and 5 list all variables for both infectious disease and trauma by sex and age groups.

Table 3

Distribution of Infectious Disease and Trauma by Skeletal Site
Males & Females Combined

	Hld Trauma		Peri. Trauma		Active Inf		Hld Inf		Inf & Trauma		Norm		Tot
	#	%	#	%	#	%	#	%	#	%	#	%	#
Skull	9	3	1	.4	36	14	5	2	–		211	81	262
Clav.	4	2	–		2	1	–		–		256	98	262
Scap.	2	1	–		8	3	–		–		252	96	262
Thor.*	24	9	1	.4	9	4	1	.4	3	1	219	85	257
Vert.	7	3	1	.4	3	1	–		–		241	95	253
Pel.**	–		1	.4	10	.4	1	.4	–		241	95	253
Hum.	2	1	1	.4	3	1	1	.4	1	.4	244	97	252
Uln.	5	2	–		1	.4	2	.8	–		244	97	252
Rad.	13	5	–		6	2	1	.4	–		232	92	252
Hand***	11	5	1	.4	–		1	.4	1	.4	219	94	233
Pat.	1	.4	1	.4	3	1	–		–		221	98	226
Fem.	6	3	–		5	2	5	2	1	.4	208	92	225
Tib.	8	4	–		21	9	10	4	–		186	83	225
Fib.	9	4	–		5	2	4	2	1	.4	204	92	223
Foot****	2	1	2	1	7	3	1	1	2	1	198	93	212

* Sternum & ribs only
** Hip bones & sacrum
*** Carpals, metacarpals & phalanges
**** Tarsals, metatarsals & phalanges

Table 4 :
Distribution of Infectious Disease and Trauma by Sex and Age Groups Males N=146

	17-29	30-39	40-49	50-59	60-69	70-79	80+
ACNONUP (N=20)	4	7	3	2	1	2	1
HLNONUP (N=4)	1	-	1	1	1	-	-
HLNONLO (N=10)	1	4	2	-	3	-	-
ACNONLO (N=16)	3	4	6	2	-	1	-
HLFRACUP (N=50)	2	13	15	11	6	1	2
HLFRACLO (N=17)	-	6	6	4	1	-	-
UNFRACUP (N=1)	-	1	-	-	-	-	-
UNFRACLO (N=2)	-	-	1	1	-	-	-
DIS (N=2)	-	-	1	1	-	-	-
SPON (N=4)	1	1	2	-	-	-	-
TB (N=5)	1	1	2	-	-	1	-
SYPH (N=2)	-	-	-	2	-	-	-

Table 5
Distribution of Infectious Disease and Trauma by Sex and Age Groups Females N=104

	17-29	30-39	40-49	50-59	60-69	70-79	80+
ACNONUP (N=24)	7	3	6	5	2	1	-
HLNONUP (N=2)	-	1	-	-	1	-	-
HLNONLO (N=11)	2	3	2	1	1	-	2
ACNONLO (N=14)	3	1	2	6	2	-	-
HLFRACUP (N=15)	1	2	4	6	2	-	-
HLFRACLO (N=8)	1	-	4	1	2	-	-
UNFRACUP (N=2)	-	-	-	2	-	-	-
UNFRACLO (N=1)	-	-	-	1	-	-	-
DIS (N=2)	-	-	-	-	1	-	1
SPON (N=2)	1	-	-	-	1	-	-
TB (N=7)	-	2	2	1	2	-	-
SYPH (N=2)	1	-	-	-	-	-	1

Figure 1 shows the combined male and female distribution, by percentage, of infection and trauma from the total sample of 250 individuals. Thirty-two percent showed no evidence of either infection or trauma; 3% demonstrated evidence of syphilis; 4%, tuberculosis; 22%, active, nonspecific infection; 8% healed, nonspecific infection; 1%, dislocation; 26% healed fractures; 2%, unhealed (perimortem) fractures and 2%, spondylolysis.

% of Infection & Trauma
M/F Combined (N = 250)

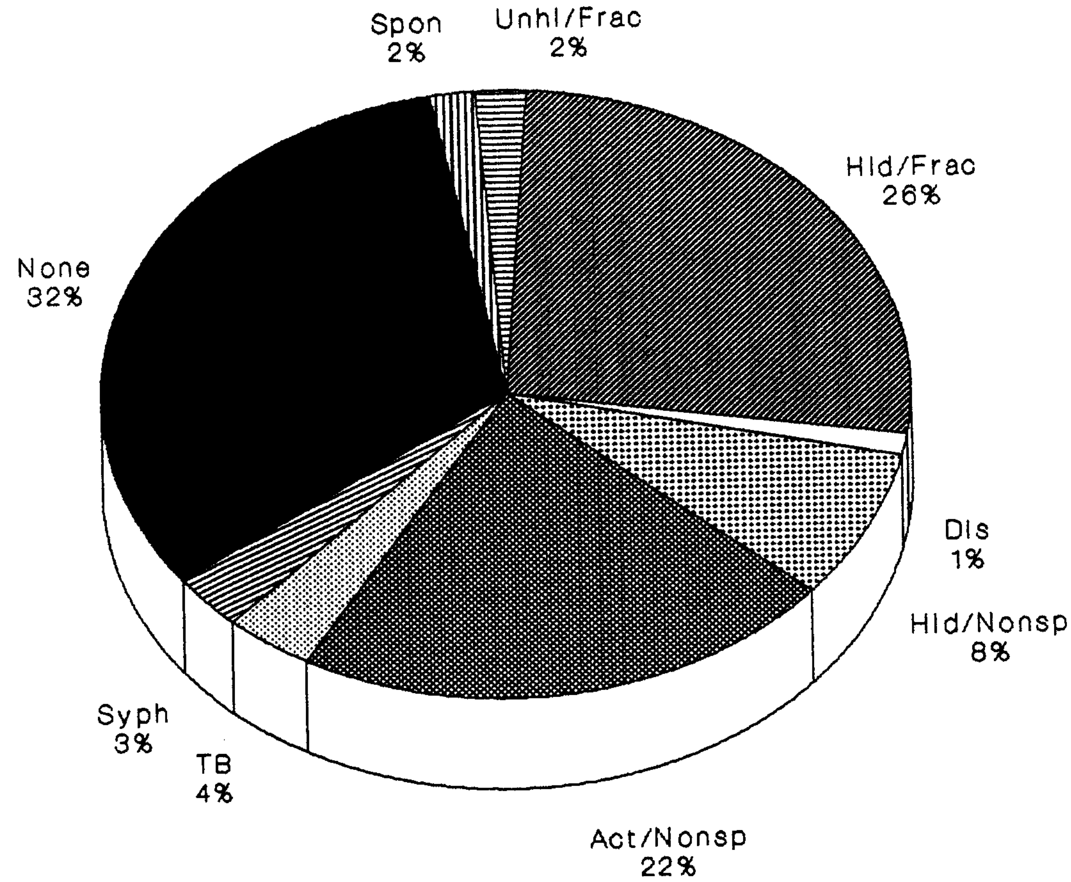
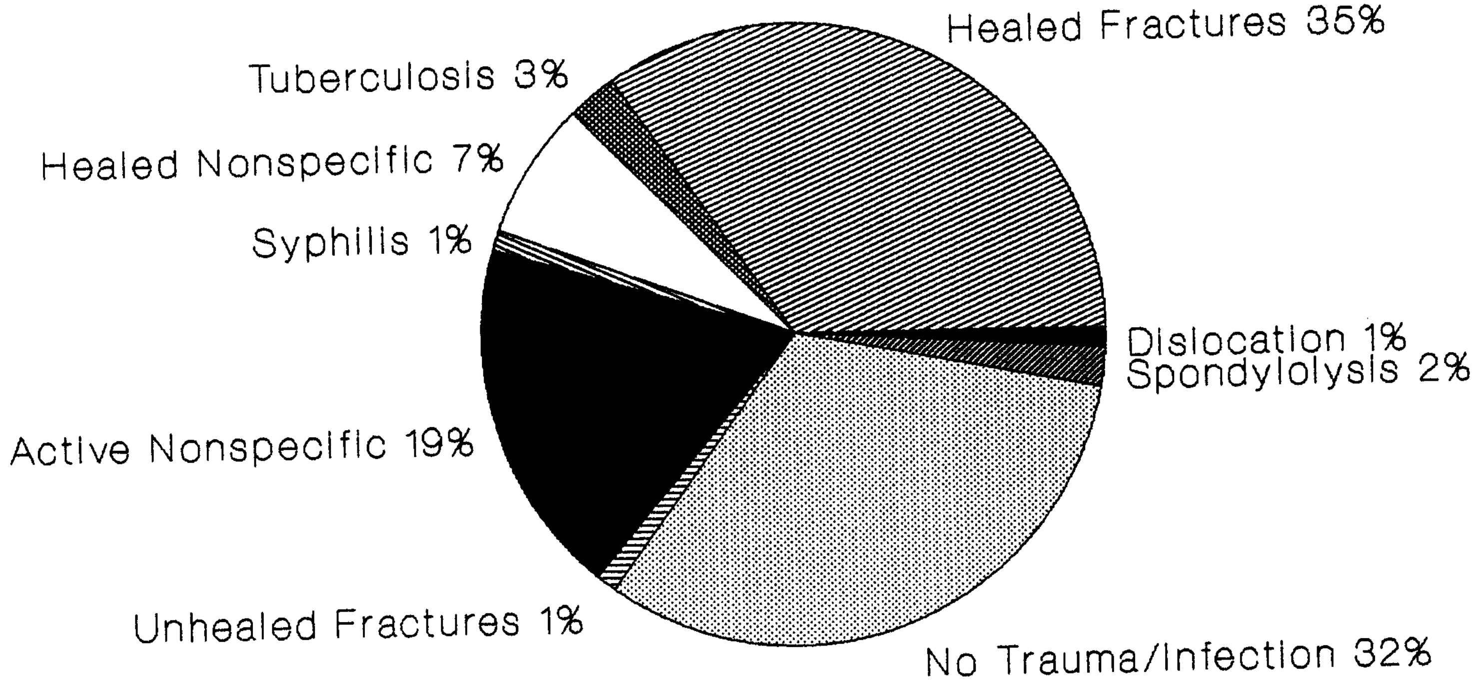


Figure 1

Figure 2 illustrates, in pie chart format, the overall percentages of infectious disease and trauma for males from the total male sample of 146. As illustrated, 32% demonstrated no evidence of either infection or trauma. Healed fractures accounted for 35% of trauma; dislocation, 1%; spondylolysis, 2% and 1%; unhealed (perimortem) fractures. Tuberculosis accounted for 3% of infection; healed, nonspecific infection, 7%; syphilis, 1%, and active, nonspecific infection, 19%.

Infection and Trauma

Males

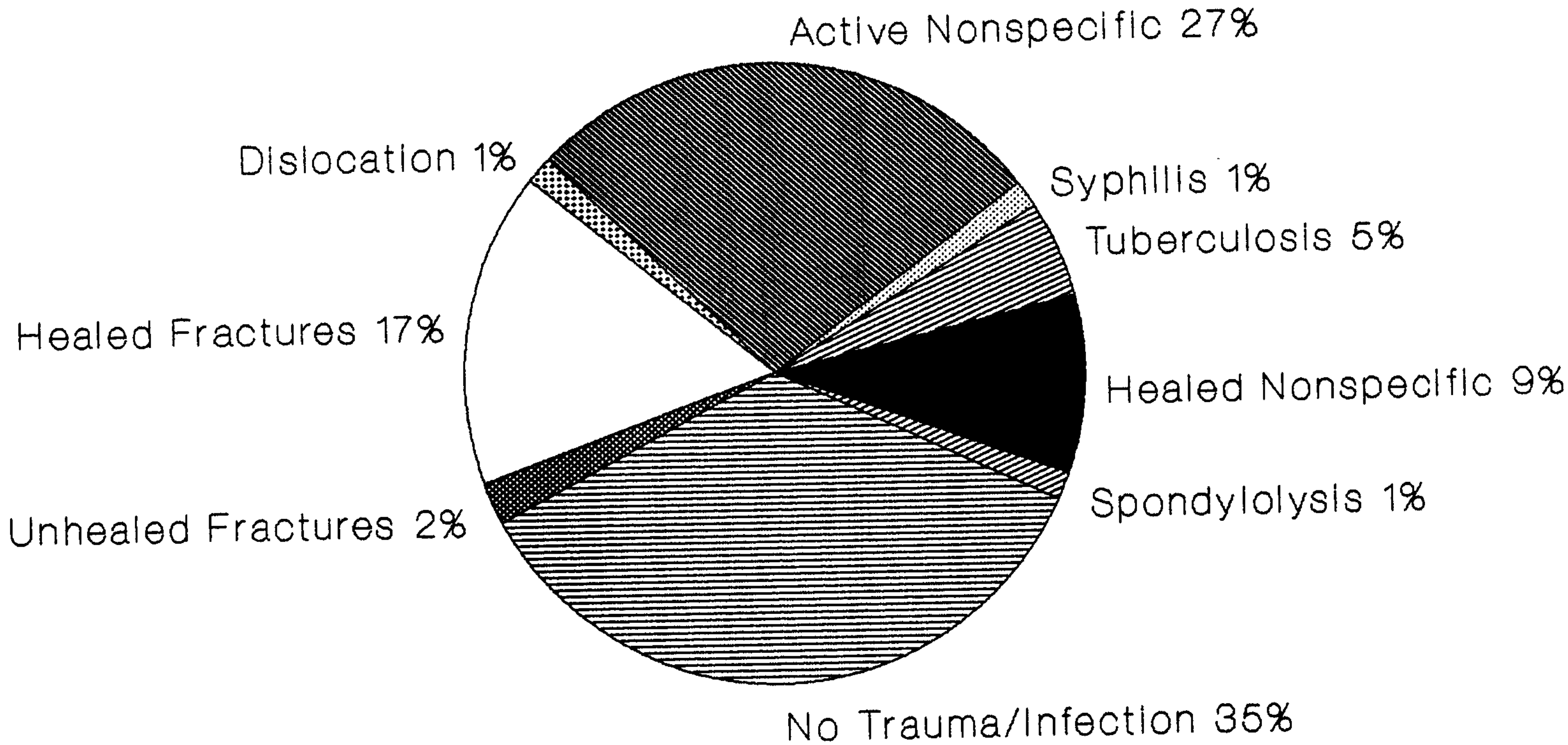


N=146

Figure 2

Figure 3 illustrates, in pie chart format, the overall percentages of infectious disease and trauma for females from the total female sample of 104. As illustrated, 35% showed no evidence of either trauma or infection. Active nonspecific infection accounted for 27% of infection; syphilis, 1%; tuberculosis, 5%; and healed, nonspecific infection, 9%. Dislocation accounted for 1% of trauma; healed fractures, 17%; unhealed (perimortem) fractures, 2%, and spondylolysis, 1%.

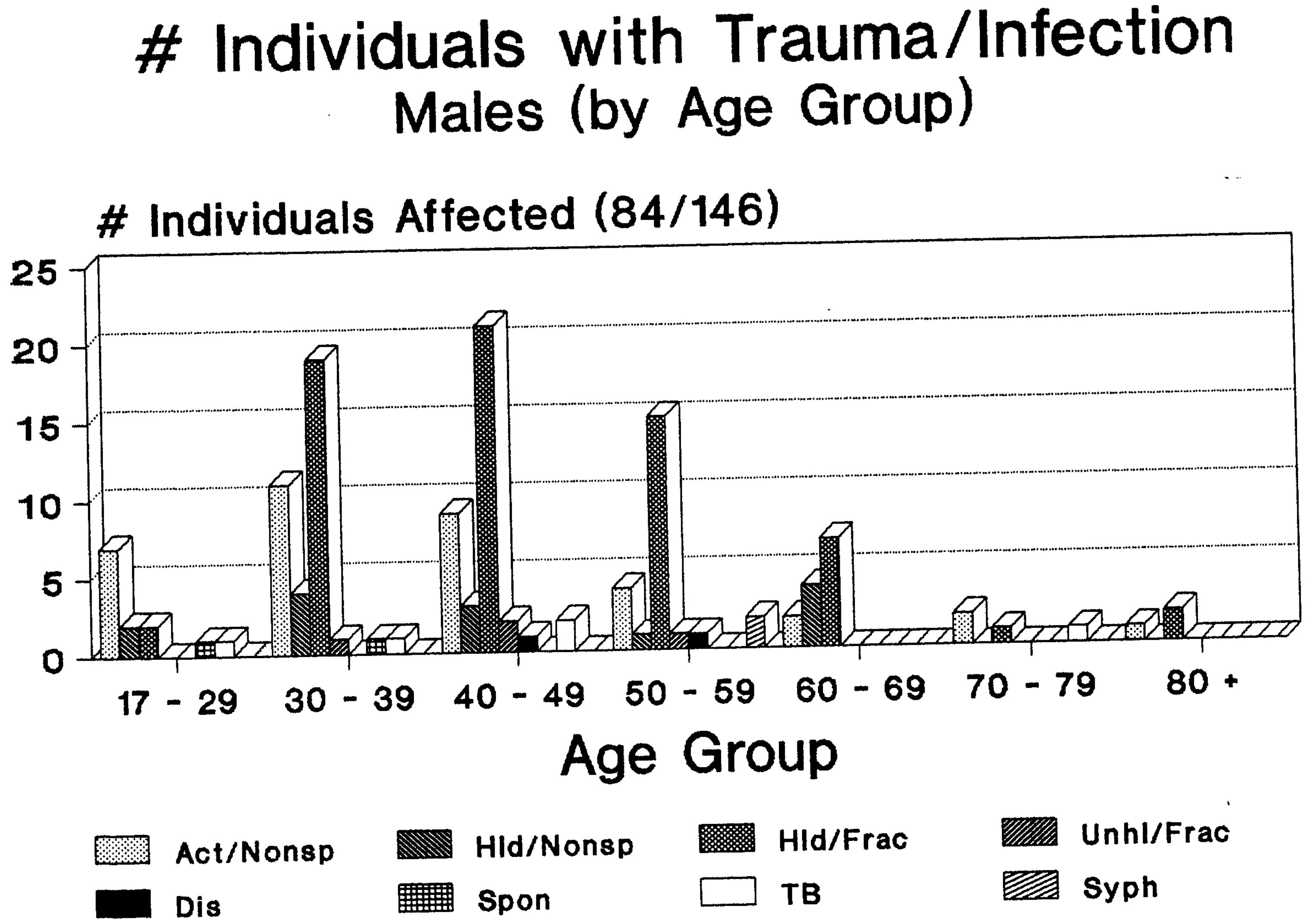
Infection and Trauma
Females



N = 104

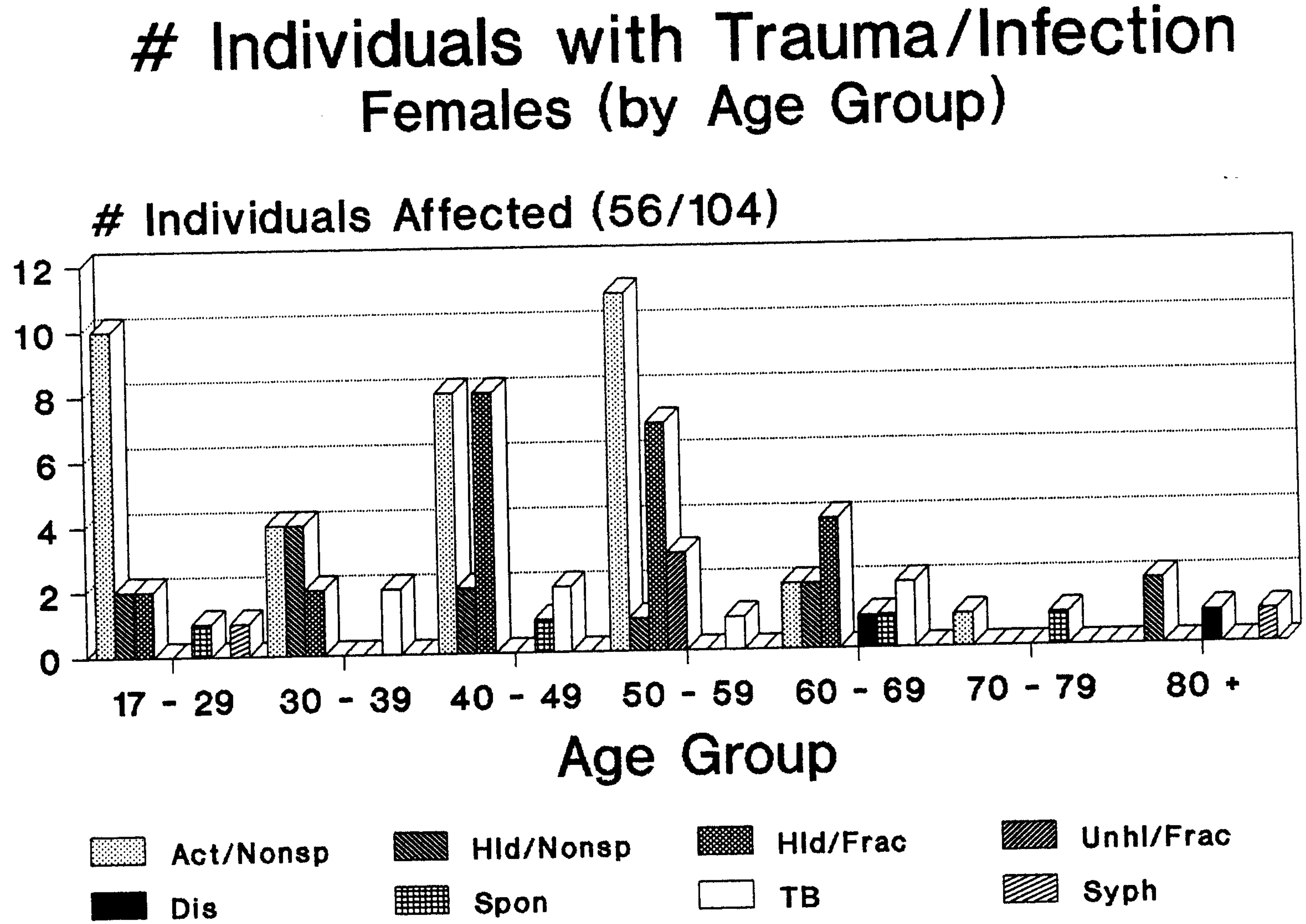
Figure 3

Figures 4 and 5 illustrate the number of individuals with traumatic injuries and/or infectious disease, by sex and age groups. As illustrated in Figure 4 (Males), the highest number of individuals affected in any age group are those with healed fractures. For females (Figure 5), the highest number of individuals affected in any age group are those exhibiting evidence of active, non-specific infection.



Individuals with Trauma/Infection
Males (by Age Group)
Individuals Affected (84/146)
25
20
15
10
5
0
17 - 29
30 - 39
40 - 49
50 - 59
60 - 69
70 - 79
80 +
Age Group
Act/Nonsp
Hld/Nonsp
Hld/Frac
Unhl/Frac
Dis
Spon
TB
Syph

Figure 4



Individuals with Trauma/Infection
Females (by Age Group)
Individuals Affected (56/104)
12
10
8
6
4
2
0
17 - 29
30 - 39
40 - 49
50 - 59
60 - 69
70 - 79
80 +
Age Group
Act/Nonsp
Hld/Nonsp
Hld/Frac
Unhl/Frac
Dis
Spon
TB
Syph

Figure 5

III Overall Distribution of Infectious Disease

A further variable, INFECTION, was created to provide an overall picture of the incidence of infectious disease, both non-specific and specific. The variable, INFECTION, combines the variables ACNON (active, nonspecific infection, all sites), HLNON (Healed, nonspecific infection, all sites), TUBERCULOSIS and SYPHILIS. Figure 6 illustrates the results of these combined variables in terms of the age and sex distribution of infectious disease. Forty-five of 104 females and 51 of 146 males demonstrate evidence of infectious disease.

Infection (All)
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	9	9	10	8
30-39	15	31	7	11
40-49	13	24	9	14
50-59	6	19	10	15
60-69	4	7	5	6
70-79	3	1	1	0
80 +	1	4	2	5
TOTAL	51	95	45	59
	(N=146)		(N=104)	

Infection (All)
% of Males (N=146) & Females (N=104)

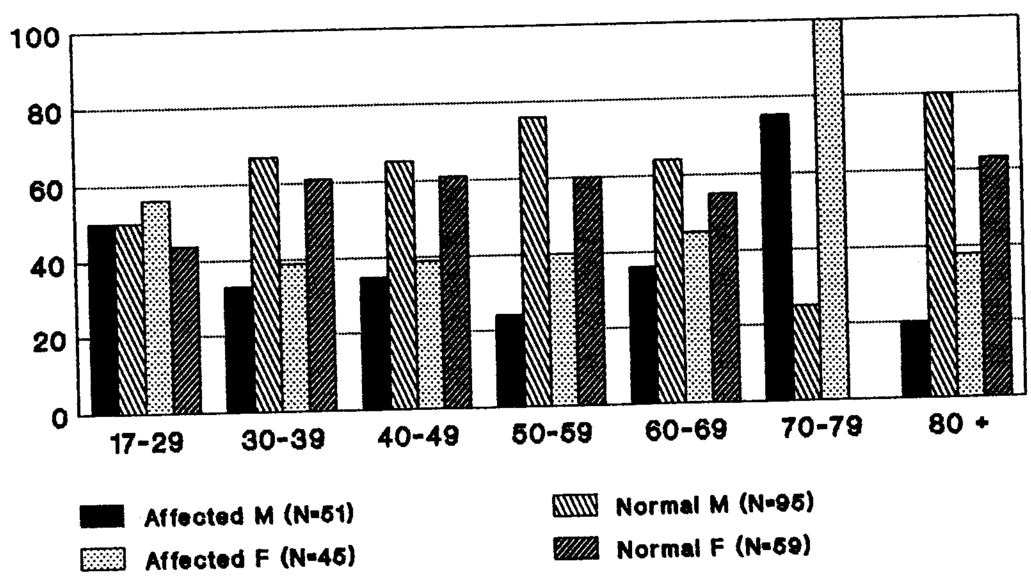


Figure 6

Figure 7 illustrates the distribution for males and females (number of individuals) in regard to infectious disease by decade.

Figure 8 illustrates infection by decade for males and females by proportion, compared to non-affected individuals.

Infection by Decade
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	10	8	13	5
30-39	16	30	10	8
40-49	14	23	12	11
50-59	7	18	13	12
60-69	5	6	8	3
70-79	4	0	1	0
80 +	1	4	3	5
TOTAL	57	89	60	44
	(N=146)		(N=104)	

Infection by Decade
Males and Females (# of Ind)

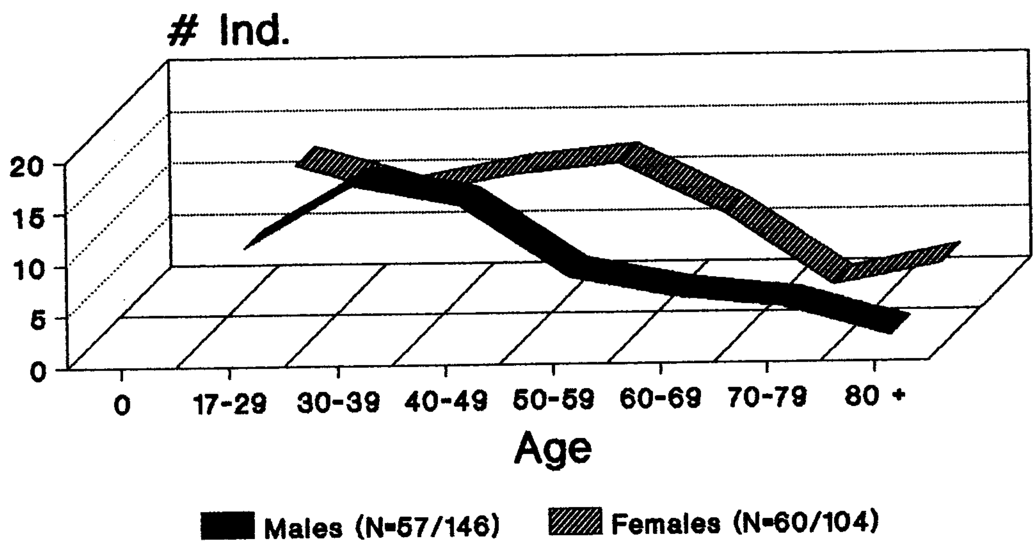


Figure 7

Infection by Decade
% of Males (N=146) & Females (N=104)

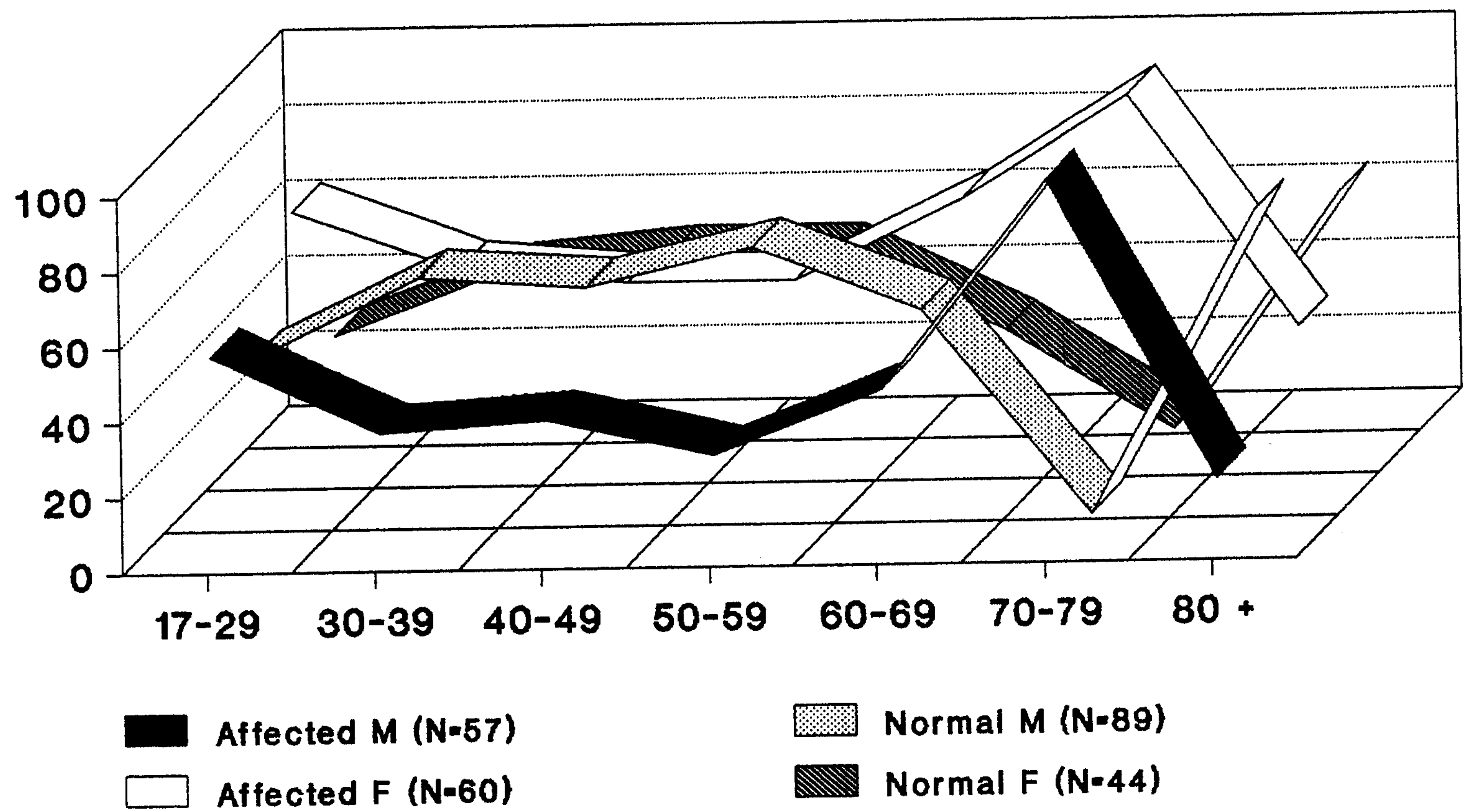


Figure 8

IV Non-Specific Infections

A) ACNONUP

Active, non-specific infection in the upper skeleton is present in 24 of 104 females and in 20 of 146 males. A breakdown by sex and age cohorts can be seen in Figure 9.

ACNONUP
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	4	14	7	11
30-39	7	39	3	16
40-49	3	34	6	17
50-59	2	23	5	20
60-69	1	10	2	9
70-79	2	2	1	0
80 +	1	4	0	8
TOTAL	20	126	24	80
	(N=146)		(N=104)	

Active, Non-Specific Infection, Upper
% of Males (N=146) & Females (N=104)

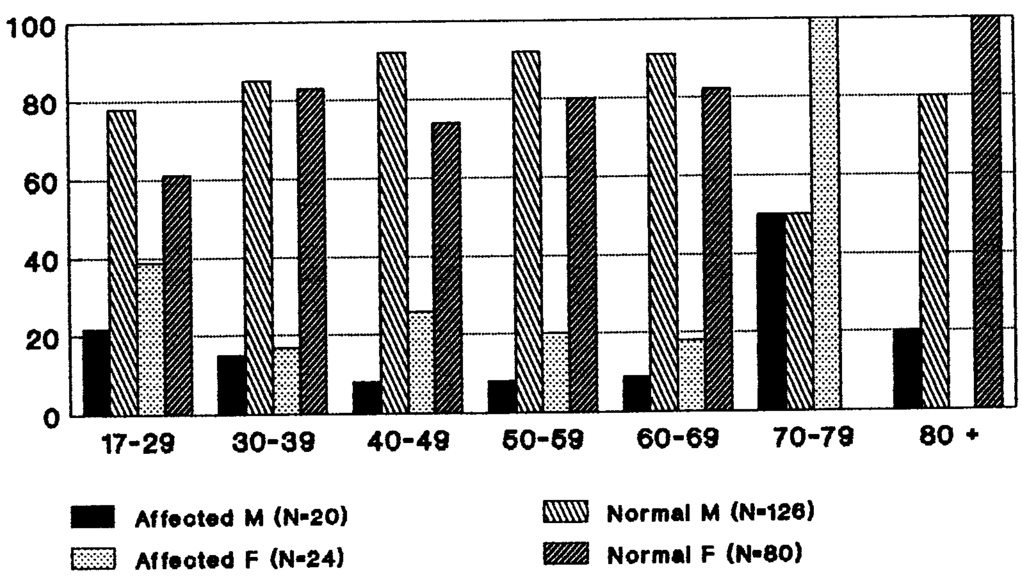


Figure 9

B) <u>ACNONLO</u>

Active, non-specific infection in the lower skeleton was present in 14 of 104 females and in 16 of 146 males. A breakdown by age cohorts and sex is found in Figure 10.

ACNONLO
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	3	15	3	15
30-39	4	42	1	17
40-49	6	31	2	21
50-59	2	23	6	19
60-69	0	11	2	9
70-79	1	3	0	1
80 +	0	5	0	8
TOTAL	16	130	14	90
	(N=146)		(N=104)	

Active, Non-Specific Infection, Lower
% of Males (N=146) & Females (N=104)

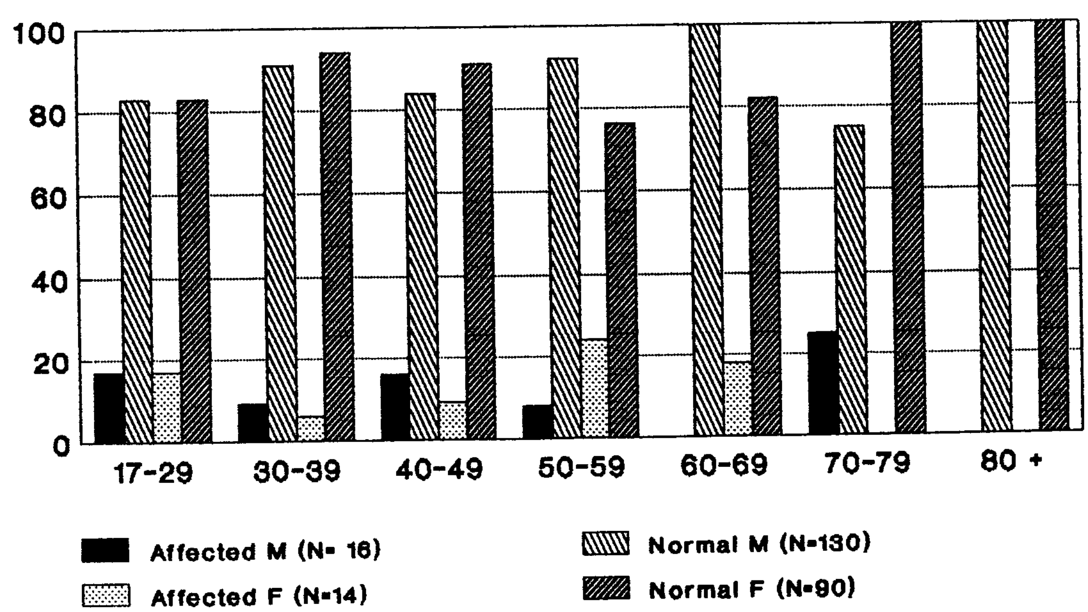


Figure 10

C) HLNONUP

Evidence for healed, non-specific infection of the upper skeleton was present in only 2 of 104 females and in 4 of 146 males. A breakdown by age cohorts and sex is found in Figure 11.

HLNONUP
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	1	17	0	18
30-39	0	46	1	17
40-49	1	36	0	23
50-59	1	24	0	25
60-69	1	10	1	10
70-79	0	4	0	1
80 +	0	5	0	8
TOTAL	4	142 (N= 146)	2	102 (N= 104)

Healed, Non-Specific Infection, Upper
% of Males (N=146) & Females (N=104)

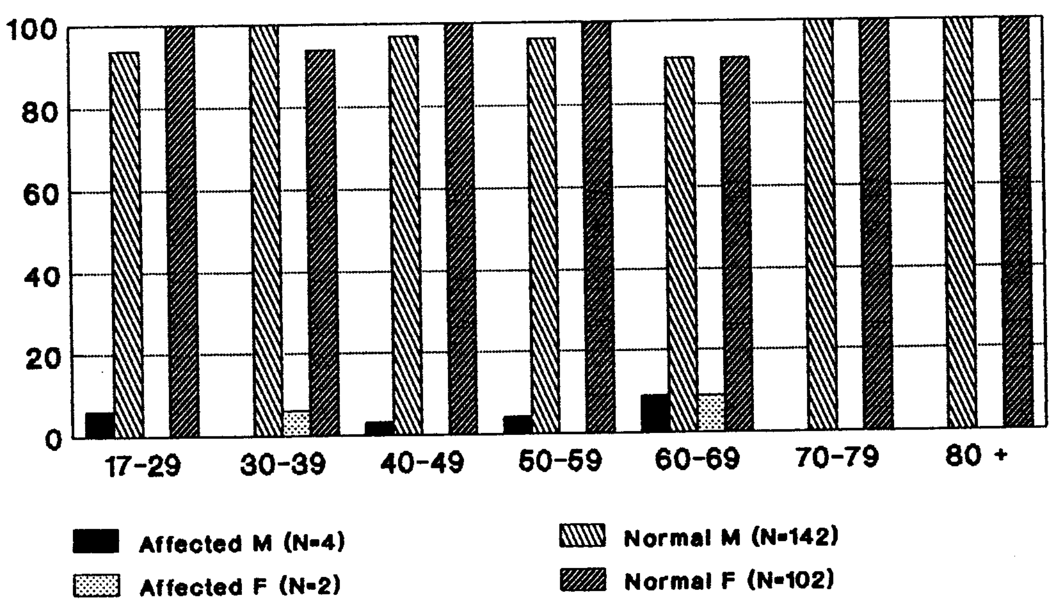


Figure 11

D) <u>HLNONLO</u>

Healed, non-specific infection of the lower skeleton is present in 11 of 104 females and in 10 of 146 males. A breakdown by age cohorts and sex is found in Figure 12.

The two variables, ACNONUP (active, non-specific infection, upper skeleton) and ACNONLO (active, non-specific infection, lower skeleton) were combined in a second analysis to produce the variable ACNON (active, non-specific infection, all sites). As a result of this combination, active, non-specific infections occur in 31 of 104 females and in 33 of 146 males. A breakdown by age cohorts and sex is found in Figure 13.

The variables HLNONUP (healed, non-specific infection, upper skeleton), and HLNONLO (healed, non-specific infection, lower skeleton) were combined to produce the variable HLNON (healed, non-specific infection, all sites). As a result of these combined variables, the distribution is slightly different. Healed, non-specific infection is present in 11 of 104 females and in 13 of 146 males. A breakdown by age cohorts and sex is found in Figure 14.

HLNONLO
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	1	17	2	16
30-39	4	42	3	15
40-49	2	35	2	21
50-59	0	25	1	24
60-69	3	8	1	10
70-79	0	4	0	1
80 +	0	5	2	6
TOTAL	10	136	11	93
	(N=146)		(N=104)	

Healed, Non-Specific Infection, Lower
% of Males & Females

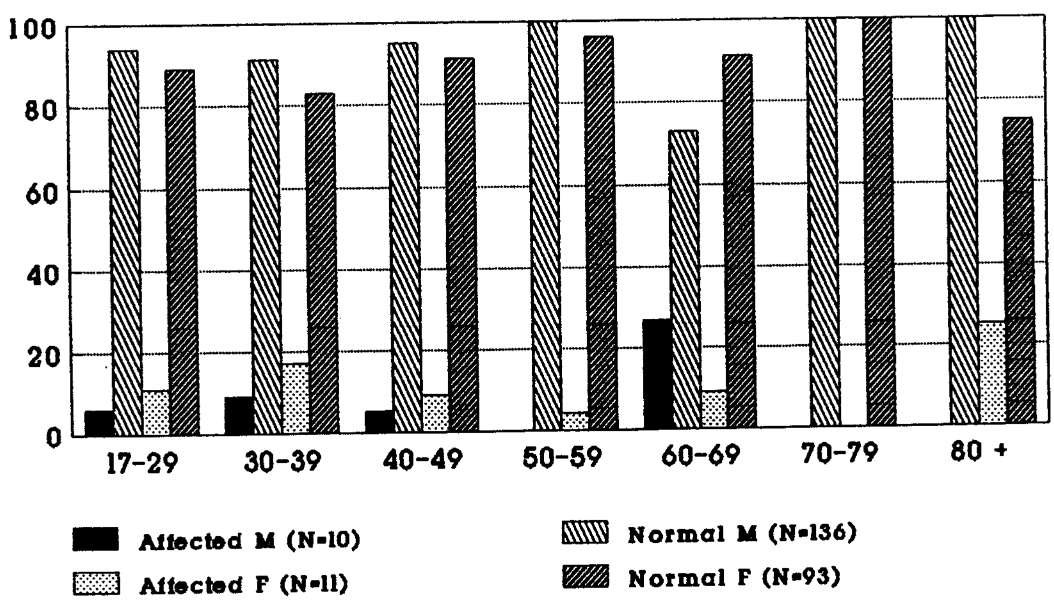


Figure 12

Active, Non-Specific Infection (All)
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	7	11	7	11
30-39	10	36	4	14
40-49	8	29	6	17
50-59	3	22	9	16
60-69	1	10	4	7
70-79	3	1	1	0
80 +	1	4	0	8
TOTAL	33	113 (N=146)	31	73 (N=104)

Active, Non-Specific Infection (All)
% of Males & Females

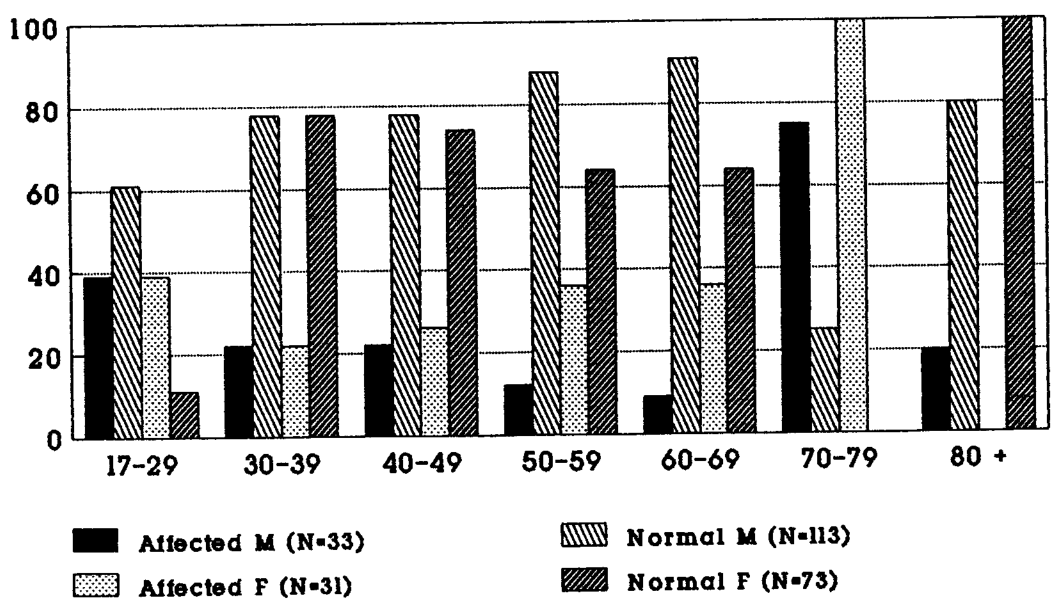


Figure 13

Healed, Non-Specific Infection (All)
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	2	16	2	16
30-39	4	42	3	15
40-49	3	34	2	21
50-59	1	24	1	24
60-69	3	8	1	10
70-79	0	4	0	1
80 +	0	5	2	6
TOTAL	13	133	11	93
	(N=146)		(N=104)	

Healed, Non-Specific Infection (All)
% of Males (N=146) & Females (N=104)

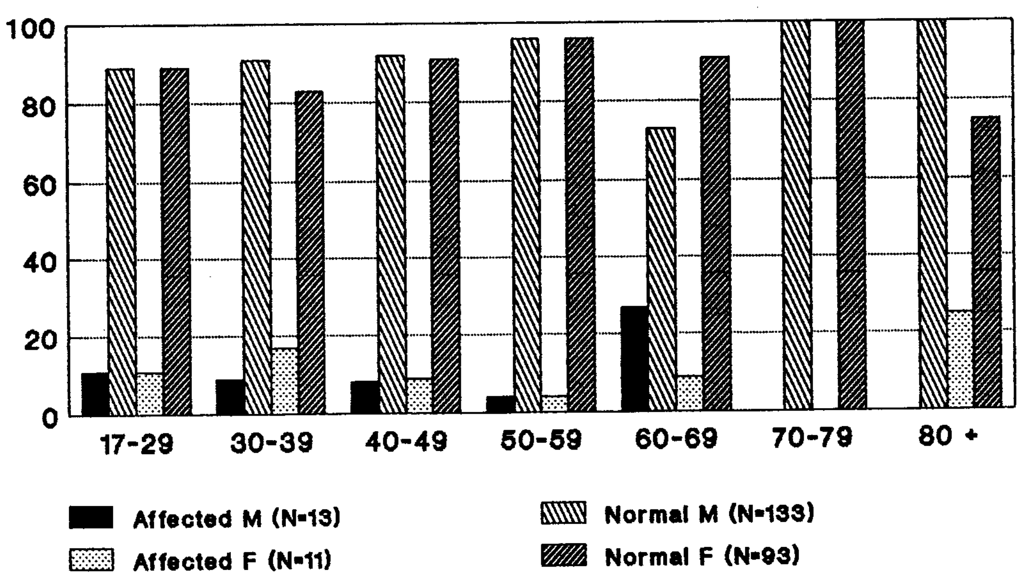


Figure 14

V Specific Infection

A) Tuberculosis

According to Brink (1965:17), the overall extent and distribution of tuberculosis in Ontario was relatively unknown during the nineteenth century. The more acute epidemics, such as smallpox, cholera, scarlet fever and measles appeared to warrant more attention, perhaps because of their swift and devastating effects. In addition, it was not until 1834 that the first Boards of Health began, after an act allowing their creation was passed by the Upper Canada Legislature (Brink 1965:17). Prior to this time, it is unlikely that demographic information about tuberculosis was available.

During the nineteenth century, it was generally thought that tuberculosis was a disease that was inherited, and as a result, little was known about its contagious aspects. Since it was not until 1881 that the tuberculosis bacillus was actually identified, the picture of tuberculosis in Ontario is vague during the nineteenth century (Brink 1965:18).

Tuberculosis was one of the major diseases that affected North American historical populations. An analysis of mortality rates for populations in the Connecticut River Valley during the eighteenth and nineteenth centuries revealed that rates of tuberculosis increased steadily from 1800 to 1875, then subsequently declined (Goodman et al 1988:184).

In their study, females generally had lower rates of mortality as the result of tuberculosis than did males, although the authors point out that this is not necessarily the case for other historical samples. Occupation was apparently one factor associated with tuberculosis. The Connecticut River Valley study showed that male farmers represented 11% of the mortality cases of tuberculosis, while approximately 24% of deaths from tuberculosis were among unskilled to semi-skilled males (McArdle cited in Goodman et al 1988). Goodman et al suggest that this distribution may reflect population densities and food resource access (1988:185).

Respiratory infections were a frequent cause of death before the introduction of antibiotics (Boyd & Sheldon cited in Molto 1990:439). A variety of respiratory diseases cause pathological changes to bone, especially the ribs. These include, but are not necessarily limited to tuberculosis, coccidioidomycosis, pneumonia, North American blastomycosis and actinomycosis (Molto 1990:444). In discussing tuberculosis in bones and joints, Fraser (1914:334) points out that tuberculosis frequently presents evidence of periostitis on the ribs, often as a result of tuberculous disease affecting the pleura.

Several factors must be considered in reaching a differential diagnosis of tuberculosis in skeletal remains.

As Kelley & El-Najjar (1980:160) point out

> The gross appearance of tuberculosis involving the skeleton varies considerably depending on the virulence of the organism, host resistance, sex...

One of the problems in examining an historic skeletal sample for evidence of tuberculosis concerns other infectious diseases present during the same time period (seventeenth to nineteenth centuries) and that may resemble tuberculosis in their manifestations in the human skeleton, such as pneumonia or typhoid (Lanphear 1989:2). As Kelley & El-Najjar (1980:167) point out, although various diseases may present similar lesions in bone, it is the particular pattern, i.e. spine-rib, spine-rib-sternum, rib-sternum, spine-hip that suggests a differential diagnosis of tuberculosis. Hartney (1981:143) has remarked that there are limiting factors involved in reaching a differential diagnosis of tuberculosis in skeletal remains. These factors include preservation quality, a recognition of the variation that may occur in the type of resorptive lesions, and a consideration of epidemiological factors (Hartney 1981:143,158).

Lanphear's study involved 296 skeletons removed from the Monroe County Poorhouse cemetery in Rochester, New York (Lanphear 1989:3). The remains date from the period 1826 to 1863 and are contemporaneous with the St. Thomas skeletal sample. The facility, like others of its kind in the United

States, was originally designed to temporarily house individuals who were unable to care for themselves (Lanphear 1989:3). Overcrowding, poor sanitation, and exposure to contagion were typical conditions of the poorhouses. Tuberculosis was the leading cause of death: of 228 complete skeletons examined in Lanphear's study, tuberculosis was suspected in 29 cases, of which 20 were definitive (9.2%) (Lanphear 1989:10). The lesions seen within the St. Thomas skeletal sample can be compared, both temporally and geographically with the Monroe County Poorhouse sample of Rochester, New York.

Sampling bias is another problem in analyzing skeletal remains from a cemetery population. The Monroe County Poorhouse sample from Rochester, New York illustrates this: two potential sources of sampling bias within the sample stem from the fact that many of the occupants tended to be either elderly individuals, or young adults with tuberculosis (Lanphear 1989:191). As Lanphear (1989:191) notes, because of the nature of the typical poorhouse sample, the rates of death associated with tuberculosis may not be representative of the population in general. Within the St. Thomas skeletal sample, the adult age sample ranges from 17 to 88 years of age, and thus provides a more comprehensive picture of diseases and traumatic injuries occurring within the sample.

The fungal diseases, blastomycosis,

coccidioidomycosis, and paracoccidioidomycosis may exhibit lesions similar to those of tuberculosis. Coccidioidomycosis and paracoccidioidomycosis are unlikely to have caused the lesions seen in the Monroe County Poorhouse skeletal sample, as Lanphear (1989:8) notes, because of their general distribution in dry, hot climates. In reaching a differential diagnosis of tuberculosis for individuals within the St. Thomas skeletal sample, it was possible to narrow the range of possible pathogens causing the particular pattern of periostitis on the ribs. As Molto (1990:444) has pointed out, coccidioidomycosis is a respiratory infection endemic to the Southwest United States and can thus be eliminated as a potential diagnosis for the St. Thomas sample. Blastomycosis may be a possibility, since it occurs throughout the northeastern United States and Ontario. It is a relatively rare mycotic infection in Ontario, and tends to produce bilateral periosteal lesions. The literature regarding its distribution and pattern is ambiguous, however. The disease is usually spread through contact with the soil, and it is frequently associated with individuals who work or live in close association with the soil, for example, farmers (Lanphear 1989:9; Buikstra and Cook 1981:116; Kane et al 1983:729). Mann and Murphy (1990:141) point out that approximately 20% to 50% of individuals affected by blastomycosis will develop skeletal lesions.

Boswell (cited in Molto 1990:445) describes these lesions as primarily lytic. Resnick and Niwayama (cited in Molto 1990:445) associate it with sclerotic margins. Shadomy (1981:28) has noted that the skeletal lesions caused by blastomycosis can be confused with those of tuberculosis. Vertebral involvement is frequently extensive (Shadomy 1981:28). In attempting to reach a differential diagnosis of tuberculosis in skeletal remains, it is necessary not only to examine and describe the lesions, but their distribution pattern as well in order to eliminate other possible fungal infections. The periosteal rib lesions associated with the St. Thomas skeletal sample, however, are unlikely to be the result of blastomycosis because of the relatively few cases that occur in Ontario. Sekhon et al (1979:60) point out that since 1906, only 120 documented cases of blastomycosis have been reported in Canada, 26 cases from Ontario.

Periostitis on the inner surface of the ribs can also be caused by respiratory infections such as pneumonia (Lanphear 1989:9). Actinomycosis is also a rare respiratory infection that may resemble tuberculosis in bone, but the ribs usually exhibit a combination of periostitis and osteolysis (Molto 1990:445), a feature not observed within the St. Thomas sample. Age and sex factors are also important: females are not affected as often as males, and most cases of actinomycosis occur within the 15 to 35 year age range (Kelley

& El-Najjar 1980:164).

Kelley and El-Najjar (1980:153) examined the Hamann-Todd Osteological Collection for evidence of skeletal tuberculosis. In order to assess the range of variation of the lesions, they classified them into four groups, depending on location: paradiscal (either side of the intervertebral disc), circumferential, neural arch and centrum (within vertebral body) (Kelley & El-Najjar 1980:155). This scheme assisted them in describing the lesions in a consistent and specific manner. The authors noted that tuberculous lesions of the ribs were most frequently located on the inner surfaces of the rib and at the costovertebral articulation (Kelley & El-Najjar 1980:157).

Pfeiffer (1990:3) analyzed skeletal remains from the Uxbridge Ossuary, Ontario, for evidence of tuberculosis. In order to assess whether or not the rib lesions seen within the sample can be attributed to tuberculosis or other respiratory infections, she categorized the lesions into three types: plaque, expansion, and resorption (Pfeiffer 1990:3). Both the plaque and expansion type lesions are commonly found on the inner surface of the ribs. The resorptive lesions most characteristic of tuberculosis were not common in the Uxbridge sample (Pfeiffer 1990:8). Pfeiffer (1990:8) suggests that the plaque and expansion type rib lesions seen frequently within the sample may represent some form of nonspecific periostitis, probably inflammatory. Because of the frequency of rib lesions seen within the Uxbridge sample it is clear, as Pfeiffer (1990:9) notes, that the population was under some form of chronic respiratory stress.

Records suggest that a decrease in the rates of tuberculosis in North America and Europe was occurring even before the introduction of effective treatments, during the mid nineteenth century (Dubos & Dubos 1987:185). The natural epidemic wave pattern of tuberculosis peaked in the first part of the nineteenth century (Dubos 1980:165). The cases of tuberculosis within the St. Thomas skeletal sample would date to between 1821 and 1874, although it is difficult to estimate how long the disease had been present in affected individuals before death occurred. In addition, the sample is biased toward interments dating during the 1850s and 1860s (Saunders et al 1991:6). Given the decline of tuberculosis during the mid part of the nineteenth century, we might expect to have seen more cases prior to the year (1821) that the cemetery was first used. However, as Burnet and White (1972:218) have noted, the rates at which tuberculosis occurs reflects both nutritional and social factors within a given population, and can provide information about the lifestyles of individuals within a given community. The relatively small number of deaths listed from tuberculosis in the St. Thomas sample (12/250) may reflect better nutrition and a higher standard of living. In addition, the transmission of the disease would likely be reduced since the population of villages and cities in Upper Canada was dispersed. Within the St. Thomas skeletal sample 7 of 104 females and 5 of 146 males demonstrate evidence of tuberculosis.

Mortality statistics for the late nineteenth century in Toronto, Ontario suggest that there were approximately 200 deaths from tuberculosis per 100,000 (Gale 1982:526). A paper written by Dr. C.B. Hall, of Toronto, to the August 1871 issue of The Canada Lancet about treatments for consumption also provides information on the mortality rates from tuberculosis at that time:

> Thus, I have shown you, however imperfectly that science has been carefully and faithfully investigating this important subject, to which, even as late as 1858 one-fourth of all the deaths was due; that investigation has regularly brought information; that each subsequent demonstration has produced increased practical knowledge; that the blood, the sputa, the secretions point to the danger long in advance; so that, years before the lungs become affected, the preventive treatment may stay the onward progress, and thus save, as it has done, hundreds of cases that, but a few years before, must have been certainly fatal (Hall 1871:504)

Godfrey (1979:184) reports that in 1871 in Ontario, hospitals recorded more than 1000 deaths due to phthisis (tuberculosis or consumption), out of 9100 recorded deaths, or approximately 11%.

As noted earlier, according to Steinbock (1976), approximately 5% to 7% of individuals with tuberculosis will exhibit skeletal lesions. Within the St. Thomas sample, over the 54 year period that the cemetery was in use (1820 -1874), a total of 12 out of 251 adult individuals (males and females combined) exhibited skeletal evidence of tuberculosis. However, since the exact number of individuals with tuberculosis is unknown, it is difficult to determine whether or not the 5% to 7% that can be expected to manifest skeletal lesions is reflected within the St. Thomas sample.

B) Syphilis

A second specific infection exhibited within the St. Thomas skeletal sample is syphilis. Within the St. Thomas skeletal sample 2 of 104 females and 2 of 146 males exhibit skeletal lesions associated with syphilis.

Cassel (1987:10), in his book The Secret Plague, points out that the "modern" approach to understanding venereal disease began in Canada in 1838. Up to this time, gonorrhoea and syphilis were not clearly understood with respect to both the symptoms and the pattern of the diseases (Cassel 1987:10) and this may be reflected in reporting causes of death in parish records.

One problem in attempting to estimate the extent of venereal disease in nineteenth century Canada concerns reporting. Until physicians were able to differentiate syphilis from gonorrhoea, diagnoses were often questionable. (See Chapter 4). As a result of this, many cases were unreported (Cassel 1987:17). However, Cassel (1987:18) notes that the nineteenth century Canadian physicians who wrote on the subject of venereal disease are in agreement that "...the disease was prevalent".

An additional problem in attempting to estimate how prevalent venereal diseases were in nineteenth century Southern Ontario concerns cultural models of the time. Parish registers may not be as useful as other forms of documentation in terms of causes of death. Boyce (1990: personal communication) has noted that within the St. Thomas sample, there are two cases in which there are tombstones and name plates for two individuals who are not listed in parish records. In addition, in some instances, cause of death is assumed, i.e. complications arising from childbirth (Boyce 1990). This has implications for recording causes of death in cases in which the cause is either unknown or is known and may not be recorded for reasons of "delicacy", as in the case of syphilis.

The medical technology of nineteenth century Canada differed substantially from our current practices. As Cassel (1987:25) points out, chemical and microscopic tests were rarely utilized and physicians relied primarily on observation. This may have implications in the diagnosis of syphilis in nineteenth century Ontario and in statistics concerning the actual numbers of individuals affected with the disease.

Hackett (1983:113,114) has noted that syphilis in long bones can be recognized by expansion of the bone concomitant with superficial cavitation, and frequently, "...longitudinally striated surfaces". The cortical thickening and sclerotic bone associated with syphilis is observable not only macroscopically, but can also be seen in x-rays. Areas of rarefaction in the long bones demonstrate the extent of the destruction. In addition, one other criterion diagnostic of syphilis and evident in x-rays is the involvement of the endosteal surfaces of the bones, often to the extent that the medullary cavity is the site of sclerosis (Malcolm cited in Morse 1969:56). These characteristics were observable in the cases of syphilis within the St. Thomas sample. One elderly female exhibited the "classic" signs of tertiary syphilis, including gummatous lesions and stellate scars of the skull. Photographs and radiographs of some of them are contained in Appendices 1 and 2.

VI Overall Distribution of Traumatic Injuries

The variables UNHLFRAC (unhealed fractures, all sites), HLFRAC (healed fractures, all sites), DISLOCATION and SPONDYLOLYSIS were combined to form the variable, TRAUMA. Twenty-eight of 104 females and 60 of 146 males exhibit evidence of traumatic injuries.

The line graph in Figure 15 illustrates the number of males and females exhibiting traumatic injuries (all types, all sites) by decade, compared to unaffected individuals.. Sixty of 146 males and 28 of 104 females are affected. The the peak age for traumatic injuries for males falls between the ages of 50-69. For females the peak age for traumatic injuries appears to fall within the 40-49 year age group.

Trauma by Decade
Males & Females (# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	3	16	2	16
17-39	17	29	2	16
40-49	17	20	9	14
50-59	14	11	8	17
60-69	6	5	6	5
70-79	1	3	0	1
80 +	2	3	1	7
TOTAL	60 (N=146)	86	28 (N=104)	76

Trauma by Decade
% of Males (N=146) & Females (N=104)

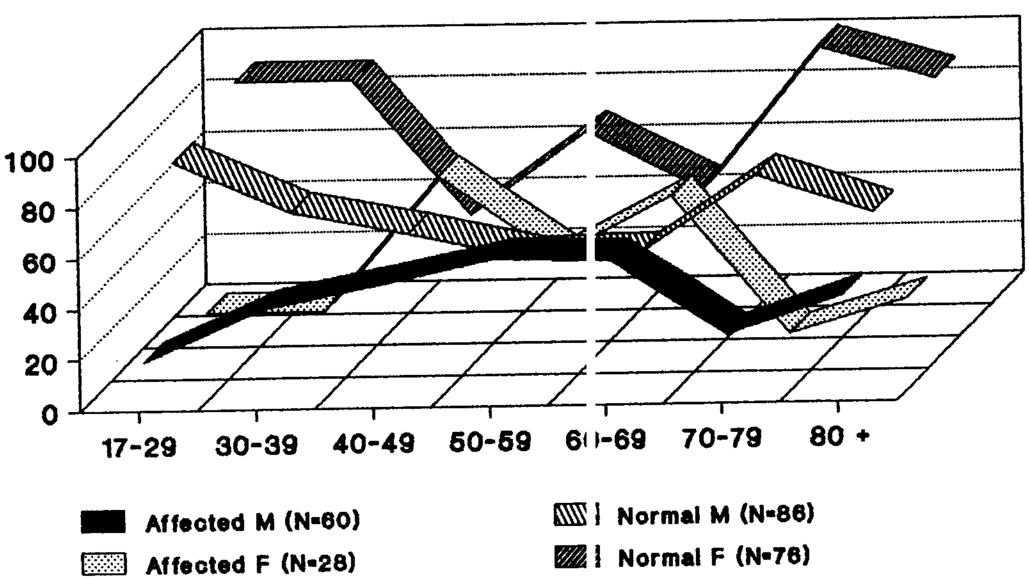


Figure 15

IV .Trauma

A) Fractures

Traumatic injuries within the Belleville sample include both healed and perimortem fractures, as well as several cases of dislocation and spondylolysis, and one case of iatrogenic trauma. Healed fractures within the sample include fractures of the following bones: metacarpals, tibiae, metatarsals, nasal bones, vertebrae (compression fractures), skulls, fibulae, clavicles, distal radii (Colle's fractures), femora, scaphoic ("waist" fractures), humerae, capitate, sternum, ulnae, cuneiform and hand and foot phalanges. Perimortem and unhealed fractures include humerus, vertebrae, fibula, tibia and skull.

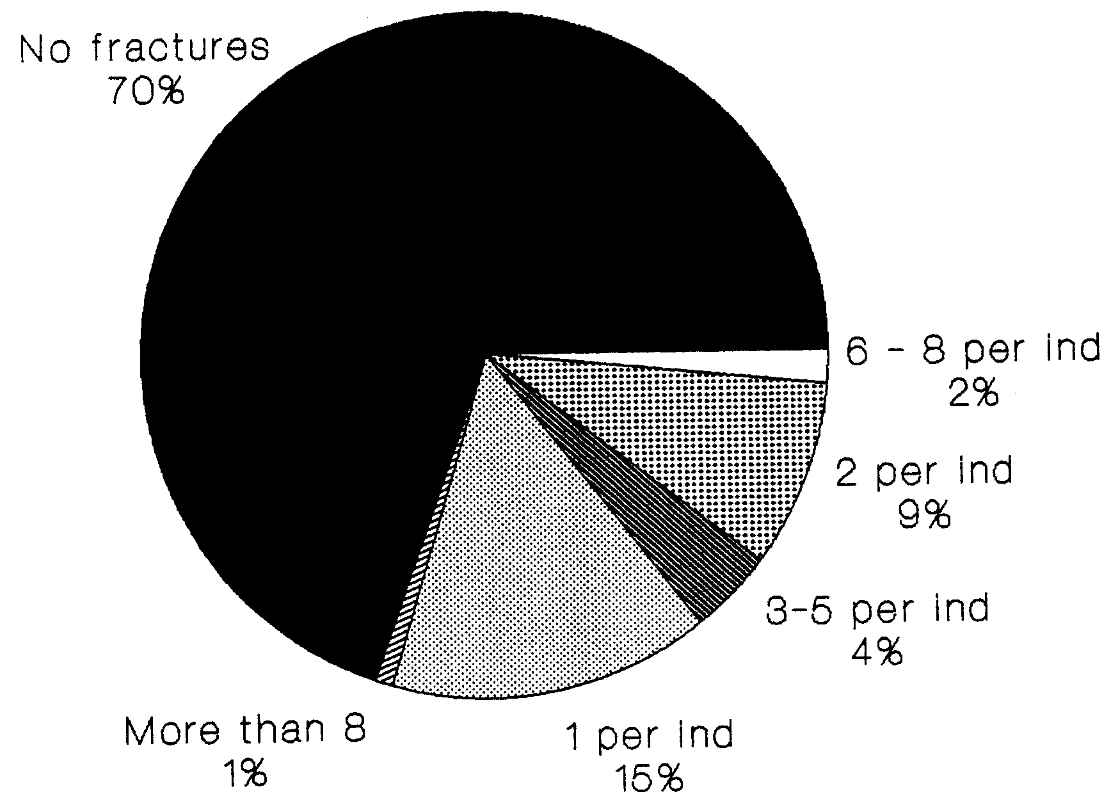
One of the disadvantages inherent in any analysis of skeletal samples concerns the difficulty of determining the age at which an individual may have suffered a traumatic injury, such as a fracture or dislocation. As Lovejoy and Heiple (1981:537) point out, knowing the age at death of the individual does not provide us with information about the time period that has passed since the injury was sustained (an exception is a perimortem injury, occurring at or shortly prior to, death). Murphy et al (1990) analyzed a large sample (N = 800) bones from a Civil War anatomical collection in order to determine the rate at which bone remodelling begins after traumatic injury. Surgical records were available that documented the time lapsed since the injury. They concluded that in most cases, remodelling did not begin until approximately two weeks from the time of injury. In addition, they suggested that a differential diagnosis of perimortem trauma should be made with caution, since an absence of remodelled bone does not necessarily indicate that an individual died at the time the injury was sustained (Murphy et al. 1990). Post-mortem breakage from earth pressure poses an additional problem.

The fracture healing process is complex and variable. Weinmann and Sicher (1955 315) have suggested that in uncomplicated cases, the fracture site cannot be identified after approximately four months. However, fractures that are the result of pathological conditions within the body, such as osteoporosis, may not follow the same time period for healing since the physiological stresses of disease will continue to affect the constituents of bone (Weinmann and Sicher 1955:329). Salter (1983:364) has noted that the age of the patient is a factor in the time required for fractures to heal. This rate is most rapid between birth and late childhood: from early to late adulthood the rate at which fractures heal remains more or less constant. In cases of suspected fracture, radiographs often prove useful. It appears that within the skeletal sample from St. Thomas, healed fractures are easily observable, possibly as a result of a lack of access to medical expertise in proper bone setting.

It would be advantageous to be able to correlate the occurrence of traumatic injuries with specific age cohorts in order to gain a clearer picture of the cultural and occupational stresses within a particular skeletal sample. A lack of this information, however, does not totally negate what paleopathologists can glean from observations of healed trauma.

Figure 16 illustrates the incidence of both healed and unhealed fractures for males and females combined (30%), compared to non-affected individuals (70%). Seventy-six of 250 (30%) individuals demonstrate evidence of either healed or unhealed fractures.

Incidence of Fractures per Ind.
M/F Combined



N = 76/250 Ind.

Figure 16

The variables HLFRACUP (healed fractures, upper skeleton), and HLFRACLO (healed fractures, lower skeleton) were combined to form the variable HLFRAC (healed fractures, all sites). The distribution pattern of healed fractures differs slightly in this overall picture. Twenty-three of 104 females and 58 of 146 males show evidence of healed fractures, all sites. A breakdown by age cohorts and sex is found in Figure 17.

Healed Fractures (All)
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	2	16	2	16
30-39	16	30	2	16
40-49	17	20	8	16
50-59	14	11	7	18
60-69	6	6	4	7
70-79	1	3	0	1
80 +	2	8	0	5
TOTAL:	58	88	23	81
	(N=146)		(N=104)	

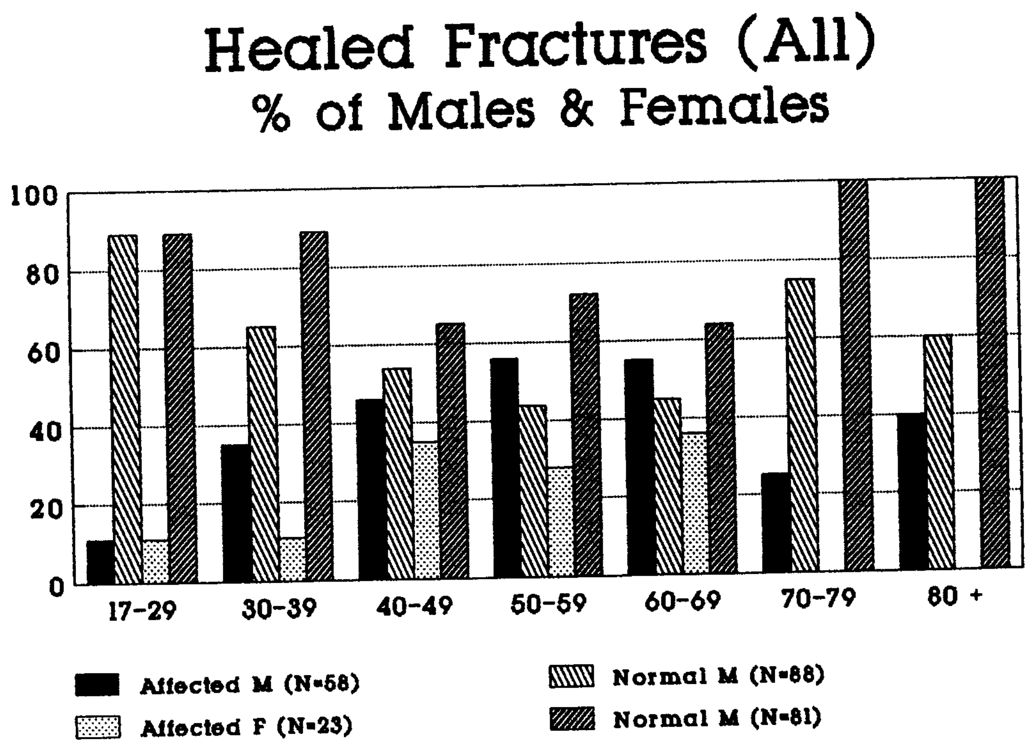


Figure 17

Figure 18 illustrates the differences between males and females in regard to fractures (both healed and unhealed, all sites). Twenty-eight of 104 females and 69 of 146 males demonstrate evidence of either healed or unhealed fractures. For males, the peak period for fractures (both healed and unhealed) appears to be within the 40 to 49 year age group, based upon number of affected individuals (21/37). For females, the risk of fractures is highest within both the 40 to 49 and 50 to 59 year age groups, although the total number of females affected is much lower (28 of 104).

Figure 19 illustrates fractures by decade for males and females by proportion, compared to unaffected individuals. Males in the 50-59 year age group are at high risk for fractures; females between the ages of 40 and 70 are more at risk for fractures, compared to other age groups.

Fractures by Decade
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	2	16	2	16
30-39	20	26	2	16
40-49	21	16	10	13
50-59	16	9	10	15
60-69	7	4	4	7
70-79	1	3	0	1
80 +	2	3	0	8
TOTAL	69	77	28	76
	(N=146)		(N=104)	

Fractures by Decade (Healed & Unhealed)
Males and Females (# of Ind)

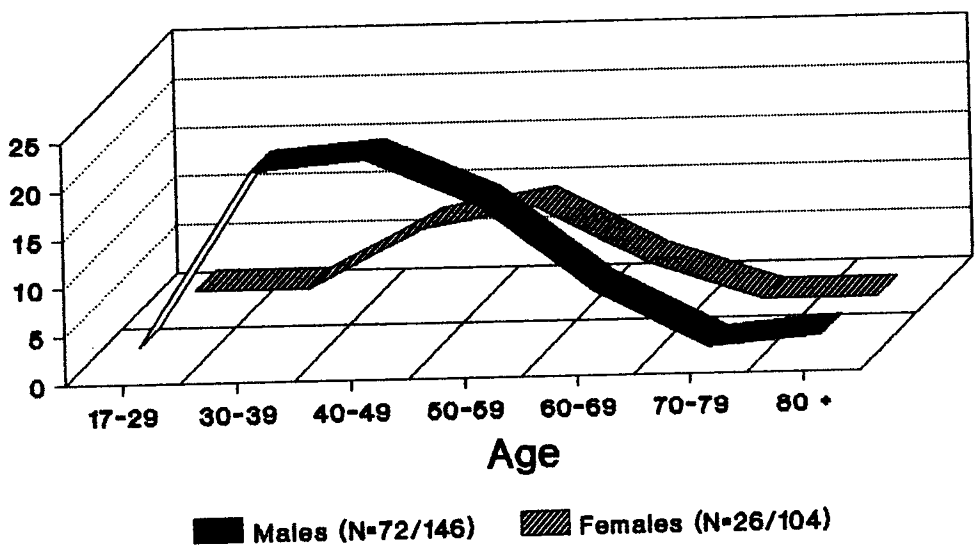


Figure 18

Fractures by Decade
% of Males (N=146) & Females (N=104)

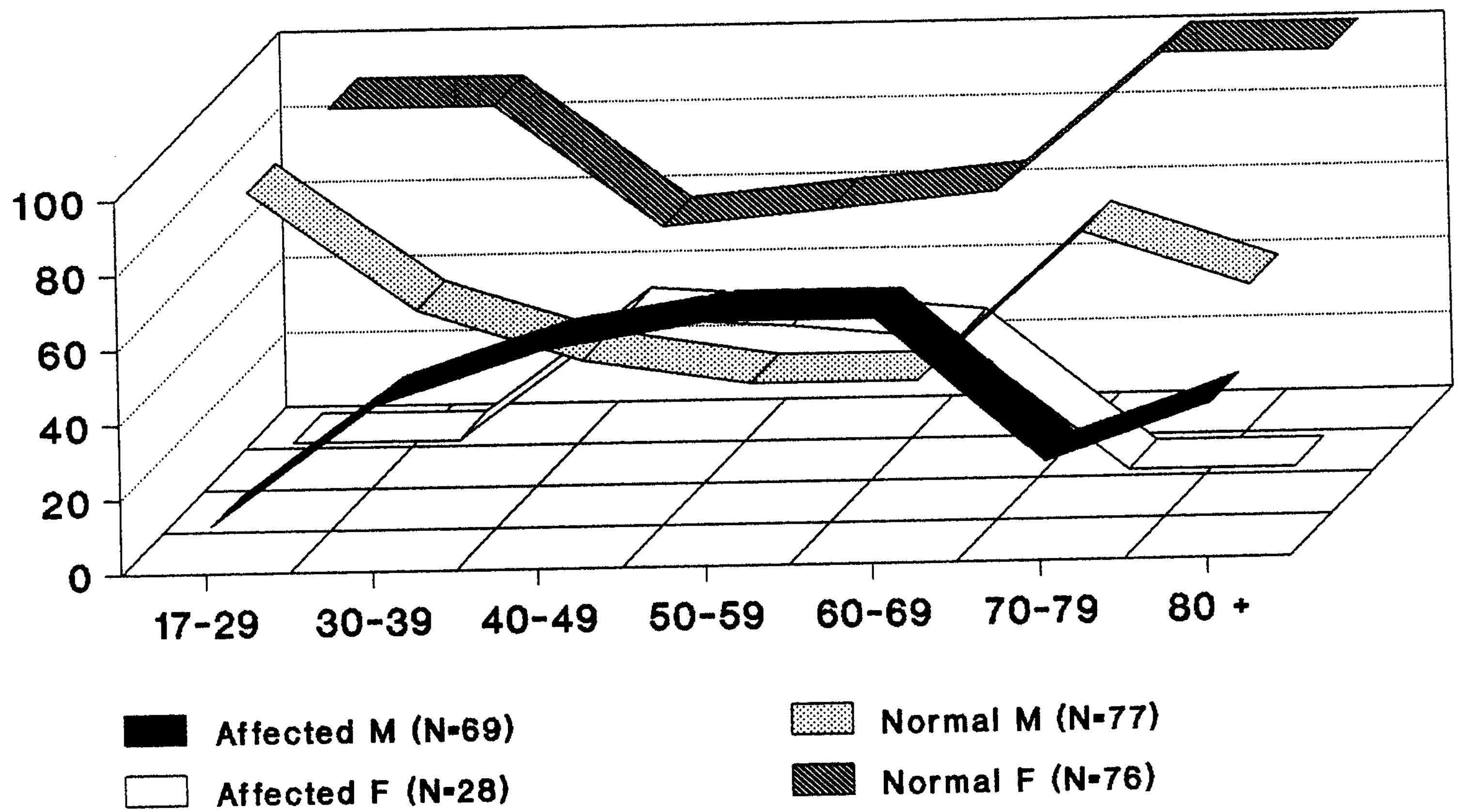


Figure 19

Lovejoy and Heiple (1981) undertook an analysis of fractures from the Late Woodland Libben skeletal sample. An analysis of fractures by years at risk demonstrated that in this prehistoric population, fractures tended to peak at two points, early adulthood and old age (Lovejoy and Heiple 1981:538). The researchers suggested that most fractures were the result of accidental trauma since there were few differences between males and females in the incidence of fractures in either age category. The type and distribution of fractures (i.e. Colle's fractures of the radius, compression fractures of the neck of the femur) also suggests trauma from accidental causes (Lovejoy and Heiple 1981:539). Occupational risks may account for the differences between the sexes in regard to the peak decade in which fractures are the most common in the St. Thomas sample.

Within the St. Thomas sample, there are several perimortem and unhealed fractures. Two of 104 females exhibited unhealed fractures of the upper skeleton (UNFRACUP) Both of these fall within the 50 to 59 year age group. One of these fractures was of the left humeral shaft, and the other was perimortem damage to the transverse processes of the fourth, fifth, sixth, eighth and ninth thoracic vertebrae.

Only 1 of 146 males exhibits a perimortem fracture of the upper skeleton, a 39 year old with radiating fractures of the right parietal, temporal, zygomatic and sphenoid bones.

One of 104 females exhibits an unhealed fracture of the lower skeleton, a 55 year old with an unhealed fracture of the left tenth rib. Two of 146 males exhibits unhealed fractures of the lower skeleton. One, a 54 year old, demonstrates an unhealed spiral fracture of the proximal left femur, with the beginnings of a pseudoarthrosis. The second, a 44 year old, exhibits a probable perimortem comminuted fracture of the proximal left tibia and a perimortem fracture of the right mid-fibular shaft.

Unhealed (perimortem) fractures of both the upper and lower skeleton affect a total of five individuals within the St. Thomas skeletal sample.

Knowles (1983:61) has suggested that fractures are important because they reveal information about behaviour and occupation. As an example, he notes that traumatic injuries to the ankle and foot occur frequently among individuals involved in occupations that place heavy stresses on the knee and hip (Knowles 1983:66). Fractures to the tarsal and metatarsal bones are present in several individuals from the St. Thomas sample. One particular type of fracture exhibited in the St. Thomas skeletal sample is the "march" fracture of the metatarsal. This type of fracture typically occurred historically as the result of long marches by soldiers (Revell 1986:214). Information obtained from parish records for St. Thomas indicates that several individuals participated in the Rebellion of 1837 (Boyce 1990: personal communication) suggesting that this type of fracture might be expected to occur within this sample.

One type of fatigue fracture of the ribs is thought to be associated with occupational hazards, including "...forking farm manure" (Kitchin cited in Revell 1986:215). Healed rib fractures are common among the St. Thomas skeletal sample and may represent occupational stresses associated with the rigors of pioneer life. There are numerous events recorded in historical documents, including parish records and newspapers that suggest that occupational hazards occurred frequently in the lives of nineteenth century Ontarians (See Section V)

Figure 20 illustrates the distribution of healed fractures of the upper skeleton (HLFRACUP) within the St. Thomas sample, by age and sex. Fifteen of 104 females and 50 of 146 males exhibit healed fractures of the upper skeleton.

HLFRACUP
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	2	16	1	17
30-39	13	33	2	16
40-49	16	22	4	19
50-59	11	14	6	19
60-69	6	6	2	9
70-79	1	3	0	1
80 +	2	3	0	8
TOTAL	50	96	15	89
	(N=146)		(N=104)	

Healed Fractures - Upper
% of Males & Females

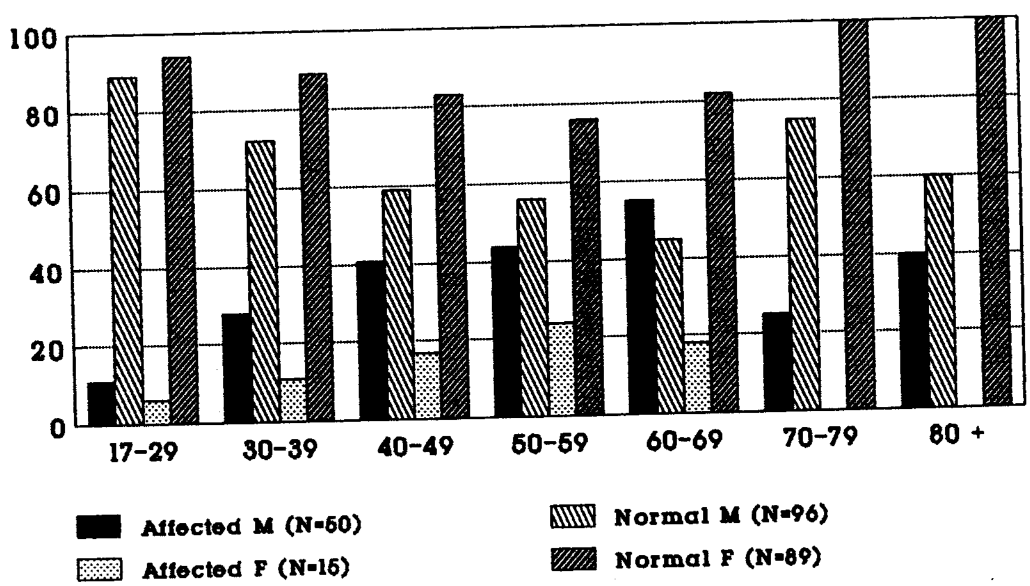


Figure 20

Eight of 104 females and 17 of 146 males demonstrate evidence for healed fractures of the lower skeleton. A breakdown by age cohorts and sex is found in Figure 21.

HLFRACLO
(# of Ind)

AGE	AFFECTED MALES	NORMAL MALES	AFFECTED FEMALES	NORMAL FEMALES
17-29	0	18	1	17
30-39	6	40	0	18
40-49	6	31	4	19
50-59	4	21	1	24
60-69	1	10	2	9
70-79	0	4	0	1
80 +	0	6	0	8
TOTAL	17	129	8	196
	(N=146)		(N=104)	

Healed Fractures - Lower
% of Males & Females

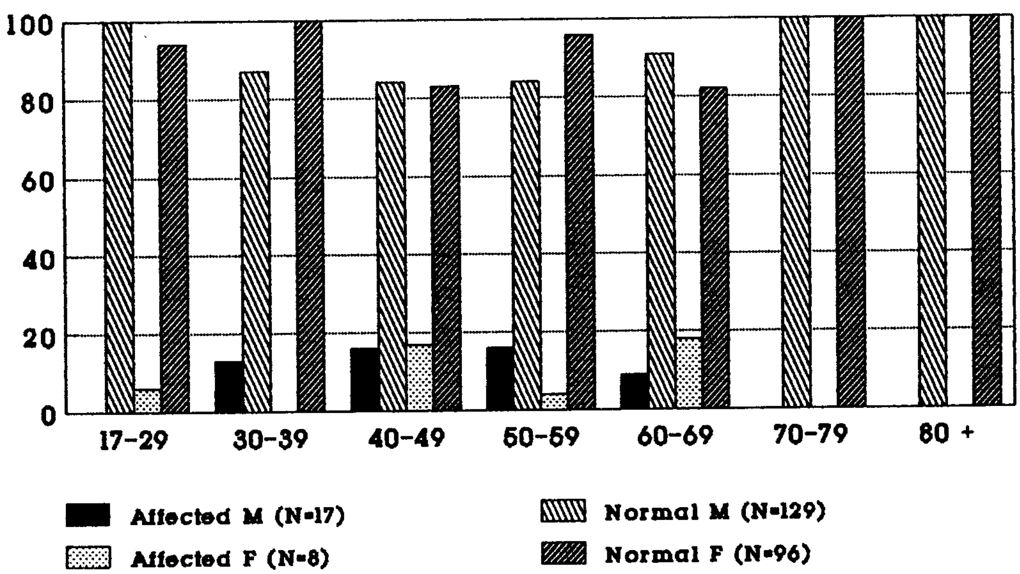


Figure 21

B) Pseudarthroses

The occurrence of pseudarthroses as the result of fracture may result from a variety of factors: failure to immobilize the broken fragments of the bone, or what Weinmann and Sicher (1955:330) refer to as "...a decrease in regenerative capacity of the patient...". This may reflect the normal aging process with its subsequent reduction in the ability of the body to recuperate from disease and injury, or it may reflect the degree of distance between the two bone fragments: too great a distance between bone fragments in fracture cases that have no medical intervention may result in a failure to unite (Weinmann and Sicher 1955:330). Non-union of a fracture is usually the result of either a failure to immobilize the broken bone or immobilizing it for a period insufficient to permit complete healing, or malalignment of the fragments during setting (Lichtenstein 1970:5).

There are two cases of pseudarthrosis within the sample, both of the femora. One case is a male, aged 54 and the other occurs in an individual whose age and sex are undetermined. In an early paper by Broca (1918:16), he observed that the persistence of the osteogenic process was responsible for the delayed union of two fragments of a fractured bone. However, he also pointed out that it is often difficult to ascertain the difference between a delay in the union of the two fragments and the actual formation of a false joint (Broca 1918:16). Like spondylolysis, cases of pseudarthrosis within the St. Thomas sample may reflect the rigors of pioneer life, although the small sample size (N=2) makes it impossible to draw any conclusions. Although a complete fracture of the femur would tend to immobilize the affected individual for a period of time, pseudarthroses might have occurred in these individuals if fracture healing was incomplete when activity recommenced.

C) Dislocation

There are several probable cases of dislocation within the St. Thomas sample, including those of the hip, humerus and one of a metatarsal. Two of 104 females and 2 of 146 males exhibit dislocations.

D) <u>Spondylolysis</u>

There is evidence for spondylolysis of the fifth lumbar vertebra in both males and females within the St. Thomas skeletal sample. Some authors have suggested a congenital basis for the condition (Ubelaker 1978; 1989; Turkel 1989:120), although others have suggested that the frequency of spondylolysis increases with age and that physical stress is a major factor in contributing to the condition (Merbs 1983 cited in Merbs 1989:170; El-Najjar and McWilliams 1978:169). Still others feel that both mechanical and genetic factors are involved in the development of spondylolysis (Bridges 1989:325). The occurrence of spondylolysis is not group-specific and it has been found globally (El-Najjar and McWilliams 1978:169).

Thieme (cited in Kennedy 1989) has noted that both spondylolithesis and [spondylosis] spondylolysis occur more frequently in males than in females and is a reflection of the heavier physical tasks usually performed by males. In 1966, Moreton reviewed approximately 32,000 cases of spondylolysis and found that the fifth lumbar vertebra was affected in 91.2% of all cases (El-Najjar and McWilliams 1978:169). Stewart, in 1953, studied 786 Alaskan Eskimo skeletons and found spondylolysis in 26.3% of them (El-Najjar and McWilliams 1978:169).

Spondylolysis is evident in the fifth lumbar vertebrae of 2 of 104 females and 4 of 146 males within the St. Thomas skeletal sample.

E) Iatrogenic Trauma

One subadult demonstrated clear evidence of iatrogenic trauma, but age and sex are undetermined. In this individual, the skull has been cut transversely above the eye orbits, a sign indicative of autopsy (Waldron and Rogers 1987:126). There is no evidence of pathological changes to the skeleton and the cause of death is unknown for this individual.

Although historical documentation from newspaper articles demonstrates that amputations were performed occasionally by nineteenth century Ontarian physicians, there is no evidence of amputation within the St. Thomas sample. Reports of amputations from early issues of the local newspapers, including the Intelligencer, describe serious accidents that occurred in Belleville.

VII Discussion of Statistical Analysis

The first null hypothesis to be tested in this analysis states that there are no differences between males and females in terms of either infectious disease or traumatic injuries. If sex and the incidence of infectious disease and/or traumatic injuries within the sample are dependent upon each other, then we would expect that the significance values would be small. A significance level of 0.05 or less suggests that the incidence of the variables for infectious disease and/or trauma are influenced by the sex of the individual. In this analysis, cases that are either missing data for the skeletal element being analyzed, or are of undetermined sex are not included. Tests were not run for those variables which lacked cases for either males or females.

The second null hypothesis to be tested states that there are no age differences between males and females in terms of either infectious disease or traumatic injuries. Again, a significance level of 0.05 or less suggests that the incidence of the variables of infection and trauma are influenced by the age of the individuals.

Table 6 illustrates the statistical values for each of the variables assigned for both infectious disease and traumatic injuries within the St. Thomas sample, by sex. The significance (probability) value of .0800 (.0550 before Yates

Correction) for ACNONUP approaches but does not reach the critical level of significance. The significance value of .0007 (.0004 before Yates Correction) for the variable, HLFRACUP suggests that males and females differ significantly in the incidences of healed fractures of the upper skeleton.

When the variables are pooled (Table 6), the differences between males and females in terms of healed fractures and trauma in general become more apparent. The significance value of .0052 (.0034 before Yates Correction) for HLFRAC (HLFRACUP + HLFRACLO), suggests that males are much more at risk for fractures in general. In addition, the significance value of .0294 (.0207 before Yates Correction) for TRAUMA (HLFRACUP, HLFRACLO, UNFRACUP, UNFRACLO, DIS, and SPON) suggests that males differ significantly from females in regard to the occurrence of traumatic injuries in general.

In particular, there appears to be a trend of more healed fractures in males. While females appear to have a slightly higher frequency of active, non-specific infection of the upper skeleton, this is not a statistically significant difference.

The statistical values by sex for trauma in different skeletal sites are illustrated in Table 7. Although the sample sizes are relatively small, there appears to be a difference in the incidences of traumatic injuries between males and females in the thorax (significance level of .0155,

.0084 before Yates Correction). While fractures of the hand for males and females approaches the critical level of significance (.0971, .0513 before Yates Correction), it cannot be said that there is a real difference in hand fractures between males and females. Males are more at risk for traumatic injuries in the thorax and this may reflect occupational stresses.

Table 8 illustrates the values for infection by sex and skeletal site. The small sample sizes for each site make analysis difficult, but there does not appear to be any major differences between males and females in terms of infection when analyzed by skeletal site.

Table 9 illustrates the statistical breakdown of infectious disease and traumatic injuries by two age groups: those under 50 years of age (by sex), and those over 50 years of age (by sex). Fisher's Exact Test was employed when cells had fewer than 5 individuals. There do not appear to be any major differences between males and females in the incidences of either infection or trauma when analyzed by age cohorts of under 50 years or over 50 years of age. This suggests that age is not a factor in the occurrence of either infection or traumatic injuries as sex is shown to be (see Table 6).

Healed fractures of the upper skeleton (HLFRACUP) are proportionately higher in older individuals (57% compared to

29% of individuals under the age of 50). Given the fact that living longer provides more opportunities to sustain traumatic injuries we might expect this, however, the statistical analysis does not support this. In females, pathological fractures often occur as the result of bone weakened by osteoporosis, however, again, the statistical analysis does not support this. Larger sample sizes may help, but this is uncertain. In males, the higher percentage of fractures of the upper skeleton are likely occurring in the region of the thorax (see Table 7) and may reflect occupational stresses during life.

It is possible to analyze both males and females in under and over 50 year age groups, but the frequencies in each variable suggest that no great differences between groups will result, with the exception of healed fractures of the upper skeleton (HLFRACUP).

The first null hypothesis can be partly rejected on the basis of statistical analysis: there appears to be a difference between males and females in the incidence of healed fractures of the upper skeleton, particularly the thorax, but there is no statistically significant difference between males and females for infection in general, or by skeletal site.

The second null hypothesis may be acceptable on the basis of the statistical analysis: there are no differences between males females under and over 50 years of age.

Part of Lovejoy and Heiple's analysis of traumatic injuries within the Libben population can be compared to the St. Thomas sample. Their study revealed that fractures of the ulna were present in 9 individuals at a mean age of 37 for males, and 45 for females (N= 9/351). Fractures of the radii in their sample were present in 15 individuals at a mean age of 41 for males and 46 for females (N=15/369)(Lovejoy and Heiple 1981:535). They attribute the occurrence of ulnar fractures at this rate (which they suggest is high) to injuries as the result of falls.

The Prospect Hill cemetery in Newmarket is contemporaneous with the St. Thomas sample. The analysis of the 77 individuals from Prospect Hill by Pfeiffer et al (1991) reveals no cases of severe bone infection. Within the St. Thomas sample there are cases of syphilis and tuberculosis, and non-specific infections, primarily of a mild nature. There are no cases of osteomyelitis in either the Prospect Hill or St. Thomas samples. Healed fractures and pseudoarthroses are present in both samples. Pfeiffer et al (1991:10) suggest that within the Prospect Hill sample, "...there is minimal evidence for medical care...". The cases of poorly aligned healed fractures and pseudoarthroses within the St. Thomas sample also reflect this lack of access to medical care (see Chapter 4).

Overall, however, within the St. Thomas sample, males appear to demonstrate more traumatic injuries than females.

Table 6
Infectious Disease and Traumatic Injuries
Significance by Sex

	M (N=146)	F (N=104)	Chi Square	Degrees of Freedom	Significance	
ACNONUP	20	24	3.06515	1	.0800	
(n.s)			3.68344	1	.0550	BYC
ACNONLO	16	14	.16221	1	.6871	
(n.s)			.36023	1	.5485	BYC
HLNONUP **	4	2	.00000	1	1.0000	
(n.s)			.17292	1	.6775	BYC
HLNONLO	10	11	.66585	1	.4145	
(n.s)			1.09681	1	.2950	BYC
HLFRACUP	50	15	11.39621	1	.0007	
*			12.40514	1	.0004	BYC
HLFRACLO	17	8	.66042	1	.4164	
(n.s)			1.05374	1	.3046	BYC
UNFRACUP **	1	3	.73089	1	.3926	
(n.s)			1.86660	1	.1719	BYC
UNFRACLO **	2	1	.00000	1	1.0000	
(n.s)			.08541	1	.7701	BYC
DIS **	2	2	.00000	1	1.0000	
(n.s)			.11806	1	.7311	BYC
SPON **	4	2	.00000	1	1.0000	
(n.s)			.17292	1	.6775	BYC
TB **	5	7	.81937	1	.3654	
(n.s)			1.45279	1	.2281	BYC
SYPH **	2	2	.00000	1	1.0000	
(n.s)			.11806	1	.7311	BYC

Table 6 (Continued)

Pooled Variables

ACNON	33	31	1.29870	1	.2545	
(n.s)			1.65537	1	.1982	BYC
HLNON	13	11	.05051	1	.8222	
(n.s)			.19584	1	.6581	BYC
HLFRAC	58	23	7.81487	1	.0052	
*			8.60013	1	.0034	BYC
UNFRAC **	3	3	.00001	1	.9973	
(n.s)			.17855	1	.6726	BYC
TRAUMA	60	28	4.74530	1	.0294	
*			5.34861	1	.0207	BYC
INFECT	51	45	1.44988	1	.2285	
(n.s)			1.78496	1	.1815	BYC

BYC - before Yates Correction
* - Statistically significant
n.s. - not statistically significant
** - Fisher's Exact Test

Table 7 Traumatic Injuries by Skeletal Site - Males & Females (Includes healed & perimortem fractures, dislocations & spondylolysis)

	Chi Square	Degrees of Freedom	Signif.	M	F
Skull	2.37487	1	.1233	9/130	1/80
	3.51447	1	.0608 BYC		
Clavicle	.80461	1	.3697	1/146	3/100
	1.98857	1	.1585 BYC		
Scapula	.00000	1	1.0000	1/143	1/97
	.07692	1	.7815 BYC		
Thorax	5.86151	1	.0155	21/137	4/93
	6.95317	1	.0084 BYC		
Vertebrae	.00906	1	.9242	6/143	3/97
	.19482	1	.6589 BYC		
Pelvis	TEST NOT RUN			0/142	1/96
Humerus	.00000	1	1.0000	2/143	1/99
	.07212	1	.7883 BYC		
Ulna	.26540	1	.6064	4/144	1/101
	.94896	1	.3300 BYC		
Radius	.00000	1	1.0000	8/143	5/98
	.02762	1	.8680 BYC		
Hand	2.75306	1	.0971	11/134	2/94
	3.79995	1	.0513 BYC		
Patella	.00000	1	1.0000	1/141	1/94
	.08405	1	.7719 BYC		
Femur	.20593	1	.6500	4/139	1/92
	.83830	1	.3599 BYC		
Tibia	.86067	1	.3536	8/130	2/83
	1.58718	1	.2077 BYC		
Fibula	.18051	1	.6709	6/141	2/88
	.63172	1	.4267 BYC		
Foot	.05305	1	.8178	5/131	2/87
	.38759	1	.5336 BYC		

Table 8
Infection by Skeletal Site - Males & Females

	Chi Square	Degrees of Freedom	Significance	M	F
Skull	2.64197	1	.1041	17/138	21/100
	3.25685	1	.0711 BYC		
Clavicle	.00000	1	1.0000	1/146	1/98
	.08118	1	.7757 BYC		
Scapula	.03293	1	.8560	4/146	4/100
	.29961	1	.5841 BYC		
Thorax	.00371	1	.9514	8/124	5/94
	.12228	1	.7266 BYC		
Vertebrae	.10116	1	.7504	1/138	2/96
	.82580	1	.3635 BYC		
Pelvis	.08814	1	.7666	5/146	5/100
	.39153	1	.5315 BYC		
Humerus	.23670	1	.6266	4/145	1/99
	.89612	1	.3438 BYC		
Ulna	TEST NOT RUN			3/143	0/100
Radius	.00000	1	1.0000	4/139	3/96
	.01202	1	.9127 BYC		
Hand	TEST NOT RUN			2/125	0/92
Patella	.12000	1	.7290	1/141	2/95
	.88140	1	.3478 BYC		
Femur	.13491	1	.7134	6/141	6/97
	.44720	1	.5037 BYC		
Tibia	.48807	1	.4848	16/138	15/96
	.80037	1	.3710 BYC		
Fibula	1.73656	1	.1876	4/139	7/93
	2.66658	1	.1025 BYC		
Foot	.00000	1	1.0000	6/112	4/89
	.00032	1	.9857 BYC		

BYC - Before Yates Correction

Table 9
Infectious Disease and Traumatic Injuries
Significance by Age Groups and Sex
Under 50 years/Over 50 years Males (N=146)/Females (N=104)

	<50 M	<50 F	>50 M	>50 F	Chi Sq.	Degrees of Free.	Signif.
ACNONUP	15/104	17/65	4/37	7/32	.06436 .36675	1 1	.7997 .5488 BYC
ACNONLO	13/104	8/65	3/37	6/32	1.07781 2.06633	1 1	.2992 .1506 BYC
HLNONUP	2/104	1/65	2/37	1/32	.80000	1 Tail	*
HLNONLO	7/104	7/65	3/37	2/32	.55573	1 Tail	*
HLFRACUP	30/104	8/65	18/37	7/32	.10963 .40121	1 1	.7406 .5265 BYC
HLFRACLO	12/104	6/65	5/37	2/32	.00000 .05252	1 1	1.0000 .8187 BYC
UNFRACUP	TEST NOT RUN						
UNFRACLO	TEST NOT RUN						
DIS	TEST NOT RUN						
SPON	TEST NOT RUN						
TB	4/104	5/65	1/37	2/32	.63636	1 Tail	*
SYPH	TEST NOT RUN						

* Fisher's Exact Test

Table 9 (Continued)

POOLED VARIABLES

TRAUMA *						
37/104	21/65	15/37	13/32	.45315	1	.5008
				.82537	1	.3636 BYC
INFECT **						
38/104	12/65	29/37	13/32	.26155	1	.6091
				.55752	1	.4553 BYC

* Includes HLFRACUP, HLFRACLO, UNFRACUP, UNFRACLO, DIS, & SPON

** Includes ACNONUP, ACNONLO, HLNONUP, HLNONLO, TB, & SYPH

NB - Number of individuals in pooled variables may not match tally of individual variables when combined since some individuals may appear in more than one category.

VIII Correlation Between Skeletal Evidence and Historical Documentation

A) Identified Individuals

Approximately seventy three individuals have been identified within the St. Thomas skeletal sample. This identification includes name, age, sex and burial number. (Boyce 1990: personal communication). Of these seventy three individuals, causes of death, recorded from parish records, are available for seven adults. The details of each burial will be discussed. The causes of death for these individuals were those listed in parish records that were kept by the succession of ministers of St. Thomas Anglican Church and transcribed by Gerald Boyce of Belleville, Ontario.

Burial number 548 is a male, aged 61 who died February 27th, 1834. According to parish records James Liddle was killed in a lumbering accident. Specifically, he "...died...in consequence of a blow he received from a small tree against which, a tree he had chopped down fell..." (Boyce 1990). My analysis reveals that this individual exhibits well healed rib fractures to the left third, fourth and eighth ribs, and to the right sixth and seventh ribs. No perimortem injuries were observable in this individual. Based upon the method of rating preservation quality, preservation was poor, and most of the bones were fragmentary as the result of post-mortem, not peri-mortem damage.

Burial number 156, according to parish records, could be either of two individuals. One of them might have been Jethro Taylor, who died July 20, 1838 (age unknown) after having been in a house that was struck by lightning (Boyce 1990). Alternatively, this individual could have been John K. Thompson, who died March 5, 1847 (age unknown) of smallpox (Boyce 1990: personal communication). No pathological changes were observed in the remains of this individual.

Burial number 115 is a male, aged 27, Dr. Charles R. Potts, who died December 17th, 1863 of exposure. According to parish records, the doctor was on his way to visit a patient, when he broke through the ice of a small lake he was crossing (Boyce 1990). The December 18th, 1863 issue of The Intelligencer reported the incident:

> ...The Dr. who had been across Stoco Lake to see a patient, was on his way home, and when near the shore the ice gave way, and he went down. He regained the ice again, but in a perfectly exhausted condition, and no help being near he died from exhaustion and exposure.
> (The Intelligencer 1863)

No perimortem injuries to bone were incurred in this event. The only evidence of pathological changes consisted of a small focal area of active periostitis was evident on the lateral side of the shaft of the distal right tibia.

Burial number 487 is a male, age 39, Thomas Burke, who died as the result of a mining accident on December 12th, 1867. Parish records indicate that the fatal accident occurred as the result of an encounter with a crushing machine (Boyce 1990: personal communication). According to an article that appeared in The Daily Intelligencer, December 16th, 1867 an inquest was held into his death:

> On Sunday, the 13th inst., an inquest was held before Coroner Gream, of Madoc, on the body of a man named Thomas Burke, who was accidentally killed at ElDorado on the day previous. It appears that Burke, who was employed as an engineer at the crushing works of Messrs. Scott & Taylor, had occasion to examine some of the higher parts of the machinery, and losing his balance, fell on to the belt, which was revolving at a rapid rate, carrying him down with such force to the ground as to break his neck. Death was instantaneous. Deceased only went from Belleville, where his family reside, about ten days ago. The verdict of the jury was "accidental death". (The Daily Intelligencer: 1867)

This individual exhibited extensive radiating perimortem fractures of the right parietal, temporal and zygomatic bones. In addition, several well healed fractures were present, including a midshaft fracture of the right fibula, a healed fracture with inferior displacement of the medial malleolus of the right tibia and a small healed fracture of the anterior portion of the sacral promontory and the inferior rim of the fifth lumbar vertebrae. Possibly any or all of these injuries might have been sustained in other industrial accidents in the years prior to Mr. Burke's death. This case is one of the clearest cases of correlation between observations of traumatic injuries and historical documentation.

Burial number 420, a female, aged 21, died June 20th, 1868, "...following childbirth" (Boyce 1990: personal communication). There is a small focal active periosteal lesion on the anterior of the left sacral ala, but no other pathological changes are present. Since many causes of death from parish records are vague, i.e. "following childbirth", we have no reliable information from which to ascertain the exact cause of death. Puerperal fever may have been the cause, or death might have resulted from other complications. If puerperal fever was responsible, its acute nature would likely preclude any pathological changes to bone.

Burial number 297 is male, age 75, John Turnbull who died in January of 1869 of "apoplexy" (Boyce 1990). The Belleville Intelligencer published his obituary on January 29th, 1869:

> This gentleman, as was feared, did not long survive the sudden and serious attack of illness with which he was attacked on Saturday evening...Mr. Turnbull was one of the first settlers in this section of the country, coming to Belleville when it was yet a small hamlet, witnessing its growth from a place of 100 inhabitants till it had a population of nearly 9,000 and assisting and sharing in its prosperity. (Belleville Intelligencer 1869).

This individual exhibited a healed fracture of the left capitate and the left fourth metacarpal and a focal area of active periostitis on the right tibia. The cause of death, "apoplexy", is defined in medical textbooks as "...copious extravasation of blood into an organ; often used alone to designate such extravasations into the brain...; stroke." (Miller and Keane 1987:87). No evidence of this would be observable in skeletal remains.

According to parish records, burial #160 is that of William H. Coleman who died November 13th, 1869 (Boyce 1990: personal communication). However, Mr. Coleman was buried in a cemented tomb which retained moisture at the time of excavation. This tomb was moved to Belleville Municipal Cemetery without osteological examination.

Despite the fact that it is not possible to compare historical documentation with the skeletal analysis for this individual, there is some information about Mr. Coleman's death that suggests that perimortem trauma might have been observable. According to an article in the November 19th, 1869 issue of the Belleville Intelligencer, Mr. Coleman was testing out a horse that he was considering purchasing, when the horse bolted, upsetting the carriage that Mr. Coleman was riding in:

> ...Mr. Coleman caught hold of one of the reins which suddenly drew the horses to oneside, causing the carriage partially to upset, and throwing both of the occupants violently to the ground. Mr. Coleman was picked up in an insensible condition and carried into his store close by. Dr. Knight was called, but he was already dead. It was found on examination that the neck was broken, which produced almost instant death. One of his legs was also broken a short distance below the knee. Mr. W.H. Coleman was about 39 years of age. (Belleville Intelligencer 1869).

Another individual buried within St. Thomas is Thomas McKnight, age 39, who died December 14th, 1871 (Boyce 1990). This individual is not one of the knowns that can be identified within the skeletal sample, but information from newspaper clippings suggests that perimortem trauma may be exhibited. Mr. McKnight was a switchman on the Grand Trunk Railway in Belleville and was killed while attempting to couple two railway cars. According to the article describing the event in the Belleville Intelligencer, December 15th, 1871:

> ...his hold gave way, and he fell partly across one of the rails, close in front of the advancing cars, the wheels of which, passing over him diagonally, caused instant death, mangling his body in a frightful manner.
> (Belleville Intelligencer 1871).

These are the only individuals for whom both cause of death and personal identification are known.

B) Causes of Death as Listed in Parish Records from St. St. Thomas

I Infectious Diseases

Some of the infectious diseases of the St. Thomas cemetery sample are not observable in skeletal remains. These include cholera, typhus fever, scarlet fever and similar acute epidemic diseases. They are, however, an important part of the entire picture of infectious disease affecting this population. Similarly, infectious diseases of children and adolescents leave no traces on bone, since death occurred rapidly after the initial infection.

Childhood mortality was high in mid-seventeenth to mid-eighteenth century English Canada (Siegel 1984:368). Cholera, whooping cough, measles, etc. were usually fatal to children and accounted for a large proportion of infant mortality (Siegel 1984:369). Scarlett fever was a common fatal disease for infants in the nineteenth century. Within the St. Thomas sample, 8 of 157 individuals listed with causes of death died of scarlett fever, all of them under four years of age. This represents 5% of the total number of individuals with causes of death.

The first United Empire Loyalists to arrive in the area of Belleville came in 1785, although it was not until 1789 that approximately fifty families arrived to settle in the area (Mika & Mika 1986:8). By 1816, the population of

Belleville was 150, and by the early 1830s it was approximately 1,200 (Mika & Mika 1986:17). Early sanitary conditions in Belleville were less than adequate, and this suggests that the environment was less than healthy. Mika & Mika (1986:17) describe Belleville in 1830:

> Garbage lay scattered for days in the streets and pedestrians making their way past the rubbish not only were apt to encounter a nauseating stench but more often than not, a pack of pigs scrounging through the refuse.

Causes of death for individuals buried within St. Thomas cemetery are diverse, according to parish records. Although a one to one correspondence is impossible to achieve because of the lack of identification of individuals, Table 10 lists causes of death by year (Boyce 1990:personal communication).

Although the sample sizes are small in each decade, it is interesting to note that accidents appear to account for the largest number of deaths within the St. Thomas sample when broken down by decade (from causes of death from parish records). Deaths from childbirth occur throughout the time period; cholera is highest from 1850-59.

Table 10:

Causes of Death for Adults by Year from Parish Records, St. Thomas
(Compiled by G. Boyce 1990)

	1820-29 (N=10)	1830-39 (N=11)	1840-49 (N=18)	1850-59 (N=33)	1860-69 (N=21)	1870-72 (N=4)
Infection						
Childbirth * (Total: 14)	2 (20%)	1 (9%)	4 (22%)	4 (12%)	3 (14%)	0
Consumption (Total: 4)	0	0	0	1 (3%)	2 (10%)	1 (25%)
Cholera (Total: 8)	0	0	0	8	0 (24%)	0 (25%)
Smallpox (Total 3)	0	0	1 (6%)	2 (6%)	0	0
Typhoid (Total: 1)	0	0	0	0	0	1 (25%)
Emigrant's Disease (Total: 7)	0	0	7 (39%)	0	0	0
Trauma/Accidents						
Industrial ** (Total: 11)	3 (30%)	2 (18%)	0	4 (12%)	2 (10%)	0
Falls (Total: 5)	1 (10%)	0	1 (6%)	1 (3%)	2 (10%)	0
Drowning (Total: 16)	1 (10%)	4 (36%)	3 (17%)	6 (18%)	1 (5%)	1 (25%)

Table 10.(Continued)

Other Acc. *** (Total: 13)	1 (10%)	4 (36%)	2 (11%)	2 (6%)	3 (14%)	1 (25%)
Miscellaneous **** (Total: 16)	2 (20%)	0	1 (6%)	5 (15%)	8 (38%)	0

* Includes deaths listed as "in/during/after childbirth" & "Puerperal fever"

** Includes lumbering & railroad accidents

*** Includes gunshots, knife wounds, runaway horses & carriage accidents

**** Includes apoplexy, epilepsy, exposure, sunstroke & heart failure

"Emigrant's Disease" was used to describe the cause of death for individuals who had arrived in Belleville by ship from the British Isles (Boyce 1990: personal communication). These individuals died anywhere from two days to three months after their arrival and parish records suggest that they died from some form of disease that they contracted on the voyage (Boyce 1990: personal communication). "Emigrant's Disease" has also been described as "ship fever" and this was a form of typhus fever which killed approximately 20,000 British immigrants on their voyage across the Atlantic or shortly after their arrival in Quebec (Boyce 1990). MacDougall (1983:138) discusses the impact of typhus on the populations of Upper Canada:

> With the beginning of the Great Famine in Ireland, however, fear of a typhus outbreak...as the weak, diseased immigrants left for North America. Upon the arrival in the Canadas, the newcomers were either quarantined at Grosse Isle, the government inspection station; or, if apparently healthy, sent on to their destination by the central administration. Since typhus has a twelve day incubation period, many of the immigrants reached Toronto just as the disease manifested itself.

In Toronto, in 1834, "ship fever" alone (typhus) was responsible for the deaths of approximately 500 people in one month (Population 6000) (Guillet 1963:96).

a) Smallpox

The effects of smallpox on Belleville are not entirely clear from historical documentation. Smallpox is not usually observable in the adult skeleton and in the small number of sub-adults within the St. Thomas sample who exhibited mild periostitis, no evidence of osteomyelitis associated with smallpox was observed. Although it is listed as a cause of death for at least three individuals (one in 1847, two in 1855) within the St. Thomas parish records, it appears that it never reached epidemic proportions in Belleville. In 1862, however, it was evidently a concern to some individuals within the community. The Town Council was notified that a family of German immigrants were living in unfinished quarters within town, and that seven of them were stricken with smallpox. Recommendations were made to the council to have them removed as a precaution (Belleville Intelligencer 1862).

By 1868 the situation was apparently different. A letter written by the Chairman of the Board of Health for Belleville, Dr. E. Burdett, was published in the January 15th, 1868 edition of the Belleville Intelligencer. Dr. Burdett hastened to reassure the community that "...the disease is almost extinct..." and that "...only one death has occurred in the Town since the disease first appeared..." (Belleville Intelligencer 1868). A second letter, written by the Town Clerk was published in the January 30th, 1868 issue of the

Belleville Intelligencer and served to inform the community that, indeed, smallpox was no longer a threat:

> The Board of Health has much pleasure in informing the Town Council that the Small Pox, as an epidemic, no longer exists in Belleville, the last case being now convalescent, and able to resume her ordinary avocations.
> (Belleville Intelligencer: 1867).

A notice published in the September 11th, 1868 edition of the Belleville Intelligencer informed the public that the smallpox epidemic in nearby Trenton was dying out, and that "...few cases are now occurring" (Belleville Intelligencer 1868). At approximately the same time (1868), smallpox was affecting Toronto, however, to what extent is unclear. A report of smallpox in Toronto in the February 14th, 1868 edition of the Belleville Intelligencer noted "...three deaths having lately occurred in one family from the disease" (The Intelligencer 1868). In 1870, smallpox was still present; a report in the January 28th, 1870 edition of the Belleville Intelligencer noted that the village of Newcastle (between Belleville and Toronto), was still being affected by the disease (Belleville Intelligencer 1870).

b) Cholera

The numbers of emigrants arriving in Lower Canada were highest in the early 1830's. In 1831, 34,135 emigrants arrived and in 1832, 28,204. The numbers taper off after that time, until a resurgence in 1849 (Godfrey 1968:71).

According to Godfrey (1968:12), many of the emigrants came from areas in which cholera was endemic. To complicate matters, the voyage across the Atlantic, lasting anywhere from 36 to 80 days, provided ideal conditions for the spread and maintenance of the disease: overcrowding, poor sanitation and nutritional inadequacies (Godfrey 1968:13). Once the ships arrived, the emigrants relocated to various points throughout Upper and Lower Canada: Montreal, Prescott, Cobourg, York, Brockville, Kingston, Brantford and points between. As a result of this widespread dispersal, cholera spread quickly throughout Upper Canada.

The decision to establish quarantine stations in Lower Canada was made on the basis of British information about the spread of cholera in that country (Shortt 1981:123). As a result, the Quarantine Act of 1832 was established. Subsequently, Grosse Isle was purchased as a quarantine station in 1832, although its effectiveness in limiting the spread of cholera is uncertain. The quarantine stations were established in order to keep the sick from mixing with the healthy, however, as Bilson (1983:89) notes:

> Vessels with sickness on board were detained at the station for a period after the last case appeared. Other vessels landed their passengers so they could clean themselves and their baggage while the ship was cleaned before proceeding to port. This policy had the effect, in 1832, of mixing passengers from ships with sickness on board with those from healthy craft and thus spreading the diseases it was meant to check.

Godfrey (1968:37) traces the epidemic of 1832 from its most likely point of origin, a ship from Dublin which arrived on June 3rd, 1832 at Grosse Isle, Quebec. The first case was recorded in Montreal on June 9th, and by July 8th, it had reached as far as London, Ont.

During the summer of 1832, a cholera epidemic swept through areas of Upper Canada, probably brought by immigrants arriving by ship from the United Kingdom. However, due to the posting of armed guards at roads leading from ports of entry to Belleville, the disease did not affect Belleville in epidemic proportions (Boyce 1990: personal communication). The refusal to permit any boats carrying either passengers or goods to dock undoubtedly helped to avert the impending epidemic as well.

Although relatively few deaths within the St. Thomas skeletal sample are attributable to cholera (14/157 or 9%) and the effects of the disease cannot be observed in skeletal remains, a discussion of infectious disease in the nineteenth century must include it, since it had devastating consequences for other communities within the vicinity of Belleville.

In attempting to analyze causes of death for individuals within the St. Thomas skeletal sample, there is inevitably some confusion over medical terminology. Asiatic Cholera and cholera are synonymous and both were recorded as causes of death for some individuals in the St. Thomas sample.

Marsden (1867:530) reports in an article on Asiatic Cholera, that it first arrived in Lower Canada on June 8th, 1832. This coincides with Godfrey's report of the arrival of cholera at Grosse Isle, Quebec on June 3rd, 1832 and subsequent passenger dispersals on June 7th (Godfrey 1968:14). Thus, it appears that cholera and Asiatic cholera were one and the same as a cause of death. Marsden contends that common cholera never reaches epidemic proportions, but that Asiatic cholera does (Marsden 1867:531). However, the results are the same: a swift and tortuous death.

Emigrants arriving in Upper and Lower Canada from the British Isles were often ill and for many years, no medical examinations were undertaken of departing passengers (Guillet 1963:31). Cholera and various fevers frequently caused large numbers of death on board ship, even, as Guillet (1953:32) notes, "...in non-epidemic years". There was a chronic lack of fresh fruit and vegetables, water was limited (and often contaminated), and unsanitary conditions prevailed, exacerbated by overcrowding (Guillet 1953:32). Rats were also a problem and likely carried disease.

It is interesting to trace the events surrounding the 1832 cholera outbreak from Lower to Upper Canada. In an article dated June 16th, 1832 in The Kingston Chronicle, the commissioner and other staff members returning from the quarantine station (location not specified, but probably Grosse Isle) reported that

> The rumour of there being persons at the station sick of cholera is entirely without foundation. Three persons are at the hospital sick of ordinary continued fever (The Kingston Chronicle 1832).

Further denials of a cholera epidemic are noted in the same article:

> The rumour of a death by cholera at the Emigrant Hospital in Quebec, now in circulation, is also without foundation. (The Kingston Chronicle 1832).

However, just one week later, on June 23rd, 1832, the Kingston Chronicle ran a long article on "The Asiatic Cholera":

> After announcing officially that it did not exist at Grosse Isle on Friday, we announce to-day that it does in Quebec. It existed at the time we wrote on Friday, and it has made alarming strides...

There followed an hour by hour log of events that took place since Monday, June 11th, 1832, listing locations of cholera deaths and the number of lives lost to the disease to date. A further article in the same edition, reported that Montreal was also severely affected. Suggested treatments and preventative measures to ward off the disease were given (Kingston Chronicle 1832).

There may have been some disagreement among medical practitioners in Upper Canada in regard to how contagious cholera really was. According to Shortt (1981:124), many felt that it was not truly contagious, but "...that it required an epidemic influence to develop". During the 1832 cholera epidemic in Upper Canada, medical practitioners apparently had very little additional information about the disease than did the general public. Details about the spread of the disease were published in local newspapers on a continuous basis (Shortt 1981:123).

A second cholera epidemic swept through Lower and Upper Canada in 1834. A letter written by Dr. Joseph Workman of Toronto to the Canada Medical Journal, Vol. II (1865-66:488), provides information about the spread of the epidemic.

> During the months of June and July, 1834, some vessels that had cholera amongst the passengers during the passage, arrived at Grosse isle. On the 11th of June a case occurred at this station... In about three weeks the disease was at the worst; the deaths being about seventy per diem. The total number of deaths was about 1,200.

An article appeared in the July 26th, 1834 issue of the Kingston Chronicle and Gazette, taken from the Brockville Record, July 25th. It concerned rumours of cholera in Lower Canada. Although it was acknowledged that a few cases had indeed occurred, the public was advised that there was no real cause for alarm, since the epidemic was not spreading as rapidly as it had during the 1832 outbreak.

Cholera was still a concern in the 1860's in Ontario. MacDougall (1988:62) notes that prior to the early 1860s, little attention was given to issues of public health "...except when threatened by epidemics of cholera or typhus". In 1866 the medical practitioners in Upper Canada generally agreed that cholera could be

> ..."carried by persons, effects and merchandize and even by the winds of the air and currents and streams" and that it could "make a jump over distances of several hundred miles" (Shortt 1981:127).

Whether or not this accurately reflects how cholera is spread is not crucial: the acceptance of this philosophy resulted in additional quarantine and sanitation measures to limit the spread of the disease.

Of particular concern was the infant mortality from the disease. "Cholera infantum" was the term used to describe cholera in infants (Belleville Intelligencer 1868). In an article which appeared in the Belleville Intelligencer in August, 1868, nine suggestions were given for the prevention and management of "cholera infantum". The first eight suggestions were preventive in nature: the ninth stressed that if symptoms appeared, the child should be put under the immediate care of a physician (Belleville Intelligencer 1868).

Sanitary measures were encouraged within the community in an effort to prevent, or at least contain, cholera:

> ...by a rigid quarantine, by having all filthy places thoroughly cleansed, and by the free use of disinfectants, the pestilence that walketh in darkness and that wasteth at noon-day may be prevented from visiting us.
> (Belleville Intelligencer 1868).

In 1869, concerns were raised over the town's availability of fresh drinking water. The Moira river which supplied water to the town was polluted from several sources, including cooking and manufacturing (Daily Intelligencer 1869). An article which appeared in the August 27th, 1869 issue of the Daily Intelligencer suggested that if an epidemic of typhoid fever or cholera should break out, the mortality rate within the town "...would be appalling", as the result of ingesting the contaminated water (Daily Intelligencer 1869).

This concern escalated in the 1870's. In an article concerning proposed sanitary measures for the town of Belleville, published in July, 1873, it was observed that:

> In 1849 and 1854 convincing proofs were afforded of the agency of impure water in promoting the spread of cholera, and in 1866 it was distinctly traced to the contamination of the River Lea by the drainage from a cholera house...
> (The Intelligencer 1873).

In 1876, James T. Bell, Chairman of the Board of Health for Belleville, published a thirty page pamphlet on "Epidemic Diseases and Their Prevention, in Relation to the Water Supply of the Town of Belleville". Bell was a

Professor of Mining and Agriculture at Albert University in Belleville and used his expertise in geology to make recommendations to the Town Council for the improvement of the water supply. It was not until 1879 that Bell's pamphlet became the focus of attention through a series of three rather lengthy articles published within one week in January, 1879 in The Daily Intelligencer. The author (unknown) points out that Bell's suggestions have been largely ignored:

> This pamphlet has not received the attention it deserves; and yet, if anything were needed to emphasize the views therein advanced, we have surely have had it during these three years in a very solemn form, - that of hundreds of cases of typhoid fever and its allied diseases; - even the loss of scores of lives, near and dear to many of us, - lives which appear to have been needlessly sacrificed by our criminal disregard as a community of the laws of health...
> (The Daily Intelligencer 1879).

By the 1870's the spread and prevention of cholera and other infectious diseases was generally understood. An article that appeared in the July 11th, 1873 issue of The Intelligencer, Belleville, "Memorandum on Cholera", outlined conditions that promoted the spread of the disease and how to avoid contagion:

> The local conditions that promote the propagation of cholera are: - Neglected Privies; Filthy-Sodden Grounds; Foul Cellars, and filthy or badly-drained surroundings of dwellings; Foul and obstructed house drains; Decaying and Putrescent materials, whether animal or vegetable; Unventilated, damp, and uncleansed dwellings.
> (The Intelligencer: 1873)

Regardless, the fear of contagion was still present. In an article that ran nearly a month later in The Intelligencer, residents of Belleville were still being warned of the dangers. New cases of cholera were being reported from the United States and there were fears of it spreading. The Board of Health in Belleville evidently foresaw the potential for disaster and issued regulations for the protection of the community:

> It has been proven over and over again that those Towns and Cities that strictly carry out the rules laid down by the Boards of Health, are comparatively free from the ravages of the pestilence, while neighboring localities who pay no attention to sanitary regulations suffer seriously (The Intelligencer: 1873).

II Occupational Hazards

Information obtained from Canada Census statistics includes industries located in Belleville during the time that the St. Thomas cemetery was in use. This data can be examined and analyzed within the context of possible occupational injuries seen within the St. Thomas skeletal sample. The 1851-1852 Canada Census lists manufacturing industries located in Belleville at that time (Table 11). In addition, although the number of employees are unknown, Belleville also boasted two lath factories, one shingle factory, two carriage factories, two sash factories, one paper mill and one shoelast factory. Similar information is available for Hastings County in general for the 1860 - 1861 census years (Table 12).

Table 11
Industries in Belleville from 1851-52 Census

Type of Industry	Number	# Hands Employed
Grist Mills	3	12
Saw Mill	3	31
Woollen Factories	2	4
Tanneries	1	10
Foundries	1	15
Breweries	2	8

Table 12
Industries in Hastings County from 1860-61 Census

Type of Industry	Number	# Hands Employed
Flour & Grist Mills	6	12
Saw Mills	10	12
Carding & Fulling Mills	3	27
Distilleries	2	
Paper Mills	1	
Shingle Mill	1	
Sash Factories	1	

Traumatic injuries associated with industrial accidents were not uncommon occurrences in Belleville during the nineteenth century. An article from the December 12th, 1856 edition of The Intelligencer relates the story of a boiler explosion in one of the local grist mills. Although no deaths occurred as a result of the accident, several employees were injured by falling bricks when the roof collapsed (The Intelligencer: 1856).

Several cases of death were recorded for individuals within the St. Thomas skeletal sample as the result of railroad construction accidents, and traumatic injuries were undoubtedly sustained by others. In addition, although not part of the St. Thomas sample, other local individuals suffered injury and death from such accidents. Reviewing them helps to give an overall picture of some of the occupational hazards to which the community was subjected. One such example concerns an accident which took the life of a brakesman from Belleville in May of 1856. As a result of serious injuries sustained, his left leg was amputated, however, he did not survive the operation (The Intelligencer 1856).

A report in the July 11th, 1856 edition of The Intelligencer tells of an accident involving a workman on the railroad:

> We regret to learn that on Tuesday last, one of the workmen on the Grand Trunk

> Railroad in this vicinity, was seriously injured, by having one of the dirt cars run over him, so mangling both legs that amputation was necessary. We learn that one of the legs was so nearly cut off, that it hung but by a few threads of the skin. (The Intelligencer: 1856)

An accident in November, 1857 caused serious injuries to an employee of the Grand Trunk Railway who was boarding a freight car. Although the details of the accident are unclear, the man's legs were severely mangled and amputation of both was performed by doctors in Belleville (Belleville Intelligencer 1857).

Railway accidents were not confined only to construction: there are numerous reports of passenger deaths or other accidents involving individuals within the vicinity of a passing train. One report from the October 10th, 1856 issue of The Intelligencer concerns the deaths of two men in a railroad accident on the Grand Trunk Railway not far from Belleville. Two men were killed (one had "...both his legs taken off...") (The Intelligencer: 1856) when attempting to cross the tracks in their waggon. The public was warned not "...not to venture too much upon the Railroad Track" (The Intelligencer: 1856). In July, 1869 a local railroad accident claimed the life of a brakesman who was killed when he slipped between two moving cars; in the same week, a passenger was seriously injured while attempting to board the train while it was still in motion (Belleville Intelligencer 1869).

Railway accidents, resulting either in serious injury or loss of life were frequent in Belleville and environs during the mid-nineteenth century. An article in The Intelligencer detailed the events of a railway accident of December 26th, 1856 in which a passenger train ran into a freight train that had been left on the tracks, injuring several passengers, one seriously. The article made a plea for safety, admonishing the deplorable state of rail travel:

> Accidents of this kind are becoming so frequent that a strict investigation is imperatively demanded, for unless something be done to create confidence in the Road, no one will feel safe in travelling upon it.
> (The Intelligencer 1856).

One individual, Jonathan Lawrence, died in October, 1873 as the result of falling into a drain in Belleville. According to a list of St. Thomas church burials since 1872, he was interred within the cemetery, although he is not listed in parish records (Boyce 1990). According to an article that appeared in the October 17th, 1873 edition of The Intelligencer, Mr. Lawrence evidently fell into the drain and struck his head, dying instantly (The Intelligencer 1873). Again, although it is not possible to directly correlate parish records to a specific skeleton, it is possible that perimortem trauma may have been observable in this individual.

Based on the statistical analysis of the St. Thomas sample (see Chapter 3, Section V), it appears that there is a concordance between the incidence of traumatic injuries and historical records. This is not necessarily the case for infectious disease. Because of the acute nature of many of them, skeletal manifestations are not observable and historical documentation may provide the only clues.

IX Comparison to Contemporaneous Samples

Statistics for the town of Belleville from the 1851 -1852 Canada Census indicate a population of 2314 males and 2255 females (total population 4569).

The data in Table 13 are gleaned from Canada Census (1851 -1852) which give causes of death (from trauma or infectious disease) for Hastings County, in which Belleville is located.

Table 13
Causes of Death for Hastings County 1851-1852

Total Deaths - Hastings County 1851-1852	225

Epidemic, Endemic & Contagious Disorders

Mea(z)les	6
(w)hooping cough	14
Dysentery	2
Cholera	2
Influenza	3
Fever	5
Erysipelas *	2
Scarlet Fever	9
TOTAL:	43

* A streptococcal infection characterized by fever, redness and inflammation of the skin (Miller and Keane 1987:431)

Diseases of the Respiratory and Circulating Organs

Consumption	31

Diseases of Uncertain Seat

Inflammation	6
Mortification **	2
Abscess	1
Sudden death (cause not given)	3
Accidents not specified	4

** gangrene (Miller and Keane 1987:781)

While not all of the individuals who died between 1821 and 1874 and were removed from St. Thomas cemetery have causes of death listed in parish records, for the years 1851 - 1852, one of the deaths listed for Hastings County for cholera was buried in St. Thomas cemetery. In addition, one individual from the St. Thomas cemetery died in a vehicle accident that occurred in 1852 and this is included in the "accidents not specified" category.

Causes of death (infectious diseases) for Hastings County for the census years 1860 - 1861 include:

measles	5	influenza	4
scarlet fever	3	continued fever	10
hooping cough	1	typhus fever	5
cholera	1		

No records of deaths from infectious diseases from St. Thomas cemetery for 1860 - 1861 are recorded in the parish records. Two deaths from traumatic injuries were listed for 1861, one as the result of a fall, and the other as the result of an industrial accident. This re-inforces the need to use caution when attempting to reconstruct the health status of a community from historical documentation alone. Records are frequently vague or lacking.

Tables 14, 15 and 16 provide population statistics and causes of death for the counties of York and Prince Edward and the Cities of Toronto and Kingston from Canada Census records for 1851 - 1852 and 1860 - 1861 and can be compared to data for Belleville.

Table 14:
Population Statistics - 1851-52/1860-61

Region	Population (M & F) 1851 - 1852	1860 - 1861
Hastings C.	31,977	44,970
York C.	48,944	59,674
City of Toronto	30,775	44,821
Prince Edward C.	18,887	20,860
City of Kingston	11,697	13,743

Table 15
Causes of Death (1851 - 1852)

	City of Toronto	York County	City of Kingston	Prince Edward County
Smallpox	8	1	1	0
Measles	11	5	0	2
Ague	0	0	0	0
Cholera	3	5	0	3
Fever	1	1	0	3
Syphilis	0	0	0	0
Typhus	2	1	0	0
Ship Fever	0	0	0	0
Consumption	45	42	16	17
Wounds	1	0	0	0
Fracture	1	0	0	0
Murder	0	0	2	0
Amputation	0	0	0	0
Unspecified Acc.	3	7	0	2
Leprosy	0	0	0	0

Table 16.
Causes of Death (1860 - 1861)

	City of Toronto	York County	City of Kingston	Prince Edward County
Smallpox	17	1	0	0
Measles	15	1	1	4
Ague	0	0	0	0
Cholera	4	1	0	1
Syphilis	2	0	0	0
Typhus	0	0	0	0
Consumption	143	59	25	32

The population for the City of Toronto in 1851-1852 was 30,775, with 45 deaths from consumption, representing 1.46 deaths/1000. This compares to the population for Hastings County (including Belleville), of 31,977 and 31 deaths from consumption, representing 1 death/1000.

In 1860-1861, however, the number of deaths from consumption increases dramatically in the City of Toronto, from 1.46 deaths/1000 to 3.19 deaths/1000, or nearly double the number of deaths. The specific numbers of deaths from consumption for Hastings County for 1860-1861 are unavailable.

Table 17 lists causes of death for Ontario for the 1870-1871 census years.

Table 17.
Causes of Death for Province of Ontario 1870 - 1871 Census

	Males	Females	Total
Consumption	1,031	1,152	2,183
Fever	96	90	186
Fracture	10	2	12
Inflammation	321	266	587
Disease of Lungs	608	437	1,045
Measles	61	79	140
Pleurisy	14	9	23
Smallpox	19	17	36
Syphilis	2	1	3
Railway Accident	43	1	44
Sawmill Accident	5	0	5
Trees Falling	21	0	21

What is interesting about the causes of death for the Province of Ontario for the census years 1870 - 1871 is the high proportion of deaths as the result of consumption and other lung diseases: 2,183 individuals died from consumption in Ontario during this period, 1,045 died of "Disease of Lungs", and 23 died of pleurisy (Canada Census 1870 - 1871).

Diseases of the lungs are not specified, but do not include pleurisy or consumption.

Of a total of 4,285 causes of death listed for Ontario for 1870 - 1871, 51% are attributable to consumption according to census data. A further 24% are deaths associated with other lung diseases, with pleurisy representing only .5% of the deaths for 1870 -1871 in Ontario. In addition to the infectious diseases, railway and sawmill accidents and falling trees accounted for a small proportion of deaths.

The Pioneer Cemetery in Streetsville, Ontario can provide comparative data regarding causes of death. The cemetery, associated with St. Andrew's Presbyterian Church in Streetsville, was in use from 1825 to 1890. Like Belleville, Streetsville was also settled largely by immigrants from Ireland, Scotland and England (Jimenez 1985:2). Similar industries were located in both communities, including lumber and flax mills.

Causes of death for the census years 1860 - 1861 are available for the County of Peel, in which Streetsville is located (Table 18). These can be compared to statistics from Belleville, and from Hastings County. Only deaths from traumatic injuries are included in the chart since deaths from infectious disease for Streetsville are applicable only to adolescents and children (scarlet fever, (w)hooping cough, etc.).

Table 18
Causes of Death 1860-1861 - Peel County

	No. of Cases	%
Diseases of the Breathing & Circulatory Organs		
Inflammation of the lungs	2	1.2
Bronchitis	1	.6
Consumption	28	16.9
Pleurisy	2	1.2
Violent or Sudden Deaths		
Unspecified accidents	6	3.6

Scarlett Fever and consumption account for the largest proportion deaths within the sample from the Pioneer Cemetery for the years 1860 - 1861. It is difficult to compare this to the St. Thomas sample in terms of absolute numbers, since causes of death are not available for the entire sample. However, there were three deaths recorded from scarlet fever in Hastings County (including Belleville) for 1860 - 1861, and none for consumption.

For the period from 1840 to 1870, the number of deaths by decade are listed for both the Pioneer Cemetery and the St. Thomas Cemetery, by sex (Jimenez 1985:16). Included are adults (>16 years of age) (Table 19).

Table 19:
Deaths by Decade

	Streetsville (N=97/264) M	Streetsville (N=97/264) F	Belleville (N=105/595) M	Belleville (N=105/595) F
1840-50	13	11	12	8
1851-60	25	19	27	12
1861-70	15	14	30	16

A comparison of the Pioneer Cemetery in Streetsville, Ontario to St. Thomas cemetery in Belleville, Ontario shows that deaths for both males and females are higher in the decade from 1851 to 1860 in Streetsville, but then drop slightly in the following decade, although this may simply represent a drop in the numbers of individuals within the church population.

In Belleville, there is an increase in the number of deaths for both males and females from 1840 to 1870. Within the Pioneer Cemetery in Streetsville, deaths between 1840 and 1870 represent 37% of the entire number of burials (264) for the entire period that the cemetery was in use, from 1825 to 1890. Within the St. Thomas sample, adult deaths between 1840 and 1870 represent 18% of the entire number of burials (595) for that portion of the cemetery in use from 1821 - 1874.

Figure 22 provides a comparison of the number of deaths by age cohorts (males and females combined) for the skeletal samples from St. Thomas (Belleville), St. Peter's (Mississauga) and the Pioneer Cemetery (Streetsville). St. Thomas has the highest proportion of deaths in the 17 to 29, 50 to 59 and 60 to 69 year age groups. St. Peter's has the highest proportion for the 30 to 39 year age group. The Pioneer Cemetery in Streetsville has the highest proportion of deaths in the 40 to 49 and 80 to 89 year age groups. Both St. Peter's and the Pioneer Cemetery have equal proportions of deaths occurring in the 70 to 79 year age group, but both are higher than the St. Thomas sample.

Although the sample sizes from 1840 - 1870 for the three samples differ (St. Thomas/N=44; St. Peter's/N=129/Pioneer/N=97), the proportions of deaths can be compared. The proportion of adults in the sample from the Pioneer Cemetery in Streetsville, Ontario that survived to the 80 + age group (approximately 17%) is much higher when compared to the sample from St. Thomas (approximately 2.5%). Translated into year of birth, the individuals from the Pioneer Cemetery who died at the age of 80 + years (the highest proportion of deaths from 1840 - 1870) would have been born between 1760 and 1790. Similarly, the individuals from St. Thomas who died between 17 and 29 years of age (the highest proportion of deaths from 1840-1870) would have been born anywhere between 1811-1823 and 1841-1853. The individuals from the Pioneer Cemetery, born during the late eighteenth century would likely have reached middle to late adulthood at the time that individuals from St. Thomas were approaching early to middle adulthood. Although no conclusions can be drawn from the differences between the number of deaths between these two age groups, the author suggests that this may be related to occupational risks for males. The growth of industry may have been more rapid in Belleville (Hastings County) than it was in areas in Peel County (Mississauga/ Streetsville), accounting for the differences in the proportion of deaths between the two age categories. When ages at death (under or over 50 years of age) for the three cemeteries are analyzed statistically (Table 20), there are no significant differences between them, however.

Deaths by Age Group 1840-1870
M/F Combined

Age	St.Thomas	St.Peter's	Pioneer
17-29	12	26	18
30-39	5	21	11
40-49	5	13	17
50-59	7	10	11
60-69	10	24	11
70-79	4	18	13
80 +	1	17	16
N =	44	129	97

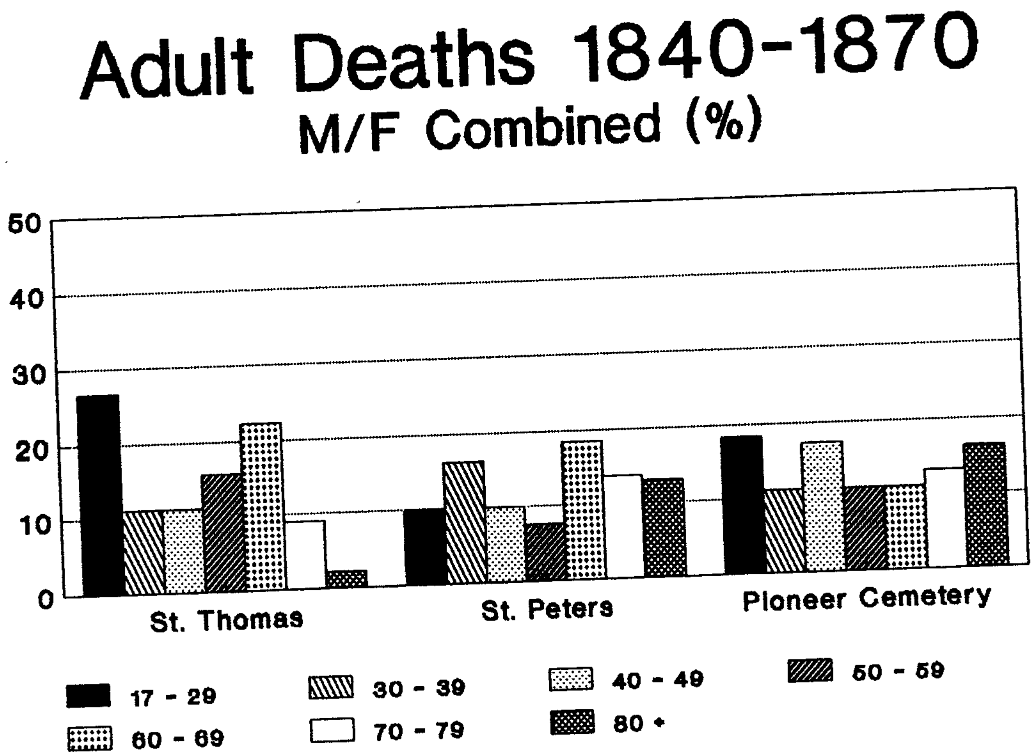


Figure 22

Table 20:

Comparison of Ages at Death:
Age under 50 and over 50 (Males/Females combined)
Number of Individuals

St. Thomas & St. Peter's

Age	St. Thomas	St. Peter's	Chi Square	Significance	
< 50	22	60	.05078	.8217	*
> 50	22	69	.16013	.6890 BYC	

St. Thomas & Pioneer Cemetery

Age	St. Thomas	Pioneer	Chi Square	Significance	
< 50	22	46	.01038	.9188	*
> 50	22	51	.08053	.7766 BYC	

St. Peter's & Pioneer Cemetery

Age	St. Peter's	Pioneer	Chi Square	Significance	
< 50	60	46	.00000	.9990	*
> 50	69	51	.01845	.8919 BYC	

BYC - Before Yates Correction
(* with one degree of freedom)

Following the procedure employed by Lovejoy and Heiple (1981:535), the incidence of both healed and perimortem fractures in the St. Thomas sample was analyzed by sex and age cohorts. Table 21 illustrates the breakdown of fractures by skeletal site. Fractures of the ulna (both healed and perimortem) for males occurs at the lowest mean age, 37 (N=4). For females, fractures of the ulna occur at the mean age of 34.5, although the sample size precludes any conclusions. Fractures of the thorax (ribs and sternum) occur at the mean age of 45.5 in males (N=21)

In the St. Thomas sample, the combined male and female mean age for fractures from all sites is 49.4 years (N=84). For males, fractures of the ulna occur at the lowest mean age, 37 years (N=4). For females the one fracture of the ulna occurs at the age of 36 years. Fractures of the radius in males occur at the mean age of 42 (N=7), and in females at the mean age of 55 (N=5). The Colle's fractures of the distal radius found in females of this age group is not surprising, since this type of traumatic injury often occurs in females with osteoporosis (Rogers 1982:90). Colle's fractures within the male sample may be attributable to occupational stresses.

Table 21
Breakdown of Fractures by Skeletal Site

Bone	Male Mean Age	N	Female Mean Age	N
Skull	43.3	8	65.5	1
Clav	44.5	1	63	3
Scap	64.5	1	23	1
Thor	45.5	21	44	4
Vert	48	6	47	3
Pel	–	0	64.5	1
Hum	45	2	54.5	1
Uln	37	4	34.5	1
Rad	42	7	55	5
Tib	48	8	50	2
Hand	52	10	45	2
Pat	54.5	1	34.5	1
Fem	52	4	64.5	1
Fib	46.2	6	49.5	2
Foot	43	5	49.5	2
All sites	44.4	84	49.6	30

Ch. 4 Medical Paradigms of Nineteenth Century Ontario

I Access to Medical Care

Parish records have been widely utilized in historical demography. They can be helpful in reconstructing the demographic profile of a community temporally, providing information that may be used to analyze population growth and/or decline and factors affecting it, such as disease epidemics, wars, etc. (Willigan and Lynch 1982:58). One disadvantage in using parish records, however, concerns their relative reliability. As Willigan and Lynch (1982:58) point out, data for certain periods may have been lost over the years, or simply unavailable as the result of inadequate record-keeping.

Willigan and Lynch (1982:60) suggest that the "ideal" burial record would include marital status, age at death, date of death, date of burial and the names of surviving relatives. They further point out that the accuracy of parish records is influenced by three factors: how well rules regarding record-keeping were enforced, the skill of the registrar, and circumstances that may have arisen at the time of the event that prevented proper recording (Willigan and Lynch 1982:61).

The quality of the parish records from St. Thomas are currently being evaluated by Carol DeVito of McMaster University. Using Drake's method of assessment, she is analyzing the records for vital events, including baptisms, marriages and burials. The method involves the identification of events month by month and determining those months in which information is lacking and why. For example, changes in record-keeping personnel or calamitous events, such as fire would likely affect registration data (Willigan and Lynch 1982:64). By establishing ratios of events, underregistration or errors in registration can be detected and the reliability of the records can then be assessed. Preliminary data suggests that the parish records for St. Thomas are thorough and reliable (Devito 1991: personal communication).

One of the problems in interpreting causes of death from parish records concerns the variety of terms used to describe diseases in the nineteenth century. Wohl notes that diphtheria was commonly given numerous other names, including "...croup, inflammation of the throat, putrid sore throat, malignant sore throat, disease in the throat, throat fever..." (Wohl 1983:128). Tuberculosis is often referred to as the "...white plague, Captain of the Men of Death, consumption, phthisis..." (Wohl 1983:130). Guillet (1963:95), in discussing some common disease treatments in nineteenth century Canada refers to "Ague". Ague was a common disease, what Guillet (1963:95) refers to as "cold or influenza". However, ague is also referred to as malaria in some medical texts (Miller and Keane 1987). Several deaths were attributable to ague within the St. Thomas sample.

An example of this confusing terminology is exemplified by one individual buried in St. Thomas cemetery, Benjamin Davy, who died of "paralysis", according to parish records (Boyce 1990). An article reporting his death in the March 7th, 1860 issue of the Hastings Chronicle, however, illustrates the imprecise nature of diagnostic procedures of the day, although a description of his symptoms suggests a stroke:

> A physician was immediately called in, and some blood was taken from him, but without avail. Symptoms of apoplexy, or congestion of the brain were soon manifest, in addition to partial paralysis which baffled all treatment by the several medical practitioners in town, who hastened to render their services...he was insensible from a few minutes after the attack, until death.
> (Hastings Chronicle 1860).

Writing in 1915 about pioneer life among the United Empire Loyalists, Herrington (1915:96) discusses the state of medicine and its availability to the settlers:

> The settlers had become so expert in treating most of their complaints, that they rarely deemed it necessary to secure the services of the medical practitioner...

Furthermore, he remarks that it was:

> ...not at all uncommon for a plain and simple farmer, with no pretension to a knowledge of medicine or surgery, to acquire a reputation as a specialist in some particular branch of the profession. Perhaps in some emergency he would set a broken limb, with results so satisfactory that his services would be requisitioned in the next case of a similar character (Herrington 1915:102)

Pioneer settlers in Upper Canada in the early part of the nineteenth century were "...much on their own when illness or accidents struck them" (Holling 1981:33). Few medical practitioners were available at the time, and most settlers could not afford to pay the fees that were charged to them. Payment for medical services was frequently in the form of property or animals (Holling 1981:33). Many early pioneer families emigrating to Upper Canada carried with them with an important travelling chest, consisting of a Bible, a list of medical remedies and a supply of seeds and medicinal herbs (Holling 1981:32).

According to Holling (1981:32), many early settlers were guided in self-treatment by the tenets expounded by the Reverend John Wesley, founder of Methodism. His book, Primitive Physic, promoted "...only cheap and safe medicines easily obtained and easily applied by plain simple man" (Holling 1981:32). Treatments were available for numerous diseases and were purported to be successful. The recommended treatment of consumption was simple, if not unusual:

> Every morning cut a small turf of fresh earth and lying down, breathe into the hole for fifteen minutes. I have known a deep consumption cured thus. In the last stages, suck a healthy woman daily. This cured my father (Holling 1981:33)

The Canada Medical Journal, Vol. I, March 1852 - February 1853 presented an article on the treatment of ankle fractures (Butcher 1853:149) discussing the manipulation techniques utilized to set the broken bones. The techniques were designed to facilitate healing and minimize damage to bone and ligaments. Whether or not these general principles in fracture setting were employed by individuals practising in the more rural areas, such as Belleville during the early nineteenth century is unknown.

Access to formal medical care in nineteenth century Ontario was limited by the number of medical practitioners available. Since most of the pioneer settlers lived in rural areas, the distance from the closest town or village likely prohibited access. Smith (1964:40) notes that "Civilian doctors were few and widely separated in the early days of Upper Canada...". With the growth of medical education, the number of qualified medical practitioners increased (Holling 1981:41).

In nineteenth century Upper Canada it was customary for people to self-doctor or rely on neighbours for assistance (Guillet 1963:98). One tale of such doctoring is related by Guillet (1963:98) about a woman in Haliburton whose neighbour treated her husband after he was injured while felling trees:

> One (tree) had rolled on him breaking his left leg at the thigh, crushing three ribs, and splitting his throat open, exposing the windpipe. She sewed up the throat with darning needle and thread, but the leg was not set, and though he lived to be over a century old, one leg remained two inches shorter than the other. Later he broke the same leg below the knee, but...reset it himself...

As Guillet (1963:100) notes, accidents in "the Bush" were frequent. Only in the most extreme of cases, such as accidents resulting in serious fractures or crushed limbs was the medical practitioner summoned.

Visiting rural patients was part of the responsibility of the local medical practitioner, except in spring, when roads became impassable. Local road conditions were often a hindrance to physicians attempting to visit patients. One account from the May 16th, 1856 issue of The Intelligencer, Belleville concerns a claim being made by a local physician, Dr. Lister, for damages incurred to his buggy when travelling to a patient's house. Committee meetings of the local municipality were held to decide the matter:

> Mr. Ponton [chairman] said that if the roads of any Municipality were in such a state as to endanger the life or limb of any person, it was firm conviction that there was good grounds for action (The Intelligencer, May 16, 1856)

Guillet (1963:28) further discusses the lifestyle of the pioneers in the early nineteenth century in his book, The Pioneer Farmer and Backwoodsman. With reference to medical practices of the time, he also points out that "Dentistry was strictly an amateur occupation at the time, and there were many more quacks than doctors" (Guillet 1963:28).

Hospitals were generally rare in nineteenth century Ontario. As Godfrey (1979:175) points out, however, by 1855, two hospitals on average, were being constructed in

Ontario each year. Nursing staff, however, were not available until the early 1880's, when the Toronto General nursing school began training individuals for positions in areas outside Toronto, including Belleville (Godfrey 1979:179).

The first hospital in Belleville was constructed in 1832 and consisted of a small two story building of less than 2500 square feet. Hospitals at this time were built primarily to provide shelter for travellers or for those who might also be sick (Boyce 1990: personal communication; Physicians' Panel on Canadian Medical History 1966). Susanna Moodie in Life in the Clearings versus the Bush (1853:214) talks about her arrival in Belleville in 1832 and of meeting some of the local people. One young woman told her of a young man with consumption who was sent to the hospital:

> Mr. S-- sent for old Dr. Morton, who, after examining the lad, informed his employer that he was in the last stage of consumption, and had not many days to live, and it would be advisable for Mr. S-- to have him removed to the hospital - (a pitiful shed erected for emigrants who may chance to arrive ill with cholera.

When typhus fever reached Belleville in 1847, however, hospital authorities turned away the victims, fearing contagion. As a result, a small building was erected on another piece of property in town, and served as the second hospital for those with contagious illnesses (Boyce 1990). The types of surgery practised by nineteenth century physicians in Belleville included operations to remove tumours, as an article in the March 7th, 1856 issue of The Intelligencer reports. An elderly gentleman had a tumour removed from the side of his head in an operation performed by two doctors, Dr.'s Bardett and Lister (The Intelligencer:1856). According to the article, the gentleman was recovering nicely from the operation and congratulations were offered to the attendant physicians. It is not known how typical this type of surgery was. Since the article was entitled "Surgical Skill in Belleville", it is likely that this operation was not a common occurrence. Not surprisingly it must have been difficult to convince a patient to submit to this type of operation, since this was the pre-anaesthetic era! As Holling (1981:40) notes, "...surgery was dreaded". Preparations containing opium or substantial quantities of whiskey were the only anaesthetic available: the patient was usually tied or held down! (Holling 1981:40).

Mitchinson (1984:383) has noted that according to nineteenth century Canadian medicine, especially the specialty of gynaecology, "...women were susceptible to ill health because they were women, that is, female". This "...vague form of environmentalism..." as Mitchinson (1984:385) describes it, did little to advance the cause of medicine where women were involved. A number of females within the St. Thomas sample exhibit healed traumatic injuries, perhaps suggesting that the image of the frail female does not fit with the pioneer way of life in this community.

In a paper by Melville Watson, entitled An Account of an Obstetrical Practice in Upper Canada (1939:181), he discusses the obstetrical career of Dr. Walter Burritt, a medical doctor practising in the area of Brockville and Peterborough from 1835 to 1886. Of 1,828 babies delivered by him during this period, only three maternal deaths occurred, an apparently excellent record compared to estimates from various areas at the time the paper was written by Watson in 1939 (Watson 1939:182). Watson attributes this low rate of maternal deaths as the result of childbirth partially to Dr. Burritt's medical expertise, and partly as the result of "...the high state of general health maintained in his patients by their pioneer existence". Watson (1939:188) also suggests that Dr. Burritt likely observed some cases of congenital syphilis in newborn infants, although he admits that there is no conclusive evidence to support this.

During the nineteenth century, maternal deaths in childbirth were frequently the result of puerperal fever, a fever that Watson (1939:182) notes was first identified as an infectious disease in the mid-eighteenth century. There are several cases of deaths by puerperal fever within the St. Thomas skeletal sample, although its' acute nature precludes any pathological changes to bone. The fever usually originates from a streptococcal infection and was common before the age of antiseptic techniques (Miller & Keane 1987:1034).

Orr (1930:24) remarks that prior to the use of Lister's antiseptic treatment, deaths as the result of compound fractures ranged anywhere from 26% to 68%. These figures, however, are not substantiated, nor are they associated with any specific location and they should be viewed with caution. Jack (1981:137) reports that prior to the use of anaesthesia in surgery, two of every three surgical patients died. This number did not change dramatically even after Lister's antiseptic treatments came into general use: one of every three died (Jack 1981:137). As Jack (1981:137) notes:

> These were statistics hardly calculated to encourage surgeons to undertake any but the least complicated knifework. So the art continued to be rough and ready.

During the early part of the nineteenth century in Upper Canada, when epidemics of smallpox, cholera and typhus were common, medicine tended to be focused on the "curative approach" to disease. It was not until the mid to late -nineteenth century that the preventative approach to medicine began to gain acceptance and this was generally manifested in improved sanitation (MacDougall 1983:135).

Advertisements in newspapers from Belleville and

Kingston during the early part of the nineteenth century promised miraculous cures for nearly every disease, including smallpox, cholera, and consumption. One such advertisement that appeared in The Intelligencer in September, 1857 exemplifies this "magic bullet" (Brandt 1987) approach to medicine by extolling the virtues of a product that would cure consumption:

> Consumption: the great scourge by which so many are doomed to a permanent grave, could in many cases be effectively cured by simple remedies if taken in season. Wistar's Cherry Balsam has cured hundreds within a few years.
> (The Intelligencer 1857).

In general, it appears that an awareness of proper sanitation and how infectious diseases such as cholera and smallpox were spread did much to prevent these diseases from reaching epidemic proportions in Belleville during the nineteenth century. Although deaths from cholera, smallpox and typhus fever did occur, the number of individuals that died were small when compared to other areas.

II Medical Education in Nineteenth Century Ontario

Outside of what he refers to as an "apprenticeship system" of medical teaching, MacDermot (1952:374) notes that there was no formal type of teaching available of medicine in nineteenth century Canada. This apprenticeship system attempted to train young males, often beginning in boyhood, to become practitioners of medicine (MacDermot 1967:110).The earliest medical school in Upper Canada was located at King's College, Toronto, and was not established until 1842 (MacDermot 1952:375).

Gibson (1928:331) discusses the medical history of Kingston and remarks that in the early 1820's, attempts were made to establish private medical schools. In June, 1855, a medical faculty was established in association with Queen's College in Kingston (Gibson 1928:333).

In the early part of the nineteenth century in Canada there were few regulations governing the practice of medicine. Jack (1981:37) points out that at the time of the War of 1812 there were numerous

> ..."licensed quacks" who deceived the public into thinking they were entitled to practice physic, surgery, and midwifery, when they were licensed to practice only one of these "branches".

As Holling (1981:39) wryly notes, "Unqualified persons with no training set themselves up as doctors often with grave results for the patient". Not surprisingly, the number of "quack" practitioners probably reflects a general lack of understanding of the nature and treatment of various diseases at the time (Holling 1981:39). Senior (1981:53) describes the general state of medical treatment in the early to mid-nineteenth century in Upper Canada. With the exception of surgical procedures, treatment was generally limited to "...prescribing mixtures or pills, purging, administering emetics, bleeding, and blistering..." (Senior 1981:53).

Unlicensed practitioners were more frequently located in Upper Canada, according to MacDermot (1967:20), because there was a definite lack of licensed medical practitioners in this area. There may have been several reasons for this, as MacDermot (1967:20) suggests:

> Pioneering conditions made country practice too unattractive, and when the American Revolution caused the migration of large numbers of United Empire Loyalists to Ontario, there were few medical men among them, partly because doctors were not forced out as much as were the other professionals, and partly because of the rigorous conditions of life.

In 1827, "An Act to Amend the Laws Regulating the Practice of Physic, Surgery and Midwifery" was passed in Ontario (Godfrey 1979:17). Under this act, a license to practice medicine would be granted to anyone with a diploma from either the Royal College of Physicians and Surgeons, London, or from any university (Godfrey 1979:17) (on payment of the fee of 2 shillings, sixpence!). However, as Godfrey

(1979:18) points out, it was cheaper for most pioneers to self-doctor "...or go to a friendly quack...".

Licensed medical practitioners became concerned about the state of the medical profession in Upper Canada. A letter written by three doctors was sent to the Upper Canada Medical Board (formed in 1819) in which they bemoaned the situation:

> ...everywhere there are ignorant pretenders to science, who, besides practising Physic in open defiance of the law, bring an obloquy on the profession (Canniff 1894:64)

Homeopathic medicine was frequently practised in early nineteenth century Ontario towns and villages. Senior (1981:69) points out that

> It flourished in Upper Canada to such a degree that most homeopaths were able to obtain a provincial license to practice much to the chagrin of the allopaths, the orthodox physicians.

The practice of homeopathic medicine persisted during the nineteenth century in Upper Canada. MacNab (1970:9) notes that homeopathic practitioners finally received recognition by the Legislature in Ontario in 1859.

Homeopathy was regarded with suspicion by some, however. An article (no author given) in the May 29th, 1856 issue of the Hastings Chronicle, published in Belleville, concerned a Dr. Lewis who:

> ...has been enlightening the "natives" of Belleville on the wonderful beauties of Homeopathy, by several Lectures in Coleman's Hall.

When questioned on what homeopathy was, Dr. Lewis suggested that it was a form of medicine in which:

> ...those medicines which when taken in the healthy state are calculated to produce certain symptoms, are the proper remedies for the diseases to which those symptoms belong.
> (Hastings Chronicle:1856)

The author, however, remained dubious of the benefits of homeopathy and attempted to educate the public with an example. Finding fault with the small doses of medicine administered in homeopathy, he suggested that these minuscule amounts were ludicrous and

> ...the effect of which would be about the same as if a pound of Epsom salts had been thrown into the Niagara river above the Falls, for the purpose of producing laxative properties in the waters of the St. Lawrence at Montreal or Quebec.
> (Hastings Chronicle: 1856)

According to Shortt (1981:121), attempts to enforce admission standards to practice medicine in the early part of the nineteenth century were largely ineffective because they could not be enforced. By 1839, however, a Provincial Act incorporated the College of Physicians and Surgeons of Upper Canada, thereafter having the authority to examine potential candidates before issuing medical licenses in what later became the province of Ontario (Godfrey 1979:46). It was not until 1869 that an act to amend "...and consolidate the Acts relating to the Profession of Medicine and Surgery..." was passed in the Ontario Parliament (The Intelligencer 1869).

The act was designed to penalize those individuals who "...wilfully and falsely..." claimed to be licensed medical practitioners by subjecting them to stiff fines (The Intelligencer 1869).

The Canadian Medical Association (CMA) was not formed until 1867, in the year of Confederation. The organization was intended to:

> ...give a frequent, united, decided expression of medical opinion of the country, must tend to advance medical knowledge and elevate the standard of medical education, besides directing and controlling public opinion in regard to the duties and responsibilities of medical men and serve to excite emulation as well as harmony in the profession and to facilitate and foster friendly intercourse among its members (Physicians' Panel on Canadian Medical History:1966)

Licensed Upper Canada medical practitioners "...in good and regular standing..." and whose medical practice was "...not based on any exclusive doctrine" were the qualifications for membership within the association (Physicians's Panel on Canadian Medical History:1966). However, in the early years of the association, debates frequently ensued as to whether or not a particular medical practitioner (especially those practising "eclectic" medicine) might be suitable to join his colleagues (Physician's Panel of Canadian Medical History:1966).

The provincial and municipal health boards did not begin to materialize until the beginning of the 1880s in Upper

Canada, and it was not until the early part of the twentieth century that effective sanitation measures became the responsibility of these organizations (MacDermot 1967:81).

Numerous doctors practised in Belleville during the early to mid-nineteenth century in Belleville. Table 22 contains a list compiled from a document written by Dr. D.T. Brearly of Belleville concerning the medical practitioners in Belleville that graduated prior to 1900 (Brearly 1985). The approximate years of practice in Belleville are included.

Table 22
Physicians Practising in Belleville

Dr. S. A. Abbott	1868 - 1887	
Dr. G. E. Allen	1876 - 1886	(Homeopathy)
Dr. D. E. Burdett	? - 1870	
Dr. E. A. Burns	1859 - 1861	("Eclectic" physician)
Dr. W. Canniff	1857 - 1858 & 1867 - 1868	
Dr. G. A. Carson	1850's	
Dr. E. Chandler	1830's	
Dr. H. F. Chisolm	1857 - 1863	
Dr. E. H. Coleman	1855 - ?	
Dr. E. G. Dorland	1850 - 1855	
Dr. P. Van Buren Dorland	1856 - ?	
Dr. W. Henry	1830's	
Dr. R. Holden (specialized in diseases of women and children) (Canniff 1894:434)	1842 - 1876	
Dr. W. Hope (surgeon)	1850 - 1860's	
Dr. J. Lister (general practice and surgery)	1840 - 1878	
Dr. D. MacLean	1862 - 1864	
Dr. R. McLean	1837 - 1840	
Dr. A. Marshall (surgeon)	1815 - 1830	
Dr. T. Nichol	1857 - 1872	
Dr. G. J. Potts	1867 - 1879	
Dr. J. Power	1860 - 1868	
Dr. E. Stevenson	1859 - 1861	(Homeopathy)

This list is not all-inclusive, but represents physicians practising in Belleville during the time that St. Thomas cemetery was in use, from 1821 to 1874. Few physicians practised in Belleville prior to the 1850's.

As noted earlier in the discussion of access to medical care, most of Belleville was essentially rural in nature and it is doubtful that most individuals had the opportunity to benefit from medical care in most circumstances. Reliance on neighbours or self-treatment appeared to be the norm. Dr. G. Potts (one of the known individuals from the St. Thomas sample), who died enroute to visiting a patient, may have been an exception.

Chapter 5
Final Discussion and Conclusions

It appears that within the St. Thomas skeletal sample there is some correlation between historical documentation in the form of parish records, newspaper articles and other archival materials and what is exhibited in the skeletal remains in terms of traumatic injuries. Obituaries and accounts of accidents causing either death or serious injury are common in the local newspapers of the time. In some cases, as has been demonstrated, this information can be matched to known individuals within the sample. In other cases, it provides us with a picture of occupational hazards in nineteenth century Ontario, and illustrates some of the rigors associated with a pioneer existence.

Industrial accidents associated with logging, mining and saw mills, were common occurrences and caused traumatic injuries and frequently, death. The perimortem injuries, correlated to historical documentation, exemplify this in the skeletal sample from St. Thomas. Healed fractures, the result of either accidents or occupationally induced stresses, also occur with frequency within the sample. The occurrence of spondylolysis within the sample may reflect the physical labours associated with nineteenth century Ontario rural lifestyles, both for males and females.

Infectious diseases including tuberculosis (consumption), syphilis, and non-specific periostitis also occur within the sample. However, the acute infectious diseases including smallpox, cholera, scarlett fever, typhoid fever, typhus fever and puerperal fever are not visible in pathological changes to bone. Historical and archival documentation reveals that these diseases, while not necessarily of epidemic proportions, were present, and a number of deaths within the sample from St. Thomas are attributable to these diseases.

Due to the time constraints posed for the skeletal analysis of the St. Thomas sample (the remains were reburied at the end of August, 1990), and because of the large size of the sample, I focused on infectious disease and traumatic injuries in my analysis. Although non-infectious diseases, including metabolic disorders, endocrine disturbances, tumours, etc. can give valuable information about the health status of members within a community, infectious disease appears to be a better indicator of the disease load that a community is generally exposed to (Kelley 1989:191).

There is a difference between males and females in terms of fractures. Healed fractures are generally more common in males than in females (chi square values are 7.81487 or 8.60013 BYC with one degree of freedom; significance levels are .0052 or .0034 BYC) (see Table 6). Healed fractures of the upper skeleton occur more frequently in males than in females (chi square values are 11.39621 or 12.40514 BYC with one degree of freedom; significance levels are .0007 or .0004 BYC) (see Table 6). The age at risk for fractures and infection also tends to differ between the sexes. The percentage of individuals with multiple fractures (Figure 16) reflects physical stressors on the community. Chi square values for infection by sex and skeletal site suggest that there are no great differences between males and females in the incidences of infection. Tuberculosis appears to occur in slightly more females than males, but this could not be tested statistically. Dislocations occur with equal frequency between males and females, but, again, the total sample size of four limits any significant conclusions from being made.

A breakdown of sites of traumatic injury by sex and skeletal site suggests that there are significant differences between males and females in terms of trauma of the thorax (chi square values of 5.86151 or 6.95317 BYC with one degree of freedom; significance levels of .0155 or .0084 BYC) (see Table 6). In addition, traumatic injuries in general seem to occur more frequently in males than in females (chi square values of 4.74530 or 5.34861 BYC with one degree of freedom; significance levels of .0294 or .0207 BYC) (see Table 6).

The ramifications for the paleodemographic reconstruction of the health status of communities represented in historical cemeteries are important. The results of this study suggest that paleopathological analysis alone is insufficient to reconstruct a meaningful picture of the health status of an historical skeletal sample. Archival documentation, in the form of parish records, newspapers, letters, etc. are essential pieces of information that are required to supplement the skeletal analysis. This is especially true in attempting an analysis of infectious diseases because of the acute nature of many of them. It is the chronic infectious diseases such as tuberculosis or syphilis that are likely to cause pathological changes to bone. Even these will be limited by the small percentage of individuals that will actually manifest skeletal changes during the course of the disease. Parish records, in addition to errors, often lack essential information, such as cause of death. Within the St. Thomas sample, causes of death from parish records are only available for 149 of 1500 burials, but the records cannot be associated to specific burials. In attempting to extrapolate these data regarding cause of death to the rest of the sample, it is necessary to be cautious because of missing information.

Historical documentation, too, must be evaluated within the context of the time. Medical paradigms from nineteenth century Ontario differ from our current attitudes to disease and medicine. Even the terminology is often confusing and ambiguous. Diagnostic procedures were frequently inadequate and access to sophisticated equipment and technology was limited. Cultural attitudes also played a role in medical history. As discussed in Chapter 4, Medical Paradigms of Nineteenth Century Ontario, venereal diseases often went unreported, although many physicians generally agreed that they were prevalent at the time. The stigma associated with syphilis may have played a role in reporting in causes of death in parish records.

In addition, skeletal analysis is limited by a variety of factors: preservation, establishing a differential diagnosis, and what can be observed in bone.

Compared to other historical cemeteries of the same time period, the St. Thomas sample appears to reflect the rigors of pioneer life, including the industrialization that occurred in the Belleville area during the mid-nineteenth century. During the 1850's there are numerous cases of traumatic injuries, causing either death or serious injury as lumber, saw, and grist mills began to appear within the locale. The construction of the Grand Trunk Railway in 1856 accounted for a number of accidents, many of them documented in historical and parish records.

An analysis of a sample of this size (N=271) is valuable in reconstructing the health status of a community, especially when changes in health can be evaluated temporally. Comparing the skeletal evidence from the St. Thomas sample to archival documentation, there appears to be some changes that are evident over time, particularly concerning the frequency and nature of traumatic injuries. The higher frequency of healed fractures in males may be related to the expansion of industry in Belleville since we know that the bulk of burials date to post 1850. However, this cannot be tested because, at least at this point, the burials cannot be dated. Acute infectious diseases that are not observable in bone, such as cholera and typhus fever, can only be tracked through time via historical records such as parish records, newspapers, etc.

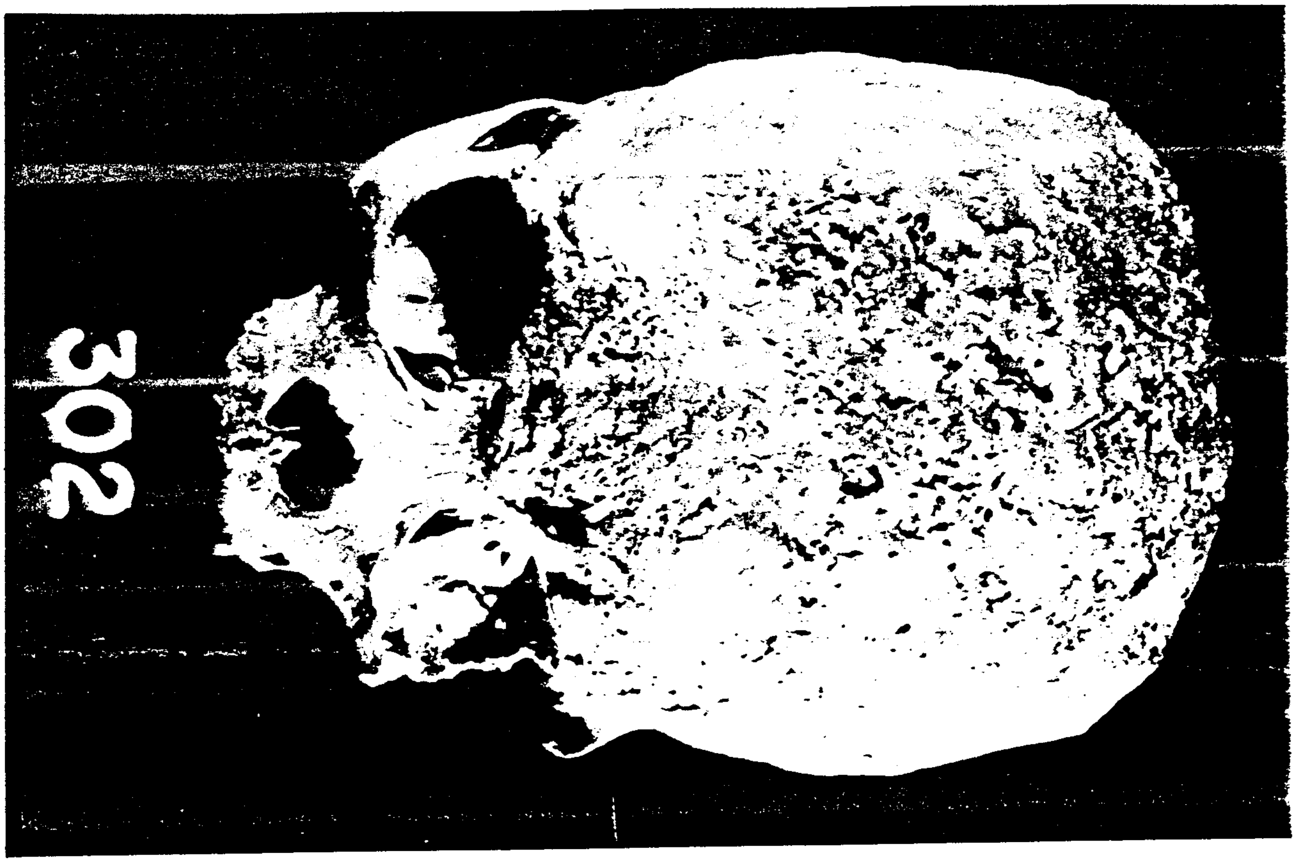
This study also reinforces the need for paleopathologists to develop a comprehensive data bank of acceptable criteria for differential diagnostics of dry bone. This is especially important in defining not only the type and nature of the lesions, but their pattern and distribution as well. In most cases, reaching a differential diagnosis in paleopathology rests largely on macroscopic observations and is subjective, at best. While some pathological conditions result in bony changes that are pathogonomic of that particular disease process (i.e. stellate scars of the skull in tertiary syphilis), many do not. In the early stages of a disease, for example, tuberculosis, the subtle periosteal changes to ribs may not be diagnostic of tuberculosis exclusively. Other pleural infections, blastomycosis, etc. may resemble each other at this point. Even in the later stages of disease, many diseases that affect bone cause similar appearing lesions to occur in similar distributions. Historical and archival documentation, although not flawless, is the best aid in reaching a differential diagnosis in cases such as these.

Although a number of medical practitioners practised in the Belleville area during the time that the individuals from St. Thomas were alive (1821 - 1874), Belleville was essentially a rural, farming community and it appears that in many cases, particularly in the case of traumatic injuries, medical care was limited by the practical aspects of accessibility or time. The cases of both malaligned fractures and pseudarthroses suggests that perhaps, the pioneer lifestyle did not permit the luxury of the time necessary or expertise to immobilize fractured limbs. Additionally, it is likely that there were a number of opportunistic unlicensed "practitioners" who were consulted by the sick. The quality of medical care provided by these individuals may be reflected within the St. Thomas sample.

Large sample sizes are essential in any skeletal analysis. Certainly, the total sample size of 271 adults within the St. Thomas sample provides sufficient material with which to analyze health status. When this is supplemented by supporting historical documentation, a reconstruction of the health stressors on a community can be made with some confidence.

APPENDIX 1
Photographs

Page	Burial #	Age	Sex	Description
186	302	54	M	Tertiary syphilis of skull
	429	43	M	Tuberculosis of thoracic 8 & 9
187	168	54	M	Pseudarthrosis of right femur with extensive fracture callus
	168	54	M	Healed malaligned spiral fracture of left femur
188	510	52	M	Complete shearing fracture of right femoral head with pseudarthrosis
	369	52	F	Healed displaced fracture of left humeral head
189	315	54	M	Healed displaced fracture of right femoral head with extensive fracture callus
	307	32	M	Compression fracture of thoracic 12
190	412	54	M	Spondylolysis of lumbar 5
	58	54	M	Healed depressed fracture of the left parietal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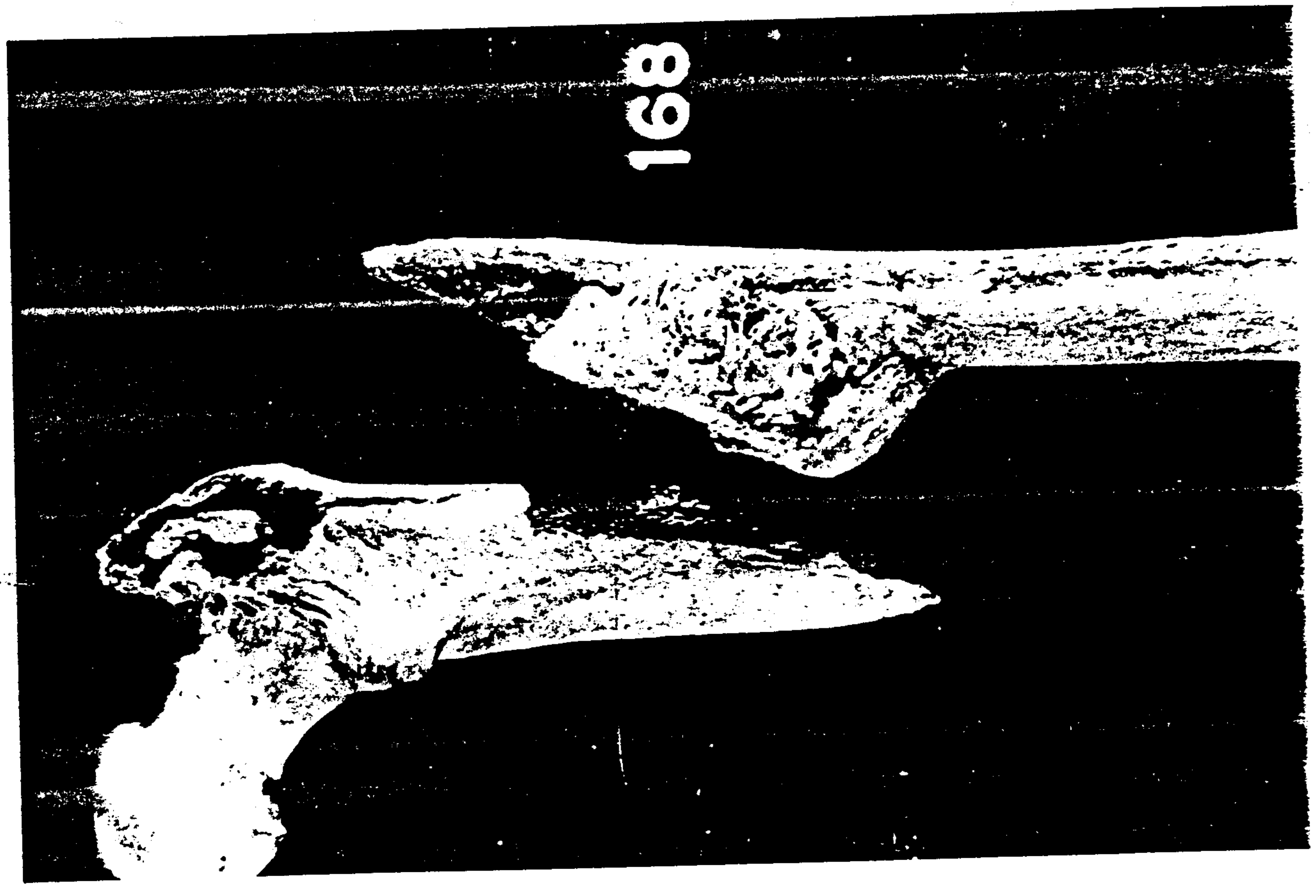
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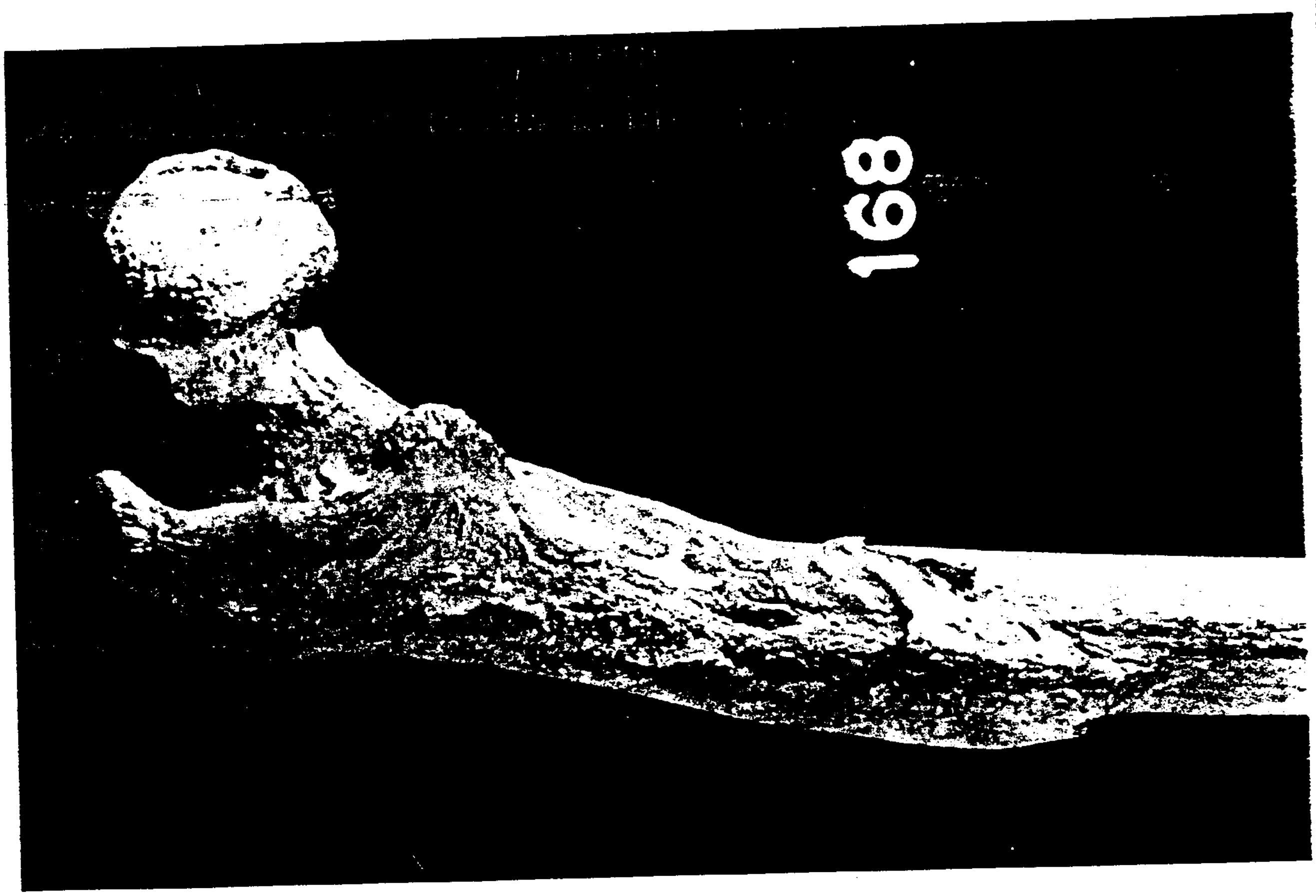
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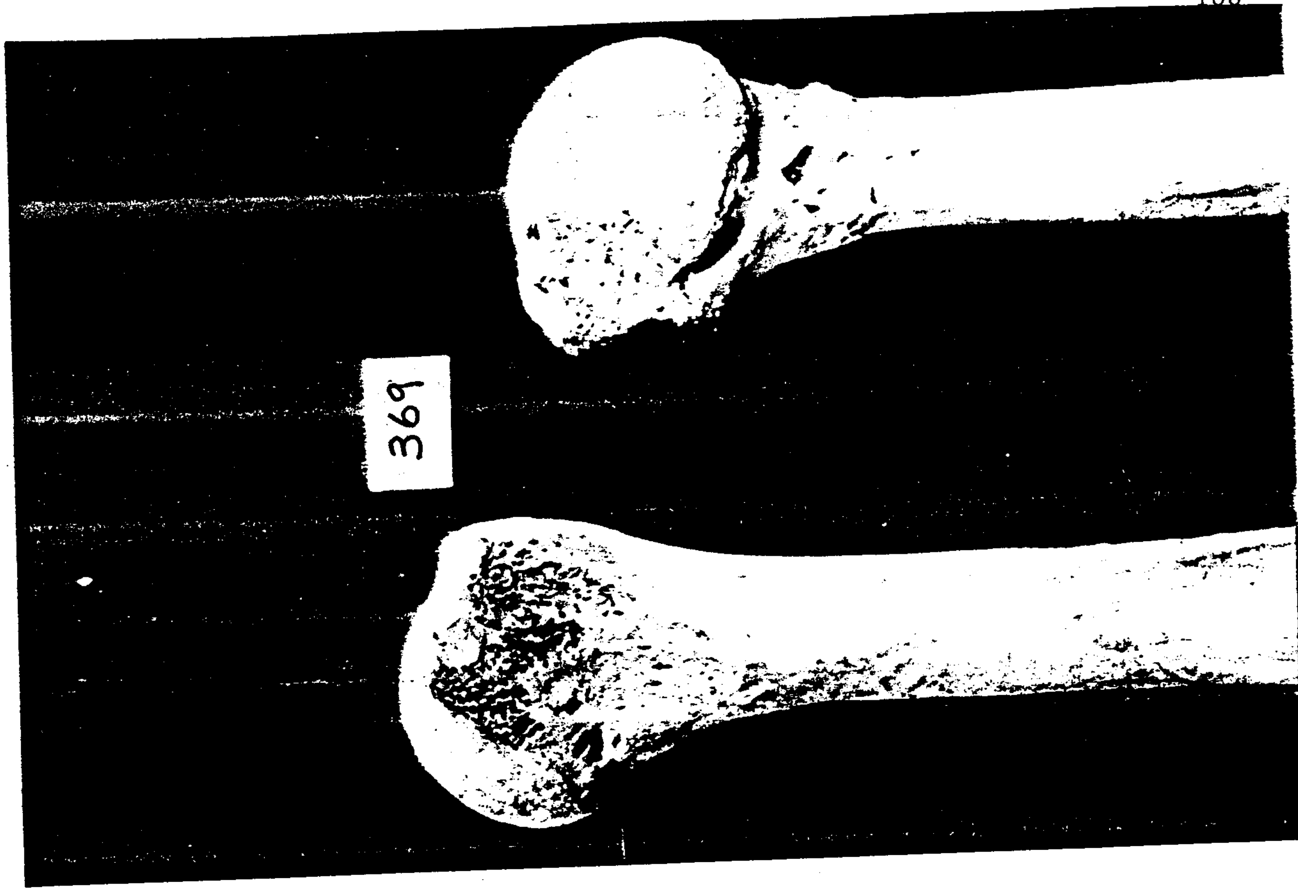
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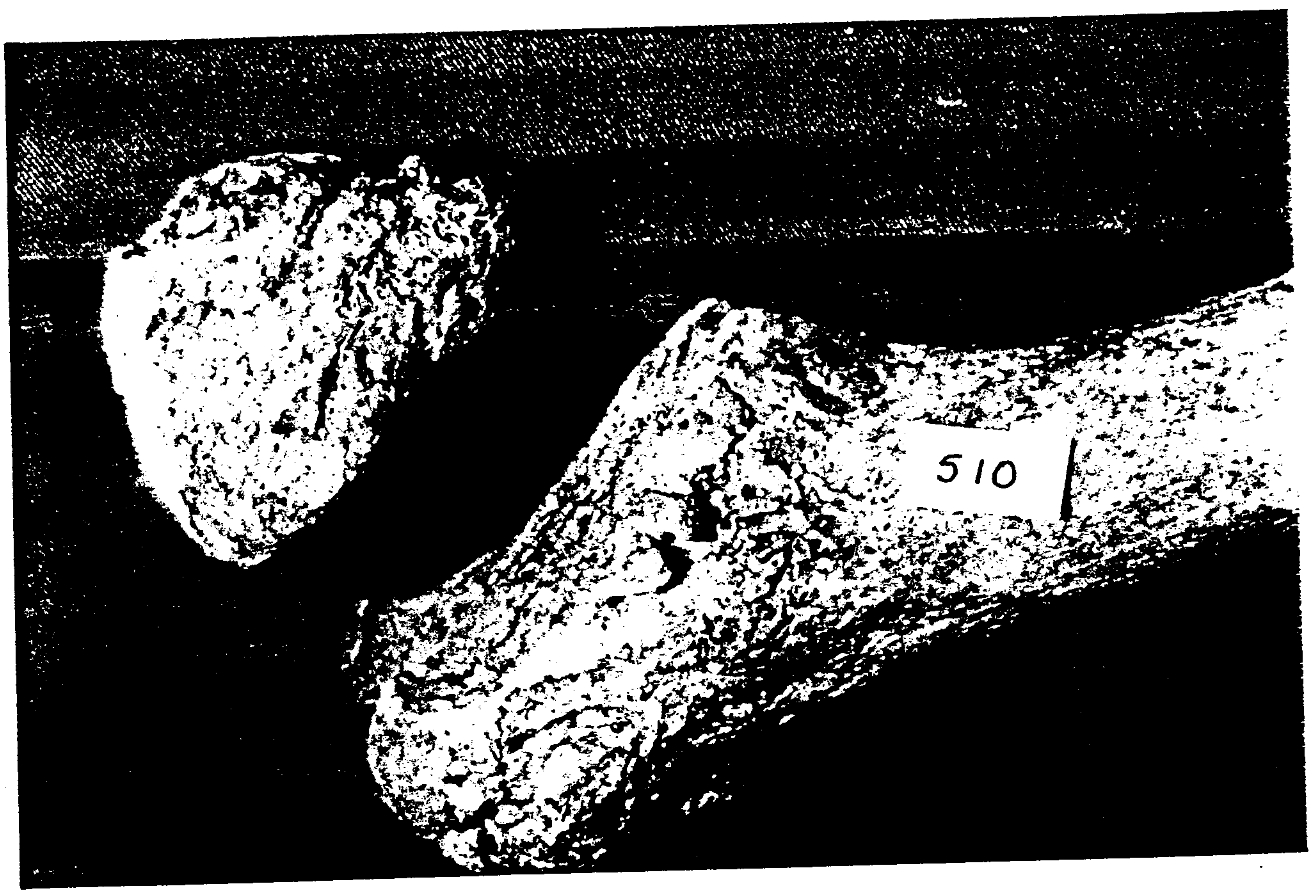
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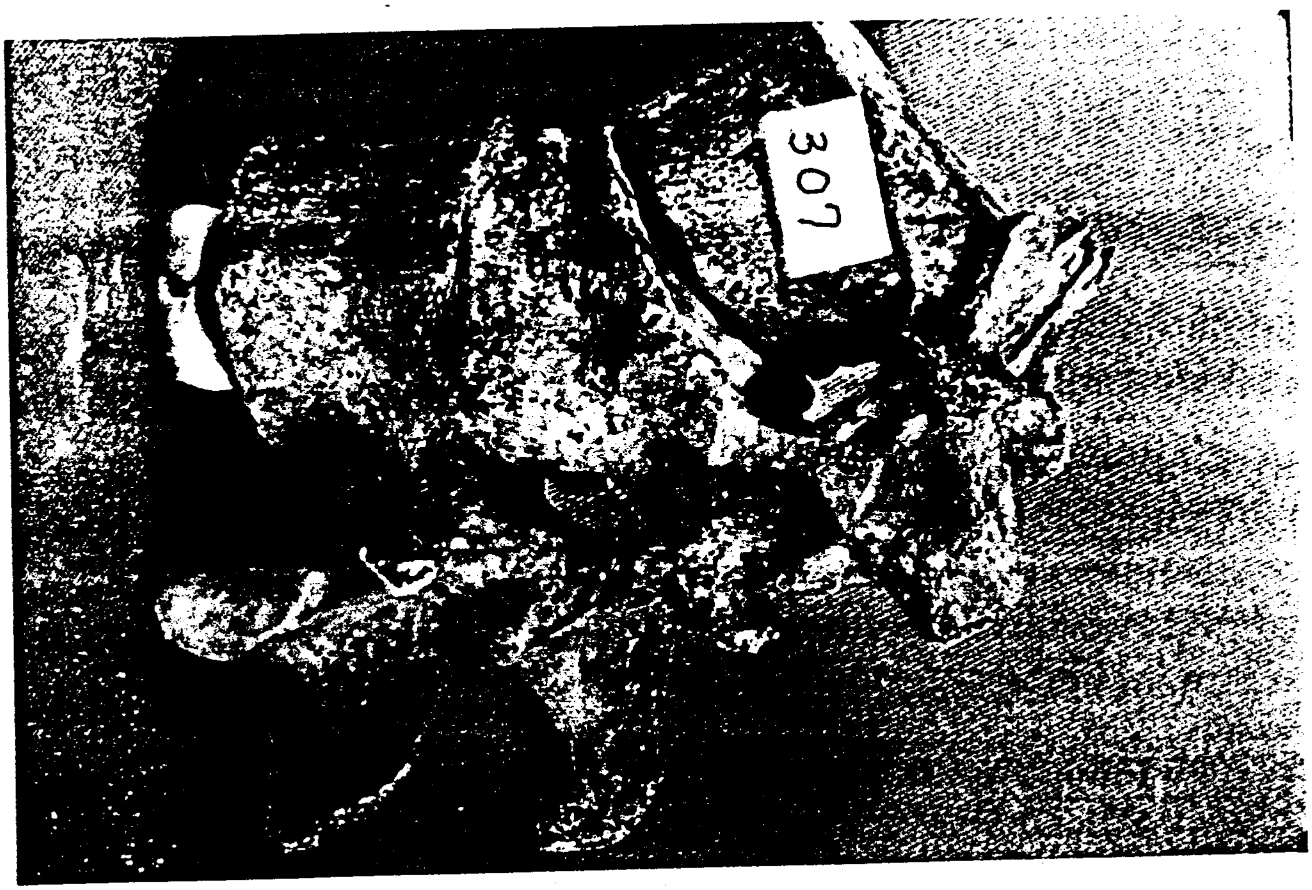
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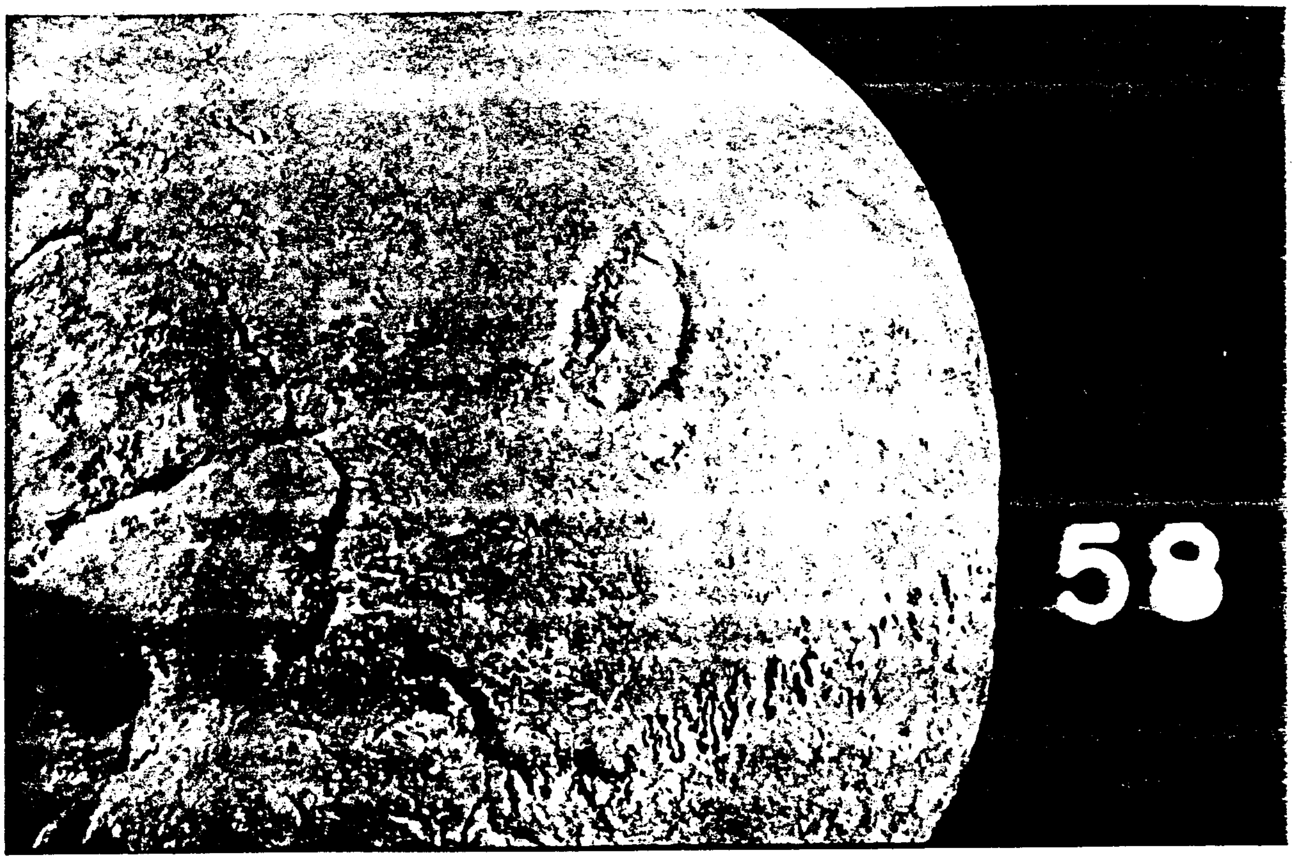
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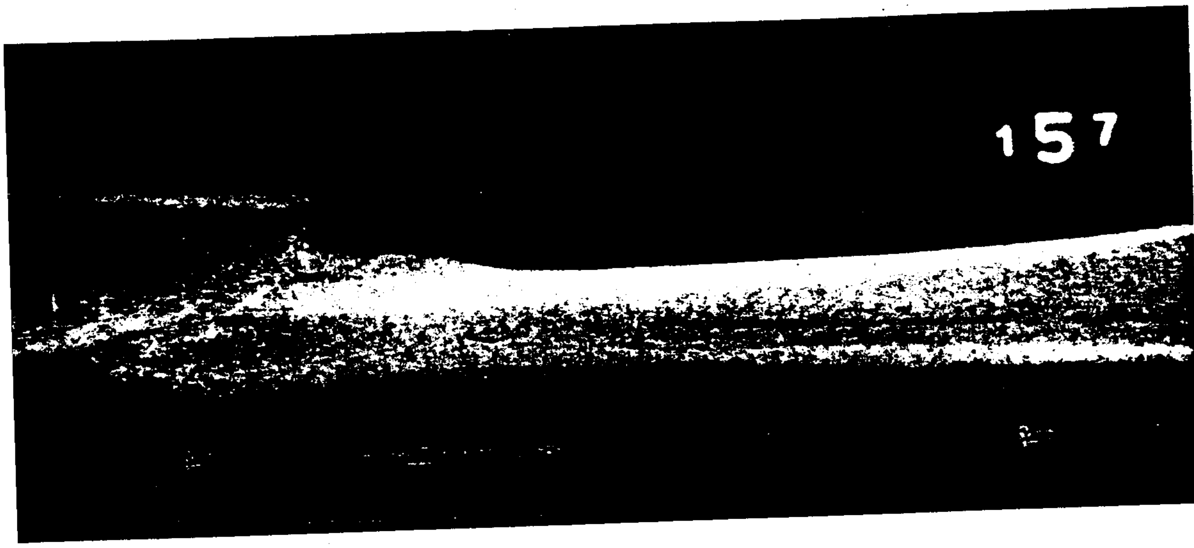
412

APPENDIX 2
Radiographs

Page	Burial #	Age	Sex	Description
192	157	53	M	Healed, malaligned fracture of the right tibia
	302	54	M	Tertiary syphilis of the right femur
193	302	54	M	Tertiary syphilis of the skull
	302	54	M	Tertiary syphilis of two thoracic vertebrae
194	302	54	M	Tertiary syphilis of the right & left humerae
	302	54	M	Tertiary syphilis of C2 - C6 with ankylosis
195	307	32	M	Healed spiral fracture of the left tibia
	487	39	M	Healed, malaligned fracture of the right fibula
	542	46	M	Healed, malaligned fracture of the left fibula
196	547	35	F	Healed fracture of the left ulna
	315	54	M	Healed fracture of the right proximal tibia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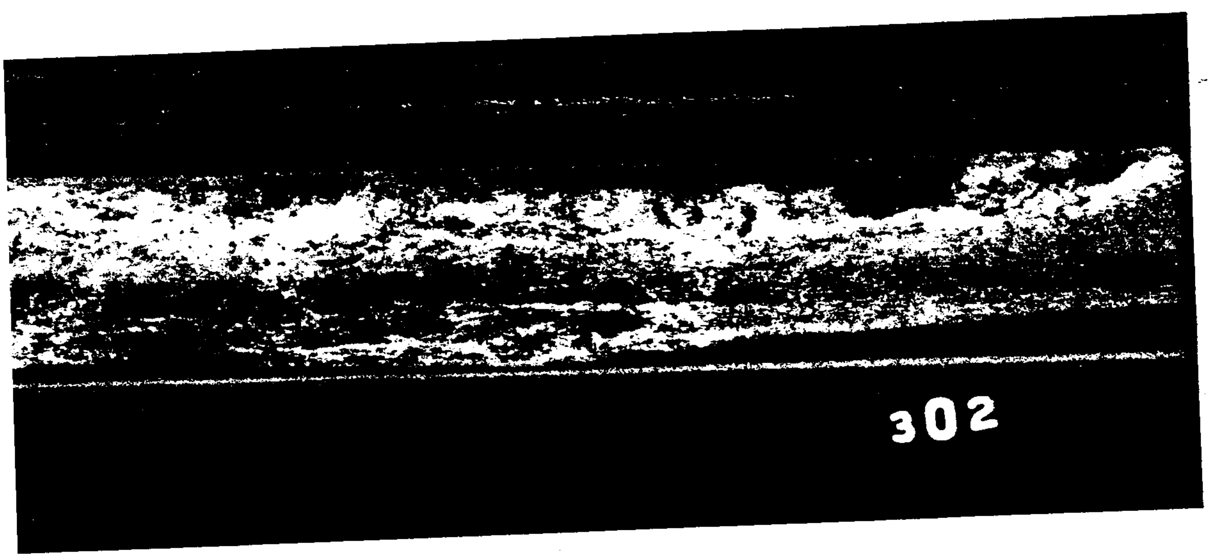
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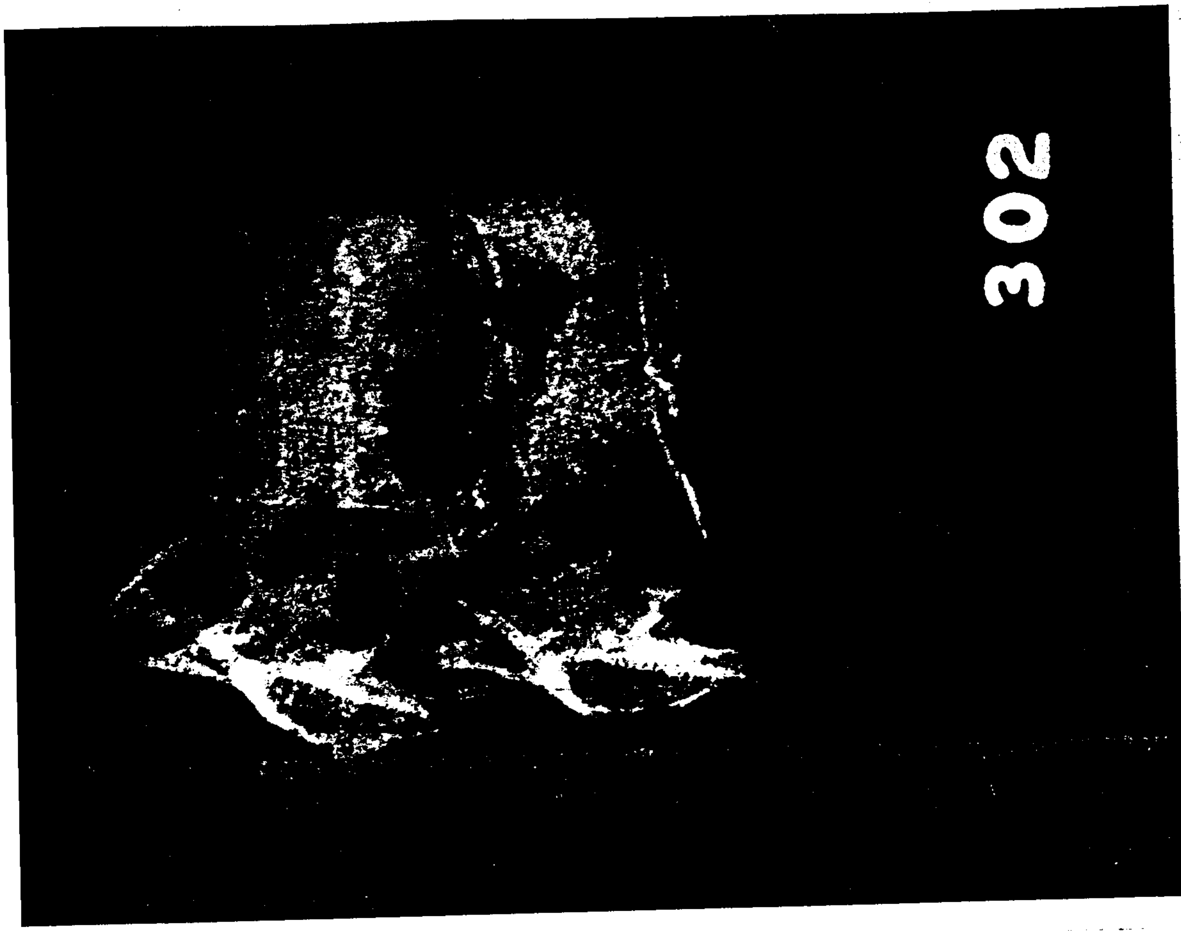

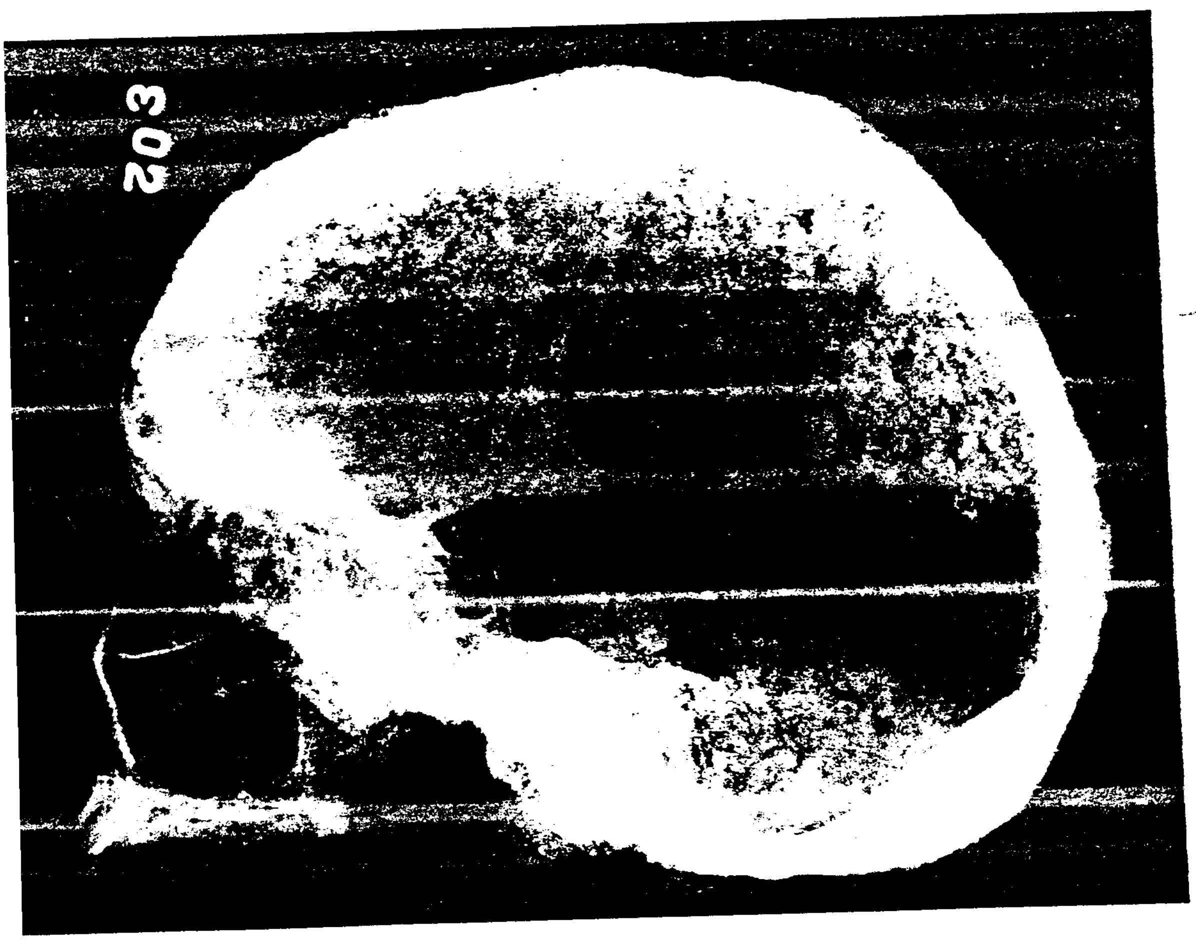

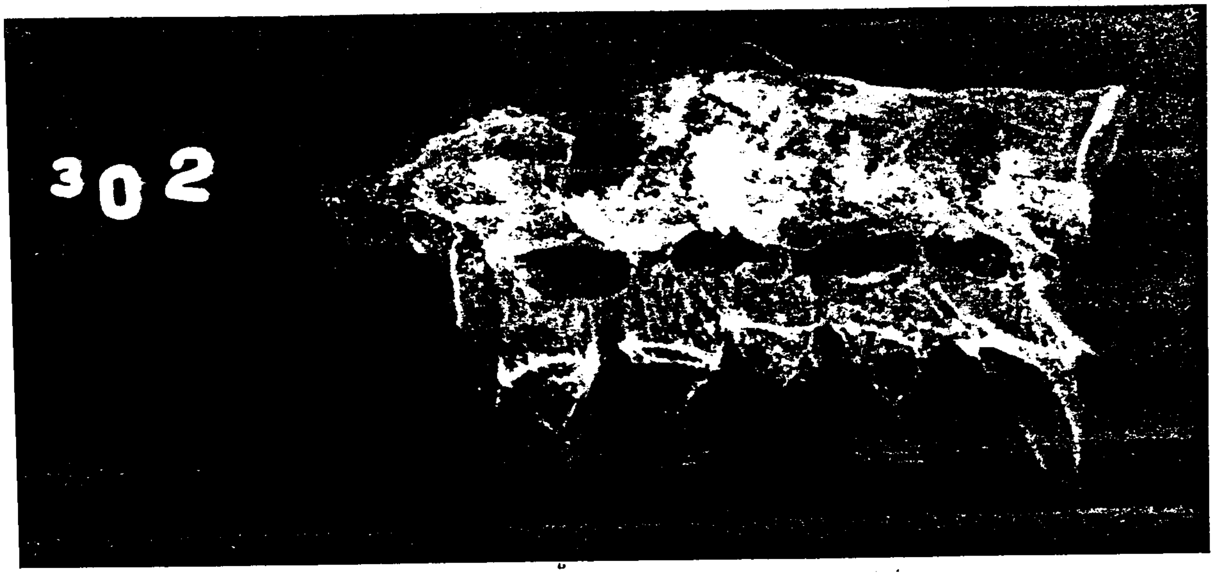
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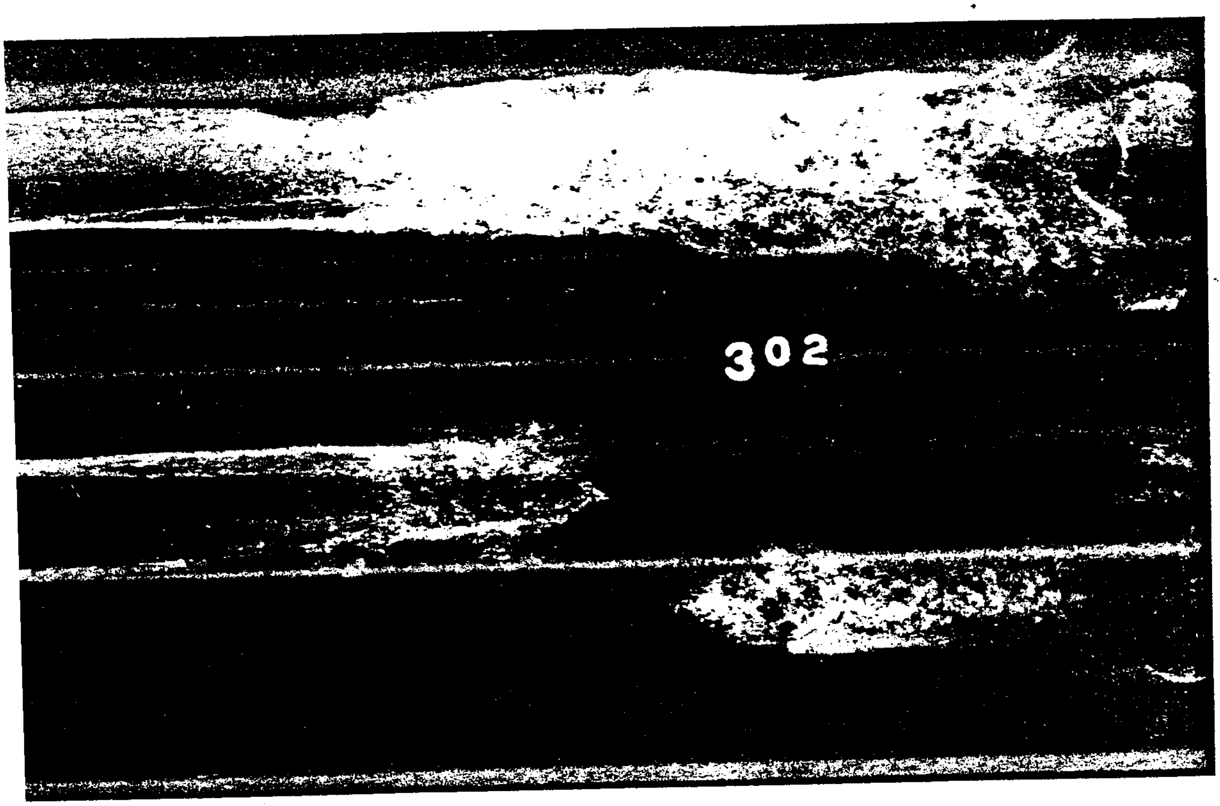
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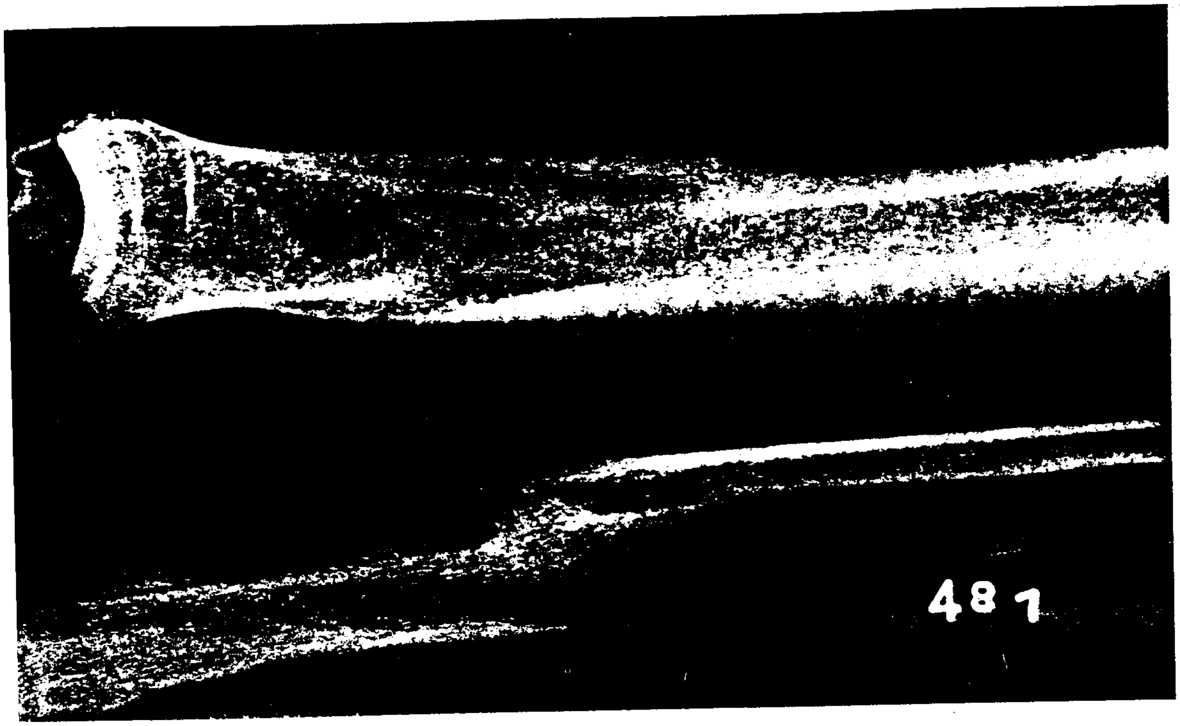
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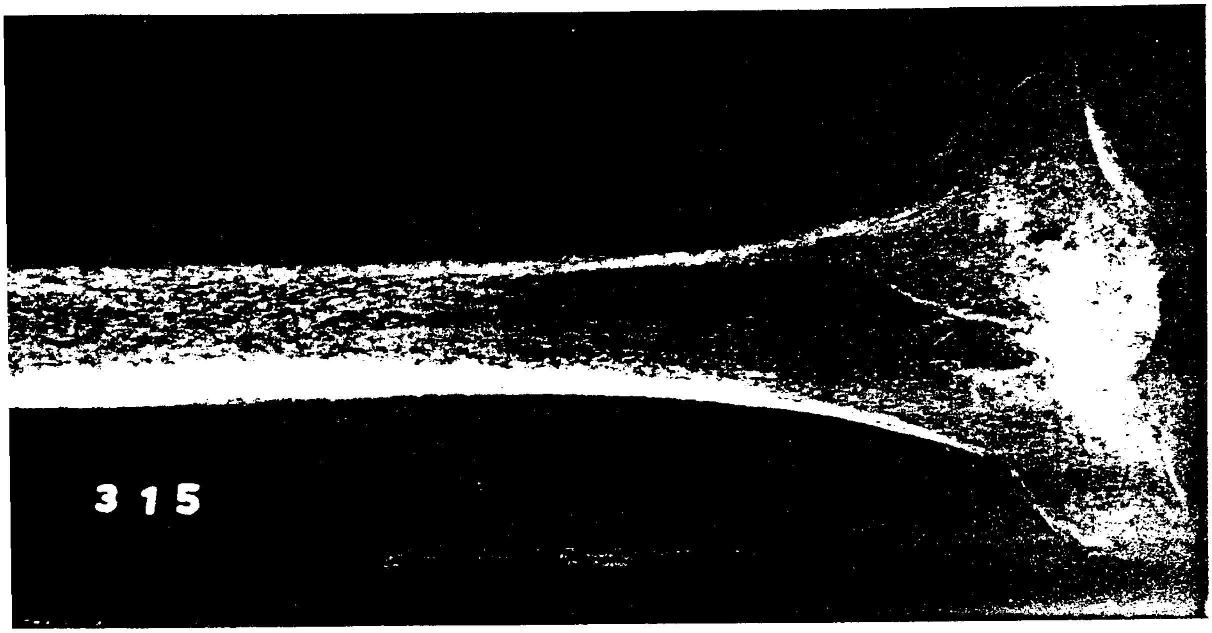
54 2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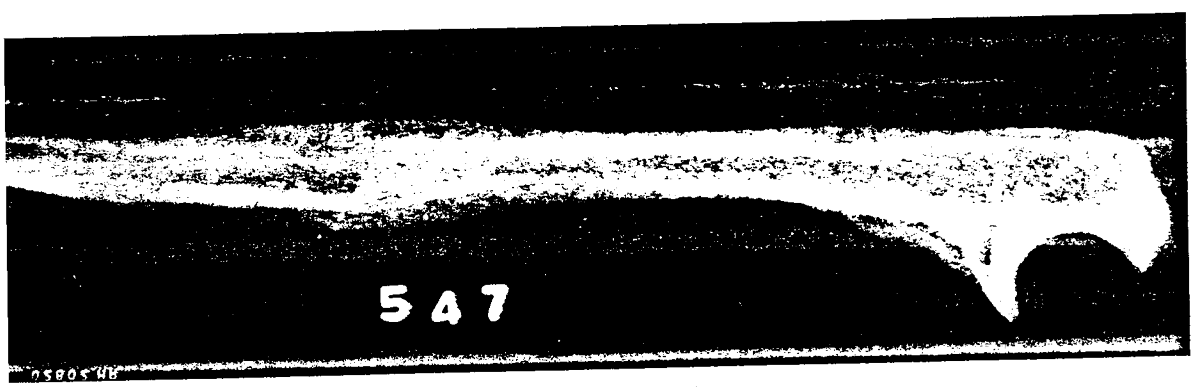
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Appendix 3

St. Thomas Anglican Church
Belleville
Sue Jimenez

Skeletal I.D: ____________
Date: ____________
Estimated Age: ____________
Sex: ____________

Skeletal Inventory:

Cranium
Frontal ___ Occipital ___ Ethmoid ___
Sphenoid ___ Mandible ___

Left	Right	
___	___	Parietal
___	___	Temporal
___	___	Zygomatic
___	___	Palatine
___	___	Maxilla
___	___	Nasal
___	___	Lacrimal
___	___	Vomer

Dentition
Deciduous:

Maxilla
Right — I1 I2 C M1 M2
Left — I1 I2 C M1 M2

Mandible
Right — I1 I2 C M1 M2
Left — I1 I2 C M1 M2

Permanent:

Maxilla
Right — I1 I2 C PM1 PM2 M1 M2 M3
Left — I1 I2 C PM1 PM2 M1 M2 M3

Mandible
Right — I1 I2 C PM1 PM2 M1 M2 M3
Left — I1 I2 C PM1 PM2 M1 M2 M3

Postcranial

Manubrium ____ Sternum ____ Xiphoid ____ Sacrum ____ Coccyx ____

Vertebrae:

C1 ____ C2 ____ C3 ____ C4 ____ C5 ____ C6 ____ C7 ____

T1 ____ T2 ____ T3 ____ T4 ____ T5 ____ T6 ____

T7 ____ T8 ____ T9 ____ T10 ____ T11 ____ T12 ____

L1 ____ L2 ____ L3 ____ L4 ____ L5 ____

Innominate: Left ____ Right ____

Left	Right	
____	____	Clavicle
____	____	Humerus
____	____	Ulna
____	____	Scapula
____	____	Radius

Hand

Left	Right	
____	____	Scaphoid
____	____	Lunate
____	____	Triquetral
____	____	Pisiform
____	____	Trapezium
____	____	Trapezoid
____	____	Capitate
____	____	Hamate

Left	Right	
____	____	Phalanges (L)
____	____	Phalanges (M)
____	____	Phalanges (D)
____	____	Metacarpal 1
____	____	Metacarpal 2
____	____	Metacarpal 3
____	____	Metacarpal 4
____	____	Metacarpal 5

Ribs

Left	Right	
____	____	Rib 1
____	____	Rib 2
____	____	Rib 3
____	____	Rib 4
____	____	Rib 5
____	____	Rib 6

Left	Right	
____	____	Rib 7
____	____	Rib 8
____	____	Rib 9
____	____	Rib 10
____	____	Rib 11
____	____	Rib 12

Lower Limb

Left	Right		Left	Right	
____	____	Patella	____	____	Tibia
____	____	Femur	____	____	Fibula

Foot

Left	Right		Left	Right	
____	____	Calcaneus	____	____	Phalanges (P)
____	____	Talus	____	____	Phalanges (M)
____	____	Navicular	____	____	Phalanges (D)
____	____	Cuboid	____	____	Metatarsal 1
____	____	Cuneiform (M)	____	____	Metatarsal 2
____	____	Cuneiform (I)	____	____	Metatarsal 3
____	____	Cuneiform (L)	____	____	Metatarsal 4
			____	____	Metatarsal 5

Pathology

State of Preservation:

Excellent ____ Good ____ Fair ____ Poor ____

Bone(s) Involved:

______________________________ ______________________________
______________________________ ______________________________

______________________________ ______________________________

Location of Pathological Changes:

Distal ______________________________

Medial ______________________________

Lateral ______________________________

Proximal ______________________________

Metaphysis ______________________________

Diaphysis ______________________________

Dorsal ______________________________

Ventral ______________________________

Superior ______________________________

Inferior ______________________________

Plantar ______________________________

Palmar ______________________________

Transverse ______________________________

Distance from landmarks:

____

Features of Pathological Changes:

Abscess
Ankylosis
Atrophy
Callus
Caries
Caries Sicca
Cavitation
Chronic
Circumvellate
Cloaca
Collapse
Congenital
Cyst
Deformity
Degeneration
Eburnation
Erosion
Exostoses
Facies Leprosa
Focal
Hematogenic
Hutchinson's Teeth
Hyperostotic
Hyperplastia
Hypervascular
Hypoplasia
Infectious
Involucrum
Lesion
Lipping
Lysis
Metastastic
Mulberry Molars
Necrosis
Ossifying
Osteitis
Osteoplastic
Osteomyelitis
Perforation
Pitting
Primary
Pyogenic

Radial
Reactive
Saber Shin
Scar
Secondary
Sequestrum
Sclerotic
Snail Track
Spina Ventosa
Stellate
Subluxation
Superficial
Systemic
Tertiary
Thinning

Extent of Pathological Changes:

Single ___ Multiple ___ Circumscribed ___ Clustered ___

Discrete ___ Localized ___ Progressive ___ Proliferative ___

Unilateral ___ Bilateral ___

State of Pathological Change at Time of Death:

Active ___ Healed ___ Partial Remodelling ___ Resorptive

Elements of Bone Structure Involved:

Cancellous bone ___ Cortex ___ Diploe ___ Endosteum ___

Medullary cavity ___ Periosteum

Possible Diagnosis:

Infectious Disease

Osteomyelitis
Periostitis
Brucellosis
Glanders
Tuberculosis
Leprosy
Treponemal Infection: Yaws
Endemic Syphilis
Venereal Syphilis
Congenital Syphilis

Actinomycosis
Nocardiosis
Maduromycosis (Mycetoma)
Fungal Infection: Blastomycosis
Cryptococcosis
Paracoccidioidomycosis

varus/valgus deformity
paravertebral abscess
gibbus :(angular kyphosis)
psoas abscess ossification
dislocation
growth deficit
osteosclerosis
periarticular osteophytosis
otitis media
degenerative arthritis
secondary infection
tuberculous arthritis
cribra orbitalia
necrosis
inadequate fusion
fusion
myositis ossificans
Charcot's joint
pseudarthrosis
nearthrosis
mis/malalignment
osteochondritis dessicans
disuse osteoporosis
Freiberg's disease
Scheuermann's disease
Schmorl's nodes
septic arthritis

<u>Confusion with?:</u>

tertiary syphilis
carcinoma
tuberculosis
osteomyelitis
mycotic infection
leprosy
lupus vulgaris
rheumatoid arthritis
sarcoidosis
syphilis
degenerative arthritis
cribra orbitalia
rickets
Paget's disease
Brodie's abscess
spina ventosa of TB
congenital syphilis
fibrous dysplasia
osteochondromatosis (Ollier's disease)

Coccidioidomycosis
Histoplasmosis
Sporotrichosis
Aspergillosis
Mucormycosis (Phycomycosis)

Viral Infection: Smallpox
Rubella (fetus)

Parasitic Infection: (Echinococcosis)

Sacroidosis

Trauma:

Fracture:

Severity:

Simple ____ Comminuted ____ Compound

Type:

articular
avulsion
Barton's
capillary
Colle's
concertina
Duverney's
fatigue
impacted
intercondylar
linear
lip
pathologic
Parry's
Pauwel's
Pott's
spondylolysis
stellate
transcervical
wedge

Dislocation　　Mutilation　　Pregnancy Trauma

Deformation　　Amputation　　Sincipital T

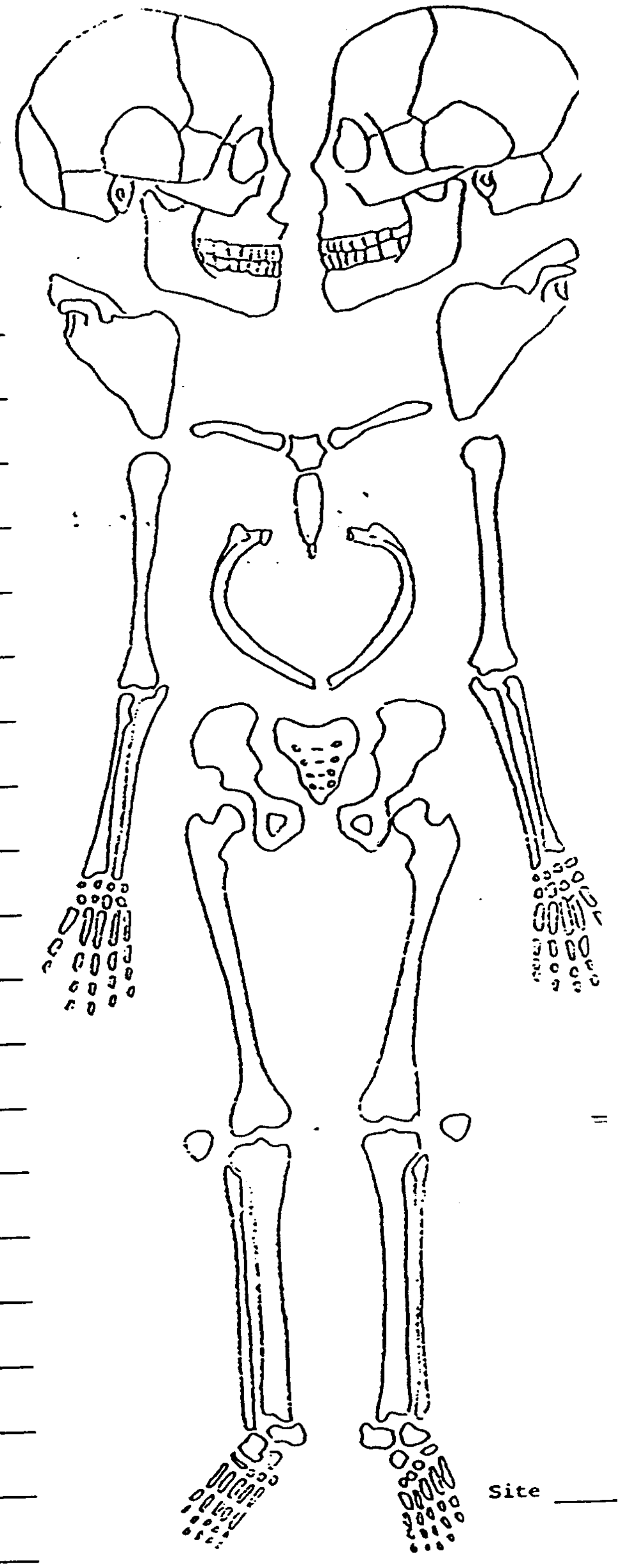
Scalping　　Trephination

Complications:

ankylosis
epiphysiolysis
pathologic fracture
Brodie's abscess
carcinoma
dactylitis
vertebral collapse

GENERAL PATHOLOGY

NOTES



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