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**Title:** Life in transition: an osteoarchaeological perspective of the consequences of medieval socioeconomic developments in Holland and Zeeland (AD 1000-1600)  
**Issue Date:** 2016-11-03
Introduction

What is the city but the people? – William Shakespeare (ca. 1604–1608)

1.1 MEDIEVAL DEVELOPMENTS AND THEIR IMPACT

This research investigates the impact of socioeconomic developments on the physical condition of medieval populations in Holland and Zeeland between AD 1000 and 1600 through the analysis of human skeletal remains from three archaeological sites. In a relatively short period of time, Holland and Zeeland developed from scarcely populated areas to a region characterised by urban centres and flourishing trade systems (van Zanden and van Bavel 2004). Historical and osteoarchaeological data from other studies focusing on similar processes in different areas of Europe suggest that these developments, urbanisation in particular, had adverse effects on the inhabitants. Woods (2003), for example, researching urban-rural mortality differences in several areas of the world, notes a clear penalty in terms of life chances for urban residents. The comparison of mortality and fertility rates demonstrates that deaths outnumbered births in many pre-modern cities (e.g., Galley 1995; Woods 2003), an observation which became known as the ‘urban graveyard effect’ (van der Woude 1982). Roberts and Cox (2003), comparing skeletal remains from different living environments in the United Kingdom, found a negative impact on the inhabitants of the newly formed medieval towns in terms of health. In contrast, Rawcliffe (2013), focusing on public health in England, found that living conditions in medieval urban centres were not as bad as had been previously assumed. This is supported by osteoarchaeological research by Lewis (1999), who notes only small differences between rural and urban children in the medieval period.

While the socioeconomic developments of the medieval period in Holland and Zeeland have been studied in detail from a broad historical perspective (e.g., van Bavel 2010; de Boer 1978, 1988; Dumolyn and Stabel 2012; Hoppenbrouwers 2001, 2002; Renes 2005), there is a paucity of data concerning the impact of these developments on the people themselves. In Holland and Zeeland (figure 1.1), medieval developments occurred rapidly and the
urbanisation rate was high (van Zanden and van Bavel 2004), which likely had an effect on the citizens of the two counties. However, based on historical research alone, the nature of this impact on medieval citizens is difficult to assess considering that individual data are often missing. Hence, this research proposes a different approach to this subject which allows a detailed examination of the physical consequences of medieval developments in Holland and Zeeland by investigating the process from an osteoarchaeological perspective.

Osteoarchaeology, the contextual analysis of human skeletal remains from archaeological sites, aims to study the lives of past individuals by looking at the remnants of their body (Beck 2006:83). The research field integrates information from human skeletal remains, such as sex, age-at-death, stature, and pathology, with cultural, social, and economic aspects of the person’s living environment (Martin et al. 2013:5). This bottom-up approach provides a different method of reconstructing past lifeways. In combination with historical data, osteological information on individual people will help to gain a better understanding of socioeconomic developments in medieval times.

Figure 1.1: Map of the current Netherlands with the study area (Holland and Zeeland) indicated.
1.2 HISTORICAL CONTEXT

The aim of this study is to integrate skeletal data with historical evidence on the socioeconomic developments during the medieval period to research the effects on the populations. This section provides a brief overview of the historically documented socioeconomic developments in Holland and Zeeland to serve as a solid framework for the human skeletal remains under study. Firstly, a characterisation of medieval society and its main developments between AD 1000 and 1200, the central medieval period, is presented. This first period can be described as an era of socioeconomic change and growth during which the foundations were laid for the large scale urbanisation that followed in the subsequent late medieval period. The second part of this section focuses on the socioeconomic developments between AD 1200 and 1600 when towns started to emerge and both the rural agricultural systems and urban industries were intensified and commercialised in response to several local and international stimuli.

1.2.1 Holland and Zeeland in development (AD 1000-1200)

Land reclamation: the creation of a human-made environment

After the fall of the Roman Empire in the 4th century AD, many regions in the Low Countries experienced a substantial decline in population size (van Bavel 2010; Henderikx 1997). This demise of the population is commonly related to the chaos and insecurity associated with the dissolution of Roman power (van Bavel 2010). Climate changes and related problems with water as well as soil exhaustion may have also played a role in the near abandonment of the region (van Bavel 2010; Besteman 1997; Henderikx 2001). Although most areas in the Low Countries, especially the loess regions (van Bavel 2010), experienced reoccupation and population growth from the 6th century onwards, habitation in Holland and Zeeland lagged behind. In Holland, the peat rich soils made habitation difficult (figure 1.2) (van Bavel 2010; Beenakker 1988). While some of the peatlands were used for grazing, extraction for fuel, dietary supplements in the form of fish and poultry, and hunting of small game, habitation and arable farming were generally limited to the elevated sandy ridges along the coast (van Bavel 2010; Ettema 2005; Rippon 2002). In Zeeland, where soils predominantly consisted of sea clay, habitation was also challenging due to constant flooding of the area (Henderikx 2012). As is visible in figure 1.2, in AD 800, Zeeland was characterised by tidal and river plains. As a result of the difficult living circumstances, most of the area of Holland and Zeeland remained fairly empty until human action made large-scale habitation possible in these wetlands.
The 10th century AD marked the beginning of the reclamation of massive areas of peat creating a new, human-made landscape (Borger 1992; van Bavel 2010). As was the case in other areas of Europe, the coast of Holland was transformed and became characterised by artificial ecosystems (Hoffmann 2014). Even though some peat lands were drained in earlier periods in order to make habitation possible, nothing can be compared to the scale with which this was done from AD 1000 onwards (Hoppenbrouwers 2002). There are many explanations for this sudden and massive expansion into the wetlands. The drier climate in the 10th century, influencing the hydrological circumstances in the peatlands, is thought to have been an important reason for the large scale reclamations (Besteman 1997; Hoppenbrouwers 2002; van der Linden 1982). Moreover, deforestation, overexploitation, and wind erosion of the sandy ridges along the coast may have been responsible for population pressure in the coastal settlements, forcing the inhabitants to colonise the wetlands (Besteman 1997).

At an early stage, land reclamations were controlled by local communities, which in their turn, were controlled by local lords or even regional rulers, such as counts or prince-bishops (Henderikx 1997). From the twelfth century onwards, these lords started to act like they were the private owners of waste lands by offering them ‘for sale’ as private sellers (vercopers in Middle Dutch) to buyers (copers in Middle Dutch; locatores in Latin) (van der Linden 1982; Buitelaar 1993). The latter usually were middlemen from the lower aristocracy, who
then attracted peasant-colonists to carry out the actual reclamation labour. Requirements and obligations of the *copers* or *locators* were stated in an agreement, known as a *cope-contract*, which regulated boundaries and measurements, public duties, and taxes (*cijns*) to be paid (Hendrikx 1998; van der Linden 1955, 1982).

Since peat consists of 80% water, the main reclamation task was the creation of adequate drainage by digging ditches which made the surplus water flow into an existing body of water. Dikes to protect the newly formed land from the surrounding water were built on the edges of the reclaimed areas.

*Living on the peat*

Living in these newly created rural settlements had an individualistic character. The excavation of Assendelft, a typical peat settlement dating to the 11th and 12th centuries AD, has given insight into life in a, locally organised, reclamation village. The farmhouses were spread out over separate strips of land with large spaces in between. The plots were artificially raised multiple times in order to deal with the subsidence of the soil and associated flooding issues. Although the house types are similar to those found in other coastal areas, the inhabitants of Assendelft had adapted their house construction to cope with the unstable reclamation subsoils. For example, the wall posts were placed on wooden boards (*sloffen*) to create more stability (Besteman 1997). The farmhouses in Assendelft combined the living quarters and stables in one space (Besteman 1997; Hoppenbrouwers 2002). It is estimated that this type of village was relatively small. Based on the remains found in Assendelft, the researchers calculated that about 70 people lived in the village, spread out over a relatively large area, resulting in low population densities.

Similar conclusions can be drawn from the excavation of a farmhouse in the Oostpolder, near Gouda. Again, evidence of artificial raising of the house floors is encountered; researchers estimate that this happened every 30 years (Kok 1999). In this case, no other farmhouses were located within 320 m to the east and 140 m to the west, supporting the idea that these farmhouses were standing in rows, with interspaces of several hundreds of meters, and each of them located on the head of an elongated plot of land (Kok 1999). The house in the Oostpolder had a similar layout and size as those excavated in Assendelft (figures 1.3 and 1.4). The wooden boards used to stabilise the wall posts were also found. The excavation of the Oostpolder house also indicates the combination of the stable and living space in one room (figure 1.4).
Figure 1.3: Floor plan of the Oostpolder farmhouse, 1:150 (after Kok 1999, figure 23, p. 46).

Figure 1.4: Spatial layout of Oostpolder farmhouse and surroundings (stal=stable, werk=work, woon=living, larger numbers indicate excavation trenches, smaller numbers: 1=fence, 2=small wooden posts, 3=bone pit (animal), 4=horse burial) (after Kok 1999, figure 32, p. 57).
Although some individuals were definitely involved with tasks associated with land reclamation and construction of works for flood protection, agriculture, both arable and pastoral farming, was the main occupation of the inhabitants of the rural villages in Holland and Zeeland (Besteman 1997; Hoppenbrouwers 2002). Both men and women were most likely involved in these activities. It is assumed that a gendered division of labour was present in the rural villages in Holland and Zeeland, although this is mainly based on later sources from the countryside in England (Jewell 2007; Whittock 2009). It is reported from the UK that women in the medieval countryside were charged with the household (estimated four to five persons) and smaller agricultural tasks such as sowing and weeding, while men were tasked with the heavier ploughing and other activities which required hard manual labour (Jewell 1996). Especially peat digging is considered to have been a difficult and labour intensive task which was exclusively reserved for men (Borger 1992).

Archaeobotanical research indicates that several cereals were cultivated in the wetlands. Although rye is commonly found in other areas of The Netherlands, as of yet, there is no reliable archaeobotanical evidence for the cultivation of this particular crop in the coastal parts and wetlands of the Western Netherlands before AD 1200 (Bakels et al. 2000). Rather, emmer wheat is commonly found, and oats and barley also tend to be present, although to a lesser extent (Bakels et al. 2000). The archaeobotanical evidence suggests that these types of cereals were locally cultivated. Although buckwheat has been found in some samples, it is unclear if this crop was locally grown to a substantial scale prior to the 16th century (Bakels et al. 2000). Archaeozoological evidence indicates that several animal species were present in the villages, cattle being by far the most common (van Bavel 2010; Ettema 2005; van Dasselaar 1999). The relatively young age of the remains suggests that the animals were bred and kept for meat (Ettema 2005). Pig and sheep/goat are also commonly found and cut marks on the bones suggest that they were consumed as well (van Dasselaar 1999).

**Impact of reclamation**

Although habitation on the wetlands created new possibilities for the villagers, living on the newly formed lands was associated with many problems. As Hoffmann (2014:167) has eloquently put it: “Nature struck back”. As a result of oxidation and drainage, the ground level deceased substantially, up to half a metre per century (Borger 1992; Henderikx 1997). This required the inhabitants of the reclamation to constantly create protection against the surrounding water in order to prevent flooding (van Bavel 2010; Henderikx 1997). Deepening of the ditches, raising of the dikes, and construction of floodgates were all measures taken to fight the water (Henderikx 1997). Some reclamations could not be saved and were surrendered to the water. Additionally, the subsidence of the soil made crop cultivation very difficult: at the end of the 13th century the peat farmers in Holland had to adopt a different strategy to be able to survive on the peatlands (Borger 1992; Ettema 2005). This development and its relationship with urbanisation are discussed further below.
1.2.2 Urbanisation and commercialisation (AD 1200-1600)

Rural development and urbanisation

In the period after AD 1200, development of the socioeconomic system in Holland and Zeeland resulted in a remarkable change of the landscape (de Boer 1988). Once solely comprised of small agricultural villages, during the late medieval period small urbanised centres started to emerge in the region. Although it is difficult to assess what the actual driving forces behind urbanisation in this period were, the developments between AD 1000 and 1200 in the rural areas must have contributed to the urban expansion (Hoppenbrouwers 2002).

The problematic nature of peat farming as a result of soil subsidence is considered to have been an important factor in the process of urbanisation. In the centuries that followed AD 1200, the peat soils became less and less suitable for grain cultivation, as shown by the research of de Boer (1978). He compared the korentienden (the percentage of revenues that had to be paid to the landlords, which can be indicative for the total grain yields) between AD 1343 and 1415. While the harvests appeared to have been stable on the geest lands, he notes a prominent decrease in yields of the peat areas, which he relates to flooding issues (de Boer 1978:223). Although grain cultivation most likely did not become completely impossible (Ettema 2005), profitable arable farming definitely became problematic in the peat areas. As a result of this, peat farmers moved away from arable farming and became more focused on cattle breeding. This is supported by the Informacie of AD 1514, from which it is evident that arable farming was only important in small areas in the Noorderkwartier (North of the river IJ) and that stock breeding was more significant (van der Woude 1972).

Since pastoral farming requires less work and an uneven seasonal distribution, not much work was required in fall and winter (Kaptein 2007). This shift in activity gave rise to a labour surplus in many parts of the countryside which triggered permanent migrations to the towns (Blockmans 1993). Therefore, the labour surplus is considered to have been an important causal factor for urbanisation, as is advocated by many scholars (e.g., Hoppenbrouwers 2002, Slicher van Bath 1960, van Zanden 1991). However, Ettema (2005) argues that there are too many uncertainties about the specific activities following the abandonment of grain cultivation in addition to cattle breeding to make any inferences about labour requirements. Van Bavel and van Zanden (2004) note that, while the ecological issues are definitely an essential element in the changes during this period, the most serious problems in arable farming only occurred after AD 1400 when the process of commercialisation and urbanisation had already began. They therefore argue that the ecological crisis did not initiate the developments but most likely did accelerate them.
Additionally, it is argued that decreasing grain demand may have been a factor in the decline in production as a result of reduction of population size due to the plague epidemics in the late medieval period (van Bavel and van Zanden 2004; Boroda 2008). However, it appears that the impact of the plague on the Dutch wetlands was less dramatic in comparison to other European countries, therefore limiting the effect on agricultural production (van Bavel and van Zanden 2004; Blockmans 1980, Jansen 1978). By studying the arable output in relation to population numbers, van Bavel and van Zanden (2004) are able to clearly show that the decrease in grain production is not correlated with a decline in population size. They state that “population developments did not dictate the ups and downs of agricultural output, or vice versa” (van Bavel and van Zanden 2004:571).

The ecological circumstances that prevented arable farming in Holland were absent in Zeeland. Its clay subsoils were suitable for crop cultivation and subsidence was not a problem (Beenakker 1988). Farms in late medieval Zeeland were focused on food production for the markets, but also on the productions of raw materials for the urban industries. Particularly madder (meekrap) cultivation, used to obtain red dye, was of great importance in Zeeland (van Steensel 2012b). Although the peasants would have possessed animals for their own use, large-scale pastoral farming was not present in Zeeland (van Steensel 2012b). In this region, therefore, a labour surplus caused by a transition to pastoral farming is not likely to have been a causal factor in the rapid urban expansion. For Zeeland, it is argued that population growth and associated increased agricultural productivity caused a surplus of people and products on the countryside, which led to movement to the new towns (van Steensel 2012a).

**Urban expansion**

Even though there is still some debate about what triggered the migration of rural residents to the newly formed urban centres, it is clear that towns and their populations grew quickly during the three centuries following AD 1200. Blockmans (1993) estimates that at the beginning of the 14th century AD, Holland counted about 260,000 individuals of which only 60,000 (23%) resided in urban centres. Data from AD 1514 show that by then already 44% of the population was living in towns (Blockmans et al. 1980; Blockmans 1993; Hoppenbrouwers 2001).

Information on population numbers in Holland comes from data collected by the central authorities for tax purposes (van der Woude 1972). The *Enqueste* of AD 1494 and the *Informacie* AD 1514 give information with regards to population size by counting the number of hearths (i.e., houses) multiplied by the average number people in one household (Fruin 1866; van der Woude 1972), which is estimated to be in the range from 4 to 4.5 individuals (Blockmans 1993: 4, Hoppenbrouwers 2001: 4-4.5, Blockmans et al. 1980: 4). Table 2.1 shows the total population size calculated using the number of (non-clerical)
hearth taken from the Informacie (Fruin 1866) of the largest towns in Holland (minimum of 3000 inhabitants). Considering the count was done for tax purposes, it was beneficial for the towns to have fewer numbers of inhabitants on record in order to minimise the tax that had to be paid (van Oosten 2014). Therefore, the population numbers displayed in table 1.1 are likely underestimating the actual population sizes.

Table 1.1: Population numbers for the largest urban centres in Holland in AD 1514.

<table>
<thead>
<tr>
<th>Town</th>
<th>Population estimate AD 1514¹</th>
<th>Hearths</th>
<th>Size range (4-4.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkmaar</td>
<td></td>
<td>889</td>
<td>3556-4001</td>
</tr>
<tr>
<td>Amsterdam</td>
<td></td>
<td>2507</td>
<td>10,028-11,282</td>
</tr>
<tr>
<td>Delft</td>
<td></td>
<td>2616</td>
<td>10,464-11,772</td>
</tr>
<tr>
<td>Dordrecht</td>
<td></td>
<td>1500</td>
<td>6000-6700</td>
</tr>
<tr>
<td>Gouda</td>
<td></td>
<td>1680</td>
<td>6720-7560</td>
</tr>
<tr>
<td>Haarlem</td>
<td></td>
<td>2714</td>
<td>10,856-12,231</td>
</tr>
<tr>
<td>Hoorn</td>
<td></td>
<td>1118</td>
<td>4472-5031</td>
</tr>
<tr>
<td>Leiden</td>
<td></td>
<td>3017</td>
<td>12,068-13,577</td>
</tr>
<tr>
<td>Rotterdam</td>
<td></td>
<td>1118</td>
<td>4792-5391</td>
</tr>
<tr>
<td>The Hague</td>
<td></td>
<td>1198</td>
<td>4792-5391</td>
</tr>
</tbody>
</table>

¹Fruin 1866. Hearths are multiplied by 4 and 4.5 to show size range.

Even though the population numbers for the towns in Holland in the 16th century are low in comparison to those of other European cities during this same time period (Paris: 225,000 Lisbon: 70,000, Ghent: 55,000 (Bairoch et al. 1988:278)), population densities might have been relatively high considering the small dimensions of the Dutch towns. Visser (1985) analysed the density of several towns between AD 1300 and 1560. He calculated that in AD 1300, the urban centres had an average of 75.5 inhabitants per hectare, while in AD 1560 average population density had increased to 126.5 (Visser 1985). Figure 1.5 shows the population densities of three cities in Holland at three moments in time (Visser 1985). Interestingly, even though Amsterdam has the most inhabitants in AD 1560, because of its size it did not have the highest population density. Dordrecht, which had substantially fewer inhabitants than Amsterdam, had a higher population density as a result of its relatively small dimensions (Visser 1985). Although Paris had a higher population density (512 inhabitants per hectare), in AD 1500, London only had a population density of approximately 192 and Gent of 262 (Bairoch et al. 1988). This suggests that, even though the total number of inhabitants was lower than that in other cities of Europe, the population densities in Dutch towns were similar and in some cases even higher.
Inhabitants per hectare

Time periods

Figure 1.5: Population density in Amsterdam, Delft, and Dordrecht at three moments in time (AD 1300, AD 1400, and AD 1560) (after Visser 1985, figure 5, p. 16).

Living in these newly formed towns was different than in the countryside. Even though during the beginning of urbanisation, towns would have had a relatively rural character, later in time as the centre grew, the layout changed. Interestingly, the original structure of the village usually remained visible and, more importantly, dictated development (Sarfatij 2008). Dordrecht is a great example of this: the town began as a small land reclamation village and transformed into a large urban centre with the new layout determined by the original outline of the settlement (Sarfatij 2008). Moreover, instead of wooden construction, most houses in the new towns were constructed out of stone materials. In Dordrecht, houses were made from brick early in its urban development (Sarfatij 2008).

Rural commercialisation and urban industries

As mentioned above, the abandonment of grain cultivation and the subsequent focus on cattle breeding are assumed to have resulted in a labour surplus in the countryside. In response, many peasants moved to the newly formed towns. However, the labour surplus was also solved by combining agricultural work with other activities (Blockmans 1993; Hoppenbrouwers 2001). Both the Enqueste and Informacie demonstrate that shipping and fishing for sea and shellfish were important sources of income for rural inhabitants, possibly even exceeding the importance of stock breeding in many villages (van der Woude 1972). Commercial excavation of peat as a source of fuel was also an important activity in the late medieval countryside (Hoppenbrouwers 2002). Although likely of lesser significance, to meet the demands of the ‘draperye’ (cloth industry) in the towns, spinning and weaving were important activities (Blockmans 1993). In addition, ship-building has been noted as a main activity in the rural areas (van der Woude 1972). In Zeeland, fishing was a significant activity in addition to agricultural tasks (van Steensel 2012b). Most of these activities were focused
on the regional and supra-regional market. The fact that the peasants were occupied with a broad range of activities, but very focused on the market, has led several scholars to conclude that the rural economy in the 15th century was highly commercialised, yet simultaneously not very specialised (van Bavel 2010; Hoppenbrouwers 2001:59; Noordegraaf 1985; van Zanden 1988).

The urban inhabitants, on the other hand, were much more specialised (Blockmans et al. 1980), often focusing on a single occupation. Additionally, agriculture was not an activity commonly undertaken by town residents, although some citizens may have had access to small gardens where they cultivated foods for their own use (Dijkman 2010). Detailed accounts from Leiden and Dordrecht demonstrate that only three percent of the urban population was involved in agriculture. In contrast, 59% of the labour force was engaged in industrial activities (van Bavel 2010), which can be divided into a number of labour sectors of which the importance differed per town. Leiden, for example, was mainly focused on textile production which is demonstrated by the high percentage of the labour force working in this sector (34%) (Blockmans et al. 1980). Dordrecht, on the other hand, was more focused on international and national trade and, consequently, most of its labour force worked in this sector (32.1%), while only four percent were employed in the textile branch (Blockmans et al. 1980). Men and women had separate tasks depending on the focus of the town and their social class. Spinning appears to have been a common activity for the poorer women in late medieval towns (Jewell 2007). Trade activities were more commonly taken up by men (Jewell 2007).

Market and trade
In the late medieval period, self-sufficiency disappeared (van Bavel et al. 2004; van Bavel 2010). The villagers in the countryside of Holland and Zeeland became more market oriented (van Bavel et al. 2004; Hoppenbrouwers 2002) resulting in a commercialisation of production and the beginning of a market economy. During the 14th and 15th centuries, international trade intensified in Holland and Zeeland. Products such as linen from Leiden and Haarlem, beer from Gouda and Delft, and of course cheese and butter, were shipped to many places outside the counties (Hoppenbrouwers 2002). Now, both villagers and townspeople became dependent on products of the market, which offered staple foods and other commodities, but also new, more exotic items such as fruits, sugars, and spices became more widely available during the late medieval period. It is however likely that these luxury items were only available for more wealthy individuals (Jansen-Sieben and van Winter 1989). Additionally, commercial fishing, especially for herring, increased in the late medieval period (van Steensel 2012b; Unger 1978) which is also indicated in the Enqueste and Informacie (van der Woude 1972). While it is assumed that meat and bread remained the main components of a medieval meal in both town and country (Baudet 1904; Jansen-Sieben and van Winter 1989).
1989), the socioeconomic developments in the late medieval period may have changed the diet adding different types of protein and carbohydrates.

1.3 RESEARCH QUESTIONS: IMPACT OF MEDIEVAL DEVELOPMENTS

The sections above have demonstrated that, from a historical perspective, much is known about the socioeconomic developments in the Central and Late Middle Ages. However, the impact of these developments on the medieval peoples themselves is difficult to assess using historical data alone. While the changes in living conditions, occupations, and food production could have influenced people substantially, in both negative and positive ways, the historical data do not provide the level of detail necessary to determine this. Therefore, the aim of this research is to assess the impact of the medieval developments by studying the skeletal remains of rural and urban populations focusing on three aspects of life: disease, activity, and diet. Using the historical information above, a series of research questions can be formulated.

The main research question is:

- In which ways do human skeletal remains reflect the key socioeconomic developments, urbanisation and commercialisation, in the medieval period in Holland and Zeeland, and how do the results contribute to a better understanding of the impact of these developments?

The following subquestions outline the separate components of this research:

- Which changes in patterns of disease and systemic stress levels can be observed? Are there differences between the skeletal remains of rural inhabitants dating before and after AD 1200 medieval times? In which ways do the rural skeletal collections differ from the urban collection?

- In which ways did changes in physical activity patterns during the medieval period and especially during urbanisation impact the bodies of the citizens? Which differences can be observed between inhabitants of villages and towns? Is it possible to observe differences in the division of labour?

- Which evidence exists for a change in dietary patterns? Are there differences in consumed food types between the earlier and later medieval rural collections? In which respect does the rural diet differ from the urban diet? Is there evidence for a change in nutritional stress levels through time or as a result of urban living?
1.4 OSTEOARCHAEOLOGY AND THE IMPACT OF SOCIOECONOMIC DEVELOPMENTS

1.4.1 Previous osteoarchaeological research into medieval developments

Research into the consequences of medieval socioeconomic developments using skeletal remains has been performed in several parts of the world. Calvin Wells (1977), studying maxillary sinusitis from the Bronze Age through the late medieval period in Britain, noted an increase in prevalence through time which he relates to higher population densities and sedentism (Lewis 1999, 2002; Wells 1997). More specifically focusing on medieval urbanisation, Mary Lewis and colleagues (1995) continued the work of Wells and compared the prevalence of maxillary sinusitis between urban and rural populations. Later, Lewis (1999, 2002) developed this line of research for her PhD and studied the impact of medieval and post medieval developments by assessing morbidity and mortality patterns of non-adult individuals. She compared skeletal data collected from four different rural and urban sites (AD 850-1859) in order to assess changes in child health (Lewis 1999, 2002). She found that industrialisation had a larger impact on health than did urbanisation (Lewis 1999). Similar research was carried out in Sweden by Anna Kjellström (2005). Although she did not compare rural with urban skeletal collections, she studied human remains from six cemeteries in the town of Sigtuna dating from the end of the 10th until the early 16th century. The skeletal material was divided into three phases of chronological development, coinciding with the establishment of the town, the peak of its prosperity, and its decline. Kjellström found a deterioration of health and a change in activity and dietary patterns, which she links to the establishment of the true urban settlement in the later period (Kjellström 2005; Kjellström et al. 2005).

In yet another part of Europe, Poland, Tracy Betsinger (2007) studied multiple facets of the urbanisation process by investigating human remains from three different cemeteries in the town of Poznań. The individuals she researched dated to three different phases (AD 950-1025, 1025-1150, 1150-1250), which allowed her to assess changes through time as a result of intensified urbanisation in the town. Betsinger, just like some of the other researchers, noted a mild decline in health in the later periods. Additionally, she observed changes in diet and activity patterns (Betsinger 2007). Most recently, Kim Quintelier (2013) studied the urban population of Tongeren, Belgium, through time in order to assess the influence of increased urbanisation. Interestingly, she observed no changes in stress levels, even though population densities increased.

These studies are examples of the successful application of an osteoarchaeological approach to study of the consequences of urbanisation and commercialisation in the past. The researchers
were able to collect data on disease patterns and systemic stress as well as information about activity and diet, not readily available in historical literature. This shows the great potential for this type of research, as well as the need for local analysis, since the researchers obtained different results while studying similar processes. The multiple variables involved with the socioeconomic developments in medieval times dictate that their effects would have varied in different populations. Therefore, each region must be analysed independently. In The Netherlands, although osteoarchaeological methods are applied to archaeological studies on a regular basis (e.g., Alders and Van der Linde 2011; Lemmers et al. 2012; Maat et al. 1998; Schats et al. 2014; Schats 2015a), this approach has not been employed to study the impact of medieval socioeconomic developments in this region.

1.4.2 Current research

The present study developed out of the need to address the potential consequences of medieval socioeconomic developments on the populations in Holland and Zeeland. This study analyses individuals from two rural and one urban skeletal collections (figure 1.6). Since the land reclamation village of Blokhuizen (AD 1000-1200) in Holland predates urban development in the area, its inhabitants can serve as a rural baseline to which the other skeletal assemblages can be compared. The second skeletal assemblage in this study is associated with the rural village of Klaaskinderkerke in Zeeland, dating to the late medieval period (AD 1286-1573) when urbanisation was well on its way. This skeletal collection provides a rural perspective on urbanisation. A skeletal collection from the town of Alkmaar (AD 1448-1572) provides the urban perspective in the present study. This research is placed in a broader perspective by including the results of four comparative skeletal collections already analysed by other researchers in the discussion of the current results.
This study focuses on the comparison of three key aspects of life between the three skeletal collections, which could have been impacted by the socioeconomic developments in the medieval period: disease, diet, and activity. Changes in the medieval period, especially urbanisation, are commonly associated with alterations in disease patterns and stress levels. Shifting living conditions towards more densely populated urban centres could have influenced the prevalence of respiratory infections such as bronchitis and tuberculosis. Rural populations may have been more subjected to infections such as malaria, brucellosis, and bovine tuberculosis, as a consequence of land reclamation and intensification of pastoral farming. Furthermore, the medieval socioeconomic developments may have altered activity patterns. Changes to the rural and urban economies in the late medieval period could have influenced activity levels within the populations. The decrease of arable farming in Holland and shift to more market orientated activities could have been responsible for different patterns, impacting the physical body in a different way. Additionally, diet could have changed as a result of the developments. Although staple foods most likely remained the same through time and space, the increased trade and market dependence could have altered the available foods and, consequently, the diet of the late medieval rural and urban individuals.
1.5 DISSERTATION STRUCTURE

This dissertation is divided into seven chapters. Chapter two provides the historical and archaeological contexts of the sites and excavation history of the skeletal collections under study to be able to interpret the skeletal data correctly and in line with the context. Chapter three outlines the skeletal indicators studied in this research. This chapter provides a palaeopathological background and discusses the way in which these pathological conditions can help to assess the physical consequences of urbanisation. Additionally, the osteological paradox is addressed and discussed. Chapter four discusses the methods used in this research to collect the necessary data from the skeletal remains. Chapter five presents the results of the skeletal analysis. The data are presented separately per site as well as in comparison with the other skeletal collections. Chapter six discusses the results of the skeletal analysis combining the data with the historical information presented in chapter one. The final chapter presents the conclusions of this study and answers the research questions posed above. This chapter ends with a discussion of possibilities for future research.