

# ESTER: RESEARCH DESIGN COURSE

## *Between Rivalry and Support*

### *Differences in the Mortality Chances of Brothers and Sisters in Taiwan and the Netherlands, 1860-1940.*

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#### **Abstract**

During the last decade, studies investigating the influence of siblings through birth rank, position within the family and sibship size have underscored their importance in demographic processes and outcomes in historical times. This PhD-project aims to fill the gap in historical mortality research by focusing on the influence of the number of siblings on mortality chances of children under the age of five from a comparative approach. Because the way in which humans organise families varies around the globe, the overall picture of the human family is one of flexibility between and within populations. Moreover, this affects the way in which family members cooperate or compete with each other. Thus, this PhD-project investigates inequality in life chances by examining the diverse roles siblings may play within households in Taiwan and the Netherlands during the period 1860-1940.

Population and household registers are used because these sources record the presence or absence of siblings in a household at a particular point in an individual's life. The theoretical framework of household systems will be used to expand our understanding of inequality in life chances by including the distinctive features, such as marriage structures, parental power and household organisation, of both Western European and Asian households. Moreover, regional variation will also be taken into account by looking at possible differences within the Netherlands and Taiwan. By doing so, it will become possible to include regional variation and to test if differences regarding sibling influences are minor within both societies compared to the differences between them. To analyse all datasets, methods appropriate for the statistical analysis of quantitative life course data will be used. Event history techniques, such as Cox proportional hazard models, can analyze mortality in the life courses of Taiwanese and Dutch siblings, while multilevel (event history) or frailty models are applied to compensate for clustered sibling data.

## 1. Introduction

It is said that death is a debt we all must pay and makes us equal in the end. However, this does not necessarily imply that the same is true during life. While every day 29.000 children die before their fifth birthday, most of them die in South-central Asia and sub-Saharan Africa where mortality rates are the highest (Unicef 2014). Yet, even within countries there are major differences in survival chances. A good example is the city of London. According to the London Health Observatory, when travelling east from Westminster, each tube stop represents nearly one year of life expectancy lost. Someone born near Oxford Circus has twenty years more to live compared with others who are born close to the stations on Docklands Light Railway (Life mapping Londen 2014). On the other side of the world, the Gansu province in China offers another example of within-country differences. Despite a general decline in infant mortality, the mortality rates for infants living in the countryside are still more than double the mortality rates of infants born in cities (Yi et al. 2011). Indeed, it becomes clear that death seems not to be equal but actually the opposite. It is usually not distributed on a random basis, neither today nor in the past.

Because of the vast range in the causes and timing of mortality, including location in space, time and social position, historical demographers have focused on mortality as a way to measure inequality in historical times (Sen 1998; Campbell 2012). Their main reason for doing so was that while there is no choice in the matter of dying, because eventually everyone dies, coincidence is most of the time not the main reason for the timing of a death in pre-modern societies. Choices, however, made within constraints originating from the historical context, are. In other words, mortality patterns do not only demonstrate biological effects, but also the availability and distribution of resources which influence survival chances. The involuntary aspect of death makes using the arrival and timing of the Grim Reaper therefore a useful indicator for investigating personal wellbeing and welfare. It is a way to examine in what ways human agency plays a role in inequality in life chances (Bengtsson, Campbell, and Lee 2004).

Infant and child mortality rates are in particular useful for investigating inequality in life chances, because these categories of children are totally dependent on the care and resources given to them by others.<sup>1</sup> They not only need food and care to stay alive, but also to develop their body and mind. Moreover, in infancy and old age people experience the highest chances of dying compared to other age categories. This fact makes possible effects of different social, economic, cultural, and demographic factors more visible. Yet, compared with other risk groups, such as elderly and widows, young children occupy an additional risky position within a family as they have absolutely no say in the division of resources. In sum, young children are the most vulnerable group in a pre-modern society, one which will experience the consequences of an unequal treatment first (Bideau et al. 1997; Corsini and Viazzo 1997; Oris et al. 2004).

Until now, however, remarkably little interest has been devoted to differences and interdependencies among siblings in mortality chances, while during the demographic transition brothers and sisters may have had a big impact on each other's lives because most people grew up surrounded by a much larger number of siblings than we do today. Stable high fertility levels and declining mortality caused a higher number of children to survive in each family during the nineteenth century. As a result, during this period the number of children within one family became the largest number it has ever been in human history (Johnson and Sabeau 2011). Moreover, sibling interactions

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<sup>1</sup> Infant and child mortality refers in this whole paper to mortality of infants and children between zero and five years old. This broad age-category from zero to five years old is generally divided in the following age-categories: neonatal (0-1 month), post-neonatal (1-12 months), toddler (12-24 months), and young child (24-60 months).

are life's longest relationships. While parents die, friends drift in and out, marriages dissolve and children leave, siblings usually remain connected by an invisible bond that transcends time and distance. Secondly, one of the most intriguing aspects of siblings is their quality of 'unity in difference'. Brothers and sisters are equals in the sense that they have a common background, shared childhood memories, similar family resources and specific family traditions. Yet, they are also different because hierarchy and inequality among siblings are the result of differences in age, gender and birth position which determine their position within a family (Davidoff 1995; Davidoff 2013). One could also argue that the number and presence of siblings might be more important in pre-modern times because of bad living conditions, a lack of social security, low levels of well-being and welfare. An extra mouth to feed, or hand to help, could make a huge difference in determining inequality in survival chances.

During the last decade, studies investigating the influence of siblings through birth rank, position within the family and sibship size have underscored their importance in demographic processes and outcomes in historical times (Bras and Neven 2007; Bras and Van Tilburg 2007; Kok and Bras 2008; Vandezande and Matthijs 2009). Scholars investigating infant and child mortality, however, disagree about the underlying causal pathways of heightened mortality in families with a larger number of siblings. Firstly, biological determinants could largely be responsible for observed differences. For example, disease environment, short birth intervals and maternal depletion can all be important effects. Secondly, sibling rivalry and support may be of importance. When siblings are young they can compete for material and immaterial resources, but when they are older they may provide care or additional income for the household. The way in which these mechanisms functioned and were connected to each other remains unclear to this day (Kippen and Walters 2012; Dong et al. 2014).

This PhD-project aims to fill this gap in historical mortality research by focusing on the influence of the number of siblings on mortality chances of children under the age of five from a comparative approach. Because the way in which humans organise families varies around the globe, the overall picture of the human family is one of flexibility both within and between populations. Moreover, household composition affects the way in which family members cooperate or compete with each other. Therefore, this PhD-project investigates inequality in life chances by examining the diverse roles siblings may play within households in Taiwan and the Netherlands during the period 1860-1940. Population and household registers are used because these sources record the presence or absence of siblings in a household at a particular point in an individual's life.<sup>2</sup> The theoretical framework of household systems will be used to expand our understanding of inequality in life chances by including the distinctive features, such as marriage structures, parental power and household organisation, of both Western European and Asian households. Moreover, regional variation will also be taken into account by looking at possible differences within the Netherlands and Taiwan. By doing so, it will become possible to include regional variation and to test if differences regarding sibling influences are minor within both societies compared to the differences between them. The remainder of this paper will introduce the two main strands of literature to which my PhD will contribute, describe the sources and introduce the methodology used to analyze them.

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<sup>2</sup> This is in most cases not possible with family-reconstitution data and birth-history data.

## 2. Infant and child mortality studies

While the first mortality studies covering historical periods were focusing on the mortality decline in relation to economic modernisation, it became clear that eventually economic modernisation could not portray and explain all the processes involved in mortality. For example, in some countries, such as Sweden, mortality already started to decline before industrialisation (Schofield and Reher 1991; Bengtsson and Lindstrom 2003). Improved living standards, the increasing quality of public health services, hygiene and health norms together with the incorporation of more know-how regarding child health in social and cultural norms, such as the behaviour of mothers and breast feeding practices, seem all to have had an effect on mortality outcomes in the past (Omran 1971; McKeown 1976; Preston and Haines 1991; Omran 1998; Fogel 2004). In short, environmental factors which determine disease environments (air, food, water, soil, insects), maternal factors (age, parity and birth interval) and nutritional intake (living standards and diet) should all be taken into account because of their interaction. Yet, this interaction can differ from one case to another (Mosley and Chen 1984; Mosley and Chen 2003). In turn, this explained why there was so much variation in the observed mortality levels between regions, or even between families and individuals. The key question when working on mortality therefore became how the effects of its main determinants could be separated.

In search of answers a more geographical perspective on mortality patterns answering the questions ‘who dies and why?’ became more important than questions as ‘why did mortality decline?’. In other words, by taking the most extreme form of inequality, namely death, scholars were concerning themselves more with questions surrounding inequality in life chances in past societies than with the causes for declining mortality levels. In addition, the digitalisation of micro data and the development of methods needed to analyze them provided the tools to begin answering the new emerging questions regarding inequality in life chances (Campbell 2012). The Eurasian Population and Family History Project, for example, contrasted populations at the extreme Eastern and Western end of the Eurasian land mass by using similar datasets and methods. The scholars in this project, however, were not just studying individuals in normal circumstance, but looked at demographic outcomes during crisis situations as well. They concluded that while the immediate causes of death were by definition biological, the important influence of social and economic background cannot be overlooked. Mortality levels are not predicted by social and biological composition of each population, but more so appeared to be a product of social and family organisation in peculiar ecotypes. For instance, prices of food and the presence of certain family members were highly significant for demographic outcomes (Bengtsson, Campbell, and Lee 2004; Tsuya et al. 2010). Another comparative project titled *Population and Society in Taiwan and the Netherlands* found an influence of especially biological determinants, such as birth intervals, maternal depletion, seasonality and parity, instead of father’s occupation or religion. This made these contributors conclude that biologically proximate factors were more important than socio-cultural factors in determining mortality outcomes in Taiwan and The Netherlands (Engelen and Wolf 2005; Engelen and Ying-Hui 2007; Wolf and Engelen 2008; Engelen, Shepherd, and Yang 2011;). Yet, these authors did not include household context and organisation or their response to food prices.

Although not all of the above mentioned determinants of mortality outcomes can be directly influenced by humans, it becomes clear that human agency may have an enormous effect on infant and child mortality. Moreover, the way in which families organise varies between populations and may determine the ways in which family members co-operate in raising children. It determines who is available, who is culturally or socially held responsible to help, and how members of the household interact with each other. Indeed, children occupy a special position in this case because they are dependent on others. Thus, household structure, ideology and norms are all connected to household

organisation (Sear and Coall 2011). Yet, the question remains how exactly sibling composition influences survival chances of infants and children. The next section will first discuss the importance of household members on mortality outcomes in general before returning to the primary subject of interest of this PhD-project.

### **3. Theoretical Framework:**

#### **The influence of household members on infant and child mortality**

Concepts, such as family, differ throughout time and place, which sometimes make them problematic and difficult to define. Family can, for instance, refer to the people to whom one is related and with whom one lives, but the concept can also be expanded to include all kin. The definition of a household is, however, very specific: the co-resident domestic group. In this PhD-project the term household will be used because it has clear boundaries and it may be seen as the unit in which the closest (positive or negative) relationships between family members are shaped. It is the place in which people share the same psychical space, eat, sleep, work and spend spare time together. Secondly, historical sources rarely record bonds between people who have not lived with each other and are therefore difficult to reconstruct (Laslett and Wall 1972; Richard, Robin, and Laslett 1983; Netting, Wilk, and Arnould 1984; Ellickson 2008; Niehof 2011).

Household context, as mentioned before, is a key determinant of individual demographic outcomes as household organisation responds sensitively to changes in the environment while preserving certain formal similarities for long periods at the same time (Das Gupta 1997; Skinner 1997). Material and immaterial resource allocation and work assignments of household members also determine their consumption and their sensitivity to the disease environment. This is important to note because most households are highly stratified, with multiple overlapping hierarchies (Folbre 1986; Wolf 1990; Lee and Campbell 1997; Klep 2004a; Klep 2004b). Chinese families are probably the best example of this because strong parental power caused senior generations to take precedence over junior ones and men had priority to women due to the patriarchal system. The least privileged can even be further differentiated according to whether particular kin was present (Das Gupta 1999; Bengtsson, Campbell, and Lee 2004). However, the same kind of hierarchies may be observed in households in which intra-household hierarchies are less clear. Within the context of the household, individuals will adapt their activities to those of other household members and to economic opportunities.

Instead of viewing the household as the result of a knot of individual interests, the household can also be treated as an independent entity with its own strategy. In this sense, a household, and its included members, makes united choices and exercises priorities when responding to external constraints or opportunities (Baud and Engelen 1997; Engelen et al. 2004). Hareven and Vinovskis (1978, 19-20), for example, claim that, “families functioned as corporate units in planning their income and labour force strategies” and “the family, rather than the individual, maximizes its utility.” Most studies use this kind of rational economic choice framework, in which the household always will try to maximize economic resources, when discussing decision making within the household (Bennett 2013; Himmelweit et al. 2013). Yet, from an evolutionary point of view, a household may be seen as more than just an economic unit, because it also functions as the organization structure of human reproduction. In this sense, the most important goal of a household is to raise healthy children. This is something which causes some scholars to argue that the household could mainly be seen as a production unit of care and well-being for its members. These theories consider the household as a

mediator of both environmental risks and human interventions to promote health. By analyzing a household as a production and consumption unit of health processes of mutual adaptation between the individual and the environment may be better understood as they are filtered through the constraints of household settings, local customs and the perspective of caretakers on individual children (Harkness and Super 1994).

Still, a household cannot solely be seen as an independent cooperative entity since it always consists of several individuals with agency. Motives of family members and power structures within the family, caused by age, gender and birth position, still exist although they are not apparent by using for example the term household strategies. Conflict is a big part of households in which a continue process of negotiating is present (Folbre 1986; Moch et al. 1987; Wallace 2002; Niehof 2011). Furthermore, people will not always act with economic rationality. For example, when having many children became an economic burden because of schooling, fertility did not immediately decline in Catholic areas. Culture, in the sense of (religious) norms and traditions, prevented fertility to decline until the 1960s despite the loss of child labour (Engelen 1997). A household can therefore best be seen as a knot of individual interests in which the struggles between generations and genders will determine household processes and organisation.

The presence of certain members can therefore have a large influence not only on the production of health, but also on the consumption of health because of the allocation of resources. One of the main observations was that family members seem important in determining mortality through the ways they influence the distribution of both material and immaterial resources. Earlier research shows, for example, the importance of the mother for the survival chances of her children. The importance of the father and grandparents vary by historical context. Especially the role of the grandfather is ambiguous, because in some cases his presence even increased the mortality of children within the household (Derosas and Oris 2002; Sear and Mace 2008; Sear and Coall 2011). In addition, studies have made claims about the clustering of deaths in certain families. This suggests that care practices, genetic influences or disease environments possibly affect the family as a whole, not just individual members (Edvinsson and Janssens 2012; Vandezande 2012). The next section will provide an overview of the factors earlier research deals with when examining the influence of siblings on the production and consumption of care and wellbeing within the household.

### **3.1 The influence of siblings on infant and child mortality**

The first research investigating the possible effect of the composition of the sibling set on infant and child mortality looked at the correlation between birth order and early child mortality (Yerushalmy 1938; Puffer and Serrano 1975). It was argued that children born in higher-birth orders were treated less well and neglected more than earlier-born siblings because of the simple fact that they were seen as superfluous. For instance, parents already had an heir who could take care of them when they grew old which caused them to be less dependent on later children. Another explanation pointed at the birth rank being an indicator for the number of siblings. Higher-birth order children would have more siblings which resulted in less individual care, attention and material resources. Furthermore, the observation of higher mortality of first born children and high parity children also suggested important biological mechanisms.

Only a second generation of studies demonstrated that the effect of birth order indeed disappears when complete family size is taken into account (Cohen 1975; Hobcraft, McDonald, and Rutstein 1985). Belonging to a large family, rather than being born later, influenced survival in pre-industrial Europe. The same was observed in developing countries. Hobcraft *et al.* (1985) concluded

that only a handful of 39 developing countries experienced weak birth order effects. For all other, developing countries birth order did not have any effect while family size did. This was, on the one hand, explained by the idea that with the arrival of more children, families became more rule ridden, less individualized, and increased physical punishment. On the other hand, the larger division of resources was again seen as a main determinant of lower survival chances. Further research discovered that the same negative relationship existed between sibship size and mortality chances. The main difference between family size and sibship size is normally defined in the sense that the latter group exists of more dependent members which possibly indicates sibling competition instead of more general within-household competition (Wagner, Schubert, and Schubert 1985).

Studies investigating social status have also observed a negative effect of additional children in the household. The main explanation for this observation is known as the resource dilution hypothesis, which argues that additional children dilute the amount of time and resources a child receives from its parents (Blake 1989; Steelman et al. 2002). Many studies underscore the importance of additional children by arguing that this effect of reduced parental investment per child has clear negative consequences for education (Downey 1995; Desai 1995). In economics the same observation, namely the fact that a reduction in the number of children raises investments in child quality, is labelled as the quality-quantity trade off hypothesis (Becker 1981; Maralani 2008).

Knodel and Hermalin (1984, 1102), however, argued that at least four major factors underlie the strong relation between infant mortality and the ultimate number of children: “the length of the birth interval, breast-feeding patterns, genetic causes, and a combination of family resources and parental care practices.” Zenger (1993) warned for the same issue because sibship size can only be regarded as a proxy for other causes. On itself sibship size cannot be considered a causal factor, because it can both indicate the influence of resource competition and disease transmission. Thus, the reason why the composition of a sibship set matters for survival chances of individuals may be the result of the allocation of material and immaterial resources, biological determinants which increase mortality or both. Moreover, individuals can have varying numbers of siblings depending on timing and birth order. For example, first-born children might acquire increasing numbers of siblings. The same is true for high parity children who might benefit from older siblings who bring in resources.

By taking above mentioned findings into account my PhD-project will investigate the consumption, production and allocation of wellbeing and care of siblings in two ways. Firstly, I will examine if there is a negative effect when the number of young siblings increases. This can be explained by the production or consumption of wellbeing and care or this can be solely a biological consequence of maternal depletion. If there is indeed a negative influence the question emerges if this is an effect of an unequal allocation of care or a consequence of biological factors. Are all siblings, or just certain siblings, within the household affected? Secondly, I will investigate if older siblings add to the production or consumption of care and wellbeing in the household. Their presence may have a positive, negative or no effect on younger siblings. In sum, we know that household composition is of huge importance, but which role do siblings play?

### **3.2 The influence of young siblings: resource dilution, competition and biology**

Discussed studies demonstrated that family resources, parental care practices and biological determinants may all be of importance in determining mortality outcomes. Finance, goods, food, parental attention, care and time should all be included in the concept of resources over which competition may exist. In this section the first strand of literature will be discussed which deals in detail with the implications of each of these factors for children under the age of five. By addressing

these issues, it will become clear in which way siblings under the age of five may have a possible effect on the consumption, production and allocation of wellbeing and care within the household.

A first theory pointing at the importance of resources is the resource dilution hypothesis. This theory simply states that parental resources are finite and that additional children dilute these resources. It does not imply an unequal treatment of children, but simply that in general when more children are present, the available resources should be divided among more people. In short, all children will experience the negative effects of a larger number of children within a household (Van Bavel et al. 2012; Dribe, Van Bavel & Campbell 2012). There are, however, three mechanisms through which sibling structure may have positive influences: (1) the position of the developmental cycle of the household, (2) extended kinship and social institutions who help when needed, and (3) changes in the perception of children throughout time (Bras, Kok, and Mandemakers 2010). Most of these studies especially look at social mobility, but the same mechanism may be at work on other demographic outcomes. Öberg (2014), for example, investigated if a negative relationship existed between sibship size and the heights of sons. Because children with many siblings were on average shorter than others, he suggests that resource scarcity and dilution, due to a higher number of siblings, has a large effect on male heights in southern Sweden. The possible effect of resource dilution should therefore also be taken into account when investigating mortality outcomes.

On the other hand, unequal allocation of material and immaterial resources is often labelled as resource competition between siblings. Especially more traditional evolutionary theories emphasize the struggle for survival, which may offer some clues for mechanisms causing resource competition. For instance, it is argued that because many animals grow up in the presence of same or different-age siblings these relationships form an important part of their developmental environment (Mock and Parker 1997; Sulloway 2001). Because these developmental environments are shared and resources are often limited, competition as a kind of natural selection is considered one of the most important mechanisms influencing survival differences between siblings (Hudson and Trillmich 2007; Hudson et al. 2011). Most studies engaging in the perspective of resource competition investigated contemporary Asian populations because scholars observed skewed sex ratios which indicate an unequal division of resources (Das Gupta 1987; Sen 1989; Coale 1991; Sen 1992; Das Gupta 2005) These studies looked into gender differences because these were more straightforward to observe due to the known causes of death in certain age-groups. Deaths during the first year of life, many of which occur soon after birth, are considered more likely to reflect endogenous biological effects which tend to favour females. In contrast, mortality after the first year of life, and especially during age one to five in which children are totally dependent on others, is considered to be influenced by differences in behaviour towards boys and girls. Higher mortality of girls until the age of five and higher mortality for boys between their first and fifth year of life are therefore considered to be the result of differences in nutritional status and health care (Dyson 2012).

Muhuri and Preston (1991), for example, connect their observation regarding the mortality chances of girls mostly depending on the number of already present female children to resource competition. This suggests that, in principle, higher female mortality is not the result of a general cultural ideology in which girls are treated differently from boys, but a result of conscious, selective neglect of individual children. The case of India suggests that parents tried to balance between male and female offspring, in which boys were favoured over girls. Other studies also find large differences in survival chances of boys and girls which seem connected with the composition of the sibling set (see for an overview Lynch 2011). Historical studies investigating resource competition are scarcer, but some studies have found evidence for intra-household competition for children who are born in a household with a lot of consumers relative to producers. For example, in the Northern Islands of



Orkney Sparks *et al.* (2013) observed a negative effect of the number of young children during the nineteenth and twentieth century, which they interpreted as sibling competition.

Nevertheless, as mentioned before, complete sibship size as a proxy for resource dilution or competition is problematic because sibship size could also be the result of biological determinants in which historical actors have no direct influence. Most historical studies investigating infant and child mortality are, for that reason, emphasizing the importance of biological factors. Firstly, the age of the mother is considered as an important determinant. Women under the age of twenty are not fully developed and children born to these women tend to have higher mortality chances. The same is true for older mothers (Knodel and Hermalin 1984). Another subject which has received a vast amount of attention for a long time is birth interval (Stevenson 1923; Hughe 1923). Already in the 1980s several studies argued that the impact of many births operates through maternal depletion resulting in low birth weights. Short birth intervals, a short breastfeeding practice, and premature births due to undernourishment could all cause maternal depletion and are all causally connected to each other (Winikoff 1983; Rodriguez *et al.* 1984; Retherford *et al.* 1989). Maternal depletion is normally defined as the ongoing decline of psychical health during the reproductive life of a woman. This implies that when a woman's body does not get enough recovering time between births, or enough nutrition, the children born will be weaker and have a higher risk of dying (Winkvist, Rasmussen, and Habicht 1992). This line of reasoning is mainly based on the fact that the length of the birth interval stood out as the most important factor influencing infant mortality. Both a shorter birth interval than 18 months, or a longer birth interval than 59 months, is observed to be harmful for infants (Fotso *et al.* 2013; Kozuki, Sonneveldt, and Walker 2013; Kozuki and Walker 2013).

The question, however, is if birth intervals only act as an indicator for mentioned biological factors? According to De Sweemer (1984) there are three causal mechanisms influencing the preceding birth interval: "maternal reserves, competition for mother's care and mother's grief for the death of a preceding child." So, besides maternal depletion, a short birth interval could also just act like an indicator for a large family, or more specifically, as an indicator of a larger group of young children which dilute, or compete for, resources. Moreover, because of the death of a previous child, birth interval could also be active as an indicator for high infant mortality. Scholars labelled this as the 'replacement effect', which causes shorter birth intervals (Conde-Agudelo, Rosas-Bermúdez, and Kafury-Goeta 2006). In short, only when controlling for the number of siblings alive and death can birth intervals act as a possible indicator for maternal depletion. Nevertheless, the biological component for which birth intervals act as an indicator is complex. For example, breastfeeding for longer periods causes longer birth intervals, while short breastfeeding allows for shorter birth intervals. Short birth intervals, however, also cause shorter periods of breastfeeding. So it is difficult to observe a clear causal relationship (Ellison 2001). Moreover, maternal depletion may also occur because children may also compete for the same material resources as the mother. These complications should be kept in mind when using birth interval as an indicator.

Previously aforementioned historical studies mostly relied on parish registers and family reconstitution, which do not provide information about whether children were resident at any particular time. What will matter for sibling dilution and competition, however, is not the actual birth placement, but the number and order of the siblings each child has during the period of parental investment (Sear and Coall 2011). In a pre-modern society the biological birth order and actual birth order within a household can differ a lot because of high mortality, marriage and service work outside the parental household. That is why it is extremely important to take differences between biological and functional birth order into account. Until now, no more than a few studies have investigated whether the actual presence of similarly or differently aged siblings was characterized by competition

or help by analyzing and comparing their probability of dying in families with diverse sibling compositions. Studies covering historical China, for example, looked at family and sibling composition, but could not take women into account because of data limitations. As a result, the actual position of siblings within the total household remains unobserved (Bengtsson, Campbell and Lee 2004; Dong et al. 2014). While some historical and contemporary studies do investigate the presence of siblings, they do not investigate the possible effect of siblings in diverse age groups on individual mortality outcomes (Makepeace and Pal 2008; Kok, Vandezande, and Mandemakers 2011; Van Poppel et al. 2012).

Only Kippen & Walters (2012) investigated the influence of sibling composition in diverse age groups and controlled for birth interval and death clustering. They conclude that the presence of any additional sibling under the age of five increases the probability of dying for children younger than five. Because of these results they argue that (the presence of) siblings seems to have concrete influences on mortality outcomes, most likely through resource competition, and should therefore be included in future studies. This PhD-project will build on these recent insights. In addition, by using a comparative approach, it investigates if the same or different effects can be found in households varying across social-economic status, religion and most importantly household composition within and between the Netherlands and Taiwan. By doing so, it will be possible to investigate if siblings, in the sense of resource dilution, resource competition or biological determinants, and the kind of household, matter for mortality outcomes

### **3.3. The influence of older siblings: support versus competition**

Siblings under the age of five are totally dependent upon others and the resources given to them. Yet, when siblings become older, they become less dependent and are able to give attention, care, time, food, or other resources to others. In other words, older siblings can offer support to younger members in the household.<sup>3</sup> The question, however, is whether older siblings in a household are actually willing, or forced, to step in and help their younger siblings, or that their resources are used for other matters? This section will discuss the second strand of literature which deals in detail with possible explanations for support versus competition of older siblings, which may have an effect on the survival chances of children under the age of five. It should, however, be noted that there are two mechanisms from different theoretical backgrounds which can explain possible influences. The first line of research originates from biology and views conflict and cooperation between siblings from an evolutionary perspective. In contrast, the second line of research originates from a cultural point of view which focuses on observations from history, anthropology and other social sciences. This kind of research mainly points at differences between the importance of individualism and collectivism in different parts of the world.

Evolutionary explanations of sibling rivalry and support mainly focus on conflict versus cooperation. As already mentioned before in the section about sibling competition, more traditional evolutionary theories emphasize the struggle for survival, which may offer some clues for mechanisms causing resource competition (Mock and Parker 1997; Hudson and Trillmich 2007; Hudson et al. 2011). According to sociobiological theories, however, most kin would be inclined to cooperate (Dawkins 2006). Hamilton (1964) already argued that while genes would do anything for their own survival, and therefore only serve their own interests, there is another way for genes to survive, namely through family. In this sense kin selection may explain altruism because of its prediction that a

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<sup>3</sup> Older siblings are normally defined as siblings from age fifteen onwards. At that moment they are considered adults in most pre-modern societies.

gene may promote the recognition of kinship by historical continuity.<sup>4</sup> Hrdy (2009) contributes to this idea by arguing that humans developed a flexible form of cooperative breeding during evolution history which made us distinct from other species. Cooperative breeding could be a result of the development of extensive mind-reading, understanding and empathy by which children persuaded mothers and other kin to care for them. The main evidence for this underlying universal empathy, that still stands today, is provided by research on the universal expressions and emotions (Ekman and Friesen 2003; Ekman 2008). Thus, it could be argued that human adults are actually uniquely wired for sharing both food and care to offspring and human kinship systems are designed to cooperate. Grandmothers may play a special role in this sense (Hawkes 2003; Hawkes and Coxworth 2013), but Hrdy (2009, 272) argues that a broader web of matrilineal kin and non-kin can be important as well, “if long-lived grandmothers were humankind’s ace in the hole, all these classificatory kin (...) and other manufactured alloparents became their wildcards.” Thus, altruism may be an important factor in why siblings support each other (Batson 2011).

Both evolutionary theories dealing with conflict and cooperation are mostly seen as universal theories, while human behaviour may also be seen from an adaptive perspective. Human behavioural ecology offers a possible solution and may explain why in some cases humans choose to cooperate, while in other cases they do not. According to the framework used by human behavioural ecology the variation in ecological patterns, which includes psychical and social aspects of the environment, plays an important role in predicting variation in behavioural and survival strategies. In other words, “people’s sets of choices are constrained by the environment in which they have to live, and they make the best choices they can given these constraints, often with knock-on effects that behavioural ecologists would described as tradeoffs”. (Nettle et al. 2013) Historians argue that constraints are the result from a historical context and that this may explain why geography plays an important role in the choices which are actually available (Morris 2010). Culture is therefore an important element in the historical context because it may throw up barriers, or act as a filter, which forces people to act in a certain way (Engelen 1987; Engelen 1997). The second line of research, which mainly consists of historical studies investigating Europe and Asia, therefore especially emphasize this importance of culture in the observed differences between acting in the best interest of the collective or the individual. The same is argued for demographic behaviour which may influence siblings to support or compete with each other (Goody 2009).

Previous research argues that most Asian societies, in which extended household structures were the norm, the individual was not very different from the role that he or she occupies, because of the collective nature of the family (Nuckolls 1993; Chu and Yu 2009). Furthermore, parental authority was absolute during the whole life of individuals as a result of virilocal marriage, which means living together with a husband's father's family (Wolf 2005). Parental background, family composition, gender of the child and his or her position among same-sex and different-sex siblings may therefore have had a decisive influence on what parents decided regarding the life course of a particular child. The willingness of siblings to support each other could therefore be subordinate to being forced to help. Three phenomena in Asian families through which siblings were linked from birth can further explain this. Firstly, sibling care-taking was already an integral part of early childhood. Secondly, marriage strategies, especially kin marriage, were practiced by parents who saw marriage like a kind of ‘business deal’ and a way to carry on the family line. Thirdly, many Asians lived in extended families based on the co-residence of adult brothers. Brothers not only lived together, they also shared

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<sup>4</sup> This can mathematically be calculated by the value  $P$ , known as the coefficient of relatedness. For example, an individual has  $P=1/2$  in relation to his brother, and  $P=1/8$  to its nephew. The expectation in this case is that there is greater altruism among brothers than nephews. On this way kin selection looks actually as a kind of genetic selfishness.

meals and other social activities, or in other words, they pooled resources and offered mutual support according ethnographic studies (Wolf 1972; Wolf and Huang 1980; Thornton and Fricke 1987; Chen 2009).

In North-Western European societies, on the other hand, siblings supposedly played a far less significant role in shaping the life course because individualism was propagated, and most households were small and nuclear (Richard, Robin, and Laslett 1983). Moreover, neolocality was the norm, which meant that children left the parental home when they married. Parental authority was therefore limited to unmarried children, but parents influenced their children's decisions well into their twenties because the age of marriage was much higher (Klep 2005). Life course decisions regarding work, marriage and residence were taken against the backdrop of the stakes and preferences of either their parental or own household. In contrast with the Asian household, the couple was central to the European household (Sabean, Teuscher, and Mathieu 2007; Engelen and Wolf 2005). Scholars argued that Western norms, cultural ideals and life course characteristics, for example a period of domestic service, stressed the development of individuals into free and autonomous beings (Hajnal 1965; Hajnal 1982; Bras 2003). Sibling relations were consequently characterized by rivalry, not by solidarity. However, the latest research has also observed cooperation between siblings (Bras and Van Tilburg 2007). Moreover, recent kinship analysis shows how much the ideology of individualism was just that – ideology. In reality the individual was still embedded in the web of family and kinship (Johnson and Sabean 2011). The question therefore remains if these siblings would also support each other or be more individualistic as a result.

Some studies offer some clues for the claimed difference of historical actors being more individual in Western Europe and being more collective in Asia. Chamarbagwala (2010), for example, finds that in India girls' mortality chances increase when the number of older sisters increases, and mortality chances decrease when there are more older brothers. The opposite is true for boys. Kippen & Walters (2012) in contrast observed no protective effect of older siblings on the survival chances of their younger co-resident siblings in a village in Belgium. The findings of these studies are just suggestive, but may indicate an important difference between household with a 'corporate' or a 'lifeboat' ethic (Das Gupta 1999). My PhD-project will pursue this line of research further by examining if, and why, older siblings had or had no effect on infant and child mortality. In addition, when time allows for it I will examine if older siblings played similar or different roles compared to other present household members.

#### **4. Approach: research sites, sources and methodology**

By using a comparative approach and examining areas from both Europe and Asia, explicitly contrasting populations at the extremes of the Eurasian continent, it becomes possible to address many debates surrounding the Malthusian paradigm. It becomes possible to tackle the assumed dichotomy between Western Europe and Asia and study the possible effects of siblings on infant and child mortality in diverse historical contexts. From this perspective it does not matter which areas one compares because Asian and Western European societies are radical different. In other words, while countries within Western Europe and Asia are all distinguishable separate entities, they are much more similar compared to countries between Western Europe and Asia (Engelen and Wolf 2005; Chuang, Engelen, and Wolf 2006; Engelen and Ying-Hui 2007; Engelen, Shepherd, and Yang 2011;). Moreover, by carrying out nearly identical analyses on similar data from diverse societies it becomes

possible to observe demographic responses in a variety of contexts identifying both unity and diversity in demographic behaviour ( Bengtsson, Campbell, and Lee 2004; Tsuya et al. 2010).

In this PhD-project Taiwan and the Netherlands are considered case-studies for Western Europe and Asia. By doing so, my PhD-project builds on the findings of the project *Population and Society in Taiwan and the Netherlands* and depart from its general idea that despite the many differences between Taiwanese and Dutch societies, there are also ways in which they are more alike than commonly is realised. These similarities are important because they provide the common ground that allows one to indentify the causes and consequences of the major differences. Therefore, both societies will be examined during the second phase of the demographic transition – the period in which mortality rates start to decline. This results in using the period between 1860 and 1910 for the Netherlands, while the period 1906-1945 is used for Taiwan. During this period both societies were firstly characterised by ‘natural fertility’. There was no birth control and no general desire for birth control in the sense of planning behaviour. Secondly, both societies experienced modernisation during the period under observation. In these transitional years modern public health measures were implemented, mass education was introduced and there was a movement from agriculture to industrial employment. A last common feature is their mixed economies. Both in the Netherlands and Taiwan the majority of the population still depended on agriculture during the entire period (Engelen and Wolf 2005). These rural parts in Taiwan and the Netherlands are chosen as main research areas of this PhD-project.

A first reason to especially use Taiwan and the Netherlands as case studies is because of the observed regional variation in family processes. These family processes define the presence of certain family members in the household, and the relations and the norms governing these relationship. In other words, there are not only significant differences between family processes in Taiwan and the Netherlands, but also within them. These varying norms, such as inheritance, co-residence and division of tasks within the household, may have a great impact on the relative value of family members and on intra-familial relationships. Moreover, because households are characterized by different sets of family members, there are differences in claims on parental property and therefore power relations (Kok, Vandezande, and Mandemakers 2011). The available digitalized data, which is the second reason for choosing these areas, can therefore also be used to test the hypothesis about the assumed fact that differences within Western Europe and Asia are minor compared to the differences between them. In short, this makes it possible not only to observe the effect of sibling composition on mortality outcomes between, but also within these two societies. The next section will highlight characteristics of the five selected areas. This will demonstrate both the diversity within, and similarity between, the Netherlands and Taiwan, which makes the proposed comparisons possible.

#### **4.1. Research sites**

##### **4.1.1. Differences within Taiwan**

In general Taiwanese families are, just like Chinese families, characterised by large household structures, known as extended families. This meant that many Asians lived in extended families based on the co-residence of adult brothers who all had claims to the corporate property. Moreover, the family represented an overarching ideology and metaphor of all levels of Chinese society. The whole society was built on the way kinship was organised (Skinner 1985; Thornton and Lin 1994). Parental authority was absolute during the entire life of individuals as a result of virilocal marriage, living together with a husband's father's family. In other words, parents could use children just like they used material resources (Wolf 2005). The authorities confirmed and strengthened the position of parents by

establishing the authority of parents in legislation. For example, under the Ch'ing laws, parents had the ability to submit a complaint about a younger member of the family. This member could be banished without further investigation as a result (Gates 1997).

Because of the authority of the parents scholars have argued that much variation and flexibility in the intensity of lineage and family organisation in China was possible. Parents would simply adapt to the local economic, political and cultural circumstances. Filial piety was very important and formed one of the corner stones of Chinese culture. Moreover, descent and the lineage were central to the definition of the family (Chin and Freedman 1970). The duty of a son towards his father therefore not only extended over death itself by means of ancestor worship, but also by having sons himself to continue the lineage (Wolf 1976). Only sons could perform this function of 'social reproduction' of the family, causing women to be only needed for the 'biological reproduction.' Thus, a Taiwanese family was patrilocal and patrilineal in nature in which gender and generation shaped household hierarchies (Thornton and Lin 1994).

The two areas under study are positioned in the northern (Hai-shan) and the south-western (Donggang) part of Taiwan. These regions are chosen because they are both rural, but differ in agricultural and demographic respect (Barclay 1972; Engelen, Shepherd, and Yang 2011). The first observed regional variation concerns marriage forms. Anthropologists observed difference in the frequency of three broad categories of marriage: major, minor and uxorilocal (Wolf and Huang 1980). Marriages performed in the major fashion were most common. When a son or daughter became of marriageable age the process began with parental negotiations between two families, and if all parents agreed, a bride-price was set their children would marry. In northern Taiwan, however, almost half of all marriages were of the minor form, while in the south this only accounted for ten percent. In a minor marriage a *sim-pua*, or little daughter-in-law, would be adopted into the family on a very young age.<sup>5</sup> Moreover, when a *sim-pua* was adopted into the family, an own daughter was usually adopted out of the family. So, the main difference between a major and minor marriage has to do with the timing and the ceremonial complexity of the marriage. This was possibly the result of a situation in which it was hard to find a bride. Yet, the practice of adoption not only had consequences for the family composition, but earlier research already demonstrated that in minor marriages marital fertility was much lower, divorce and extramarital affairs were more common, and adopted children had higher mortality chances (Pasternak 1972; Wolf and Huang 1980; Wolf 1995; Riswick 2013).

A second difference concerns agriculture and industry. In Hai-shan most people lived from agriculture until coal mines were created and the expansion of many traditional enterprises – the production of rice, sugar and wine – became more industrialized from the 1920s onwards. The location near the capital Taipei had an influence on Hai-shan because of the need to transport agricultural goods to the market. Not only jobs in production, but also in transportation became more and more important in attracting people to a wage income. These chances, however, did not convert the rural countryside into an industrial suburb (Wolf and Huang 1980). In contrast, Donggang was positioned along the coast in which most people lived from fishing and agriculture. There was no major emerging industrial city in its vicinity and as a result people were even less influenced by the Japanese efforts to modernise Taiwan.

#### 4.1.2. Differences within the Netherlands

In general the Dutch households are, just like most North-Western European families, smaller than Asian families and known as nuclear or stem. The couple was of central importance and as a result

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<sup>5</sup> Most children were adopted when they were still infants. The average age of adoption in Hai-shan was 13 months.

children were expected to set up their own household when they married or when they got children (Hajnal 1965). Parental authority was therefore limited to unmarried children, but parents influenced their children's decisions well into their twenties because the age of marriage was much higher. Moreover, parental power was based on property which is connected to individual circumstances and it was not backed up by the state or Church (Klep 2005). Before marrying, a large proportion of the population in the Netherlands was working in other households as servants. This was a way to learn new skills and to earn money for their parents or a possible marriage. Members of households in the Netherlands enjoyed more freedom than their counterparts in Asian households. Resources were less concentrated, households were less hierarchical, and there was no clear preference for boys. Moreover, most people could choose themselves, within limits, whom they would marry (Kok 2011). The care for the vulnerable, such as widows and orphans, was also not primarily the responsibility of the family, but of the community (Goody 2009).

The three regions under study are positioned in the north-western (Noord-Holland), eastern (Achterhoek), and south-eastern (Noord-Brabant) part of the Netherlands. These regions are chosen because they differ both in agricultural and demographic respect which determines the presence and power of kin within the household. According to Kok, Vandezande, and Mandemakers (2011) three broad regions can be identified in which broad regional norms regarding family processes differ within the Netherlands. These differences in inheritance, co-residence and division of tasks within households are also underscored by Hofstee (1978), Bras and Van Tilburg (2007) and Klep (2011) and are explained by pointing at inheritance, economy and marriage patterns.

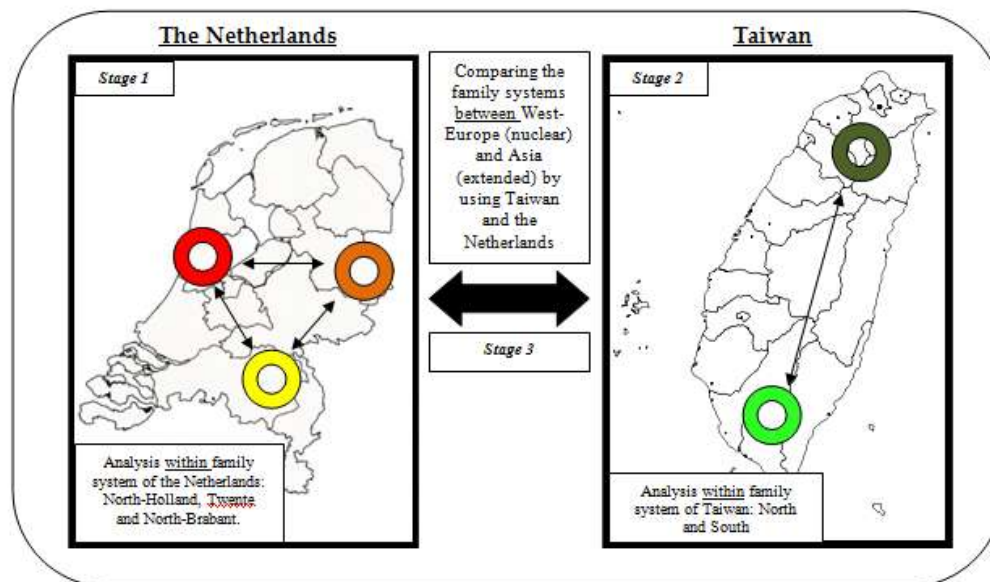
Firstly, while according to the law inheritance was the same everywhere, reality was different. In eastern areas impartial inheritance was the rule. The designated heir stayed on the farm, with the obligation to take care of his parents and unmarried siblings. Even among labourers this practice could be found. In the other parts of the country inheritance and co-residence were not directly connected to each other (Van Blom 1915; Kok, Vandezande, and Mandemakers 2011). In Noord-Holland wage is more important and children save money themselves and pay their parents. Klep (2011) labels this as an exit strategy. In Noord-Brabant, in contrast, the household functions as a bank in which members invest and all are entitled to a share of these resources when they leave the household. Klep (2011) labels this as loyalty.

Secondly, since the sixteenth century Holland was characterized by highly marked-oriented and commercialized agriculture, such as cattle farming, producing cheese and butter for the market. The sandy soil of the Achterhoek and Noord-Brabant, in contrast, produced a more mixture of pastureland, used for cows, and arable, used for growing rye, potatoes and oats. The main difference between farms in the Achterhoek and Noord-Brabant was their size. In Noord-Brabant farms were much smaller due to high population pressure and constant division of land (Kooy 1957; Van Der Woude 1983; Bras and Van Tilburg 2007).

Thirdly, important regional differences in marriage patterns can be observed. In Noord-Holland many people married relatively early and there were few people who remained unmarried. In contrast, men living in the Achterhoek married relatively late and the number of unmarried men was higher than the national average. People living in Noord-Brabant also had very high proportions of never married and a high age of marriage which approaches the ideal of the Malthusian pattern. Until the second world war these regional marriage patterns remained significant (Van Poppel 1993; Bras and Van Tilburg 2007; Engelen 2009; Kok, Vandezande, and Mandemakers 2011).

### 4.1.3. Similarities between Taiwan and the Netherlands

As mentioned before, the similarities of the selected areas in Taiwan and the Netherlands are important to make useful comparisons between them. Except the general situation of a decline in mortality, a natural fertility and the fact that all areas are rural, there are at this moment two additional reasons for selecting Noord-Holland, Noord-Brabant, the Achterhoek, Hai-shan and Donggang. The first is the fact that these areas represent areas which all have different mortality levels. For example, in both Noord-Brabant and Donggang mortality levels remain high compared to national averages during the period under investigation, while both Noord-Holland and Hai-shan have high mortality levels at the beginning of the period which decline to average levels (Engelen, Shepherd, and Yang 2011). The second similarity is the location of the areas. Both the rural areas in Noord-Holland and Hai-shan are located relatively close to major cities which also influence the countryside. Donggang, Noord-Brabant and the Achterhoek do not face the same influences. After obtaining the first descriptive statistics regarding population structure, general demographic patterns and more detailed information about the historical context the comparisons of areas between Taiwan and the Netherlands will be further elucidated.



## 4.2 Sources

As mentioned briefly before, because a large proportion of their lives was in great detail recorded in household registers a second reason for investigating infant and child mortality in the populations of Netherlands and Taiwan is the availability of digitalised sources. They are two of the best sources of individual demographic information in the world because they do not only record a sub-group within the population, but everyone. Moreover, it is possible to determine the exact date and composition of the household in which the subject of the event was living for all events that occurred during the years covered by the registers. One can therefore investigate the influence of household composition on demographic outcomes (Chuang, Engelen, and Wolf 2006). Most importantly for this PhD-project is the fact that sibling composition on mortality outcomes can also be studied.

For Taiwan, the pao-chia household registry system will be used, which was revived during the Japanese occupation, 1895-1946. This system originated from the old Chinese practice of mutual family responsibility, but was different because the Japanese did everything possible to prevent



corruption. The people themselves had to inform the authorities when changes should be made, but also a chain of people, from the head of the family through the village chief, were also responsible for providing the correct information. Moreover, police was controlling this information every year. If information was incorrect or incomplete, family elders could be placed under arrest and eventually be publicly punished. When a family moved their register would only be closed when the police received a confirmation from another district that they arrived and registered themselves. When no information of departure was received, and the police discovered that the family had left during their inspection, further investigation would take place to find them. These household registers are therefore considered very reliable (Wolf and Huang 1980).

A digital dataset of Hai-shan in the north of Taiwan was made available by Arthur P. Wolf, Professor of Anthropological Sciences at Stanford University, and the Institute of Ethnology (Academia Sinica) in Taiwan made household registers of Donggang in the south of Taiwan digitally available. Both these datasets provide basic information of the present address, native address, ethnicity and the circumstances under which the family head became head of the family. Also time-varying information was recorded, such as relation to the household head, birth, death, departure from the family and reasons, opium addiction, bound feet and further health conditions. Moreover, of all events the exact date was recorded. Name, sex, date of birth, father's name, mother's name and same sex sibling order can be used to provide unique identities for all individuals in the registers.

For the Netherlands, longitudinal life course data from the Dutch population registers are used, which basically contain the same information as the Taiwanese household registers. These registers were created by Royal Decree to start recording information in population registers from 1850 onwards. The main reason for the government to implement this kind of registration was because it would become possible to track changes in population between censuses. By doing so, information regarding the structure, number and characteristics of the population could be used by the government on issue like suffrage, civic guard, militia and poverty. Moreover, population registration could also be useful to improve future legislation (Knotter & Meijer, 1995). These data are collected, digitalised and linked into a database by the Historical Sample of the Netherlands (HSN), located at the International Institute for Social History. At this moment this database incorporates more than 40,000 life courses of individuals born in the period 1863-1922 in the Netherlands (Mandemakers 2006). Moreover, the NWO Medium Investment project *Linking Historical Lives*, led by Hilde Bras, has created a database of 3000 pairs of siblings from the mentioned three regions in the Netherlands.

The database of the project *Linking Historical Lives* was named *Linked Lives* and contains the life courses of 3.000 pairs of siblings born in the Netherlands between 1850 and 1932. The basis for this data collection is formed by the Historical Sample of the Netherlands (HSN). However, while the HSN only contains data on the life courses of one person per family, *Linked Lives* includes similar information on the life courses of 3.000 siblings of the original HSN research persons. These HSN research persons can be differentiated in three regions (Noord-Holland, Noord-Brabant & Achterhoek) and five cohorts. To compensate for high child mortality the selection was based on 3300 siblings instead of 3000. This results in fifteen groups of 110 siblings each. In other words, the random sample is stratified per province and cohort. Moreover, Noord-Holland is divided between rural and urban (Amsterdam).

This PhD-project will use these data sets containing the life courses of sibling sets covering different regional household systems in both Taiwan and the Netherlands. In addition, this PhD-project will search for qualitative sources, such as oral history, letters, ethnographic works and governmental reports, to complement mentioned quantitative sources. Examples of these sources are

Cohen (1976), Gallin (1966), Pasternak (1972) and Wolf (1968, 1972) for Taiwan, and Barentsen (1922; 1935), De Haan (1994) and Kooy (1957) for the Netherlands. By including these kind of sources I hope to formulate clear hypotheses on the one hand and preserve the complexity of individual cases that may shed light on statistical outcomes on the other.

### **4.3 Methodology**

To analyse all datasets, methods appropriate for the statistical analysis of quantitative life course data will be used. Event history techniques, such as Cox proportional hazard models, can analyze mortality in the life courses of Taiwanese and Dutch siblings, while multilevel (event history) or frailty models are applied to compensate for clustered sibling data. This will be done by measuring characteristics of siblings and their households and estimating how they influenced individual mortality outcomes (Cleves 2008; Broström 2012). Observation time begins with the birth of a child and ends when it dies (failure event) before his or her fifth birthday. Events are censored when children migrate out of the household before age five. All remaining children (which are research persons) are censored on their fifth birthday. The methods used by Kippen and Walters (2012) serve as a main guide for this kind of analysis. Separate models are used for neonatal (0-1 month), post-neonatal (1-12 months), toddler (12-24 months) and young child mortality (24-60 months) because the influence of various mortality determinants changes throughout life.

The following determinants will be taken into account: region, religion, ethnicity, inheritance system, overall predominance of family structure (nuclear, stem, extended), urban/rural, social-economic status, co-residence of siblings, parents and others, death clustering, family size, sibship size, birth interval, birth position, age of the mother, gender, being a twin, year of birth and adoption. The number of co-resident siblings will be treated as a time-varying covariate. This accommodates the fact that siblings could move in and out of the household while the index child was growing up. In addition, the number of siblings will be divided in several age categories: 0-5 year, 5-15 year and 15+ year. These groups are based on the assumption that the age of the present siblings may be of great importance as discussed before. Other variables which may change throughout time, such as the presence of other family members, occupation of the parents and family size, will also be treated as time-varying covariate variables.

## **5. Composition of the study**

### **Introduction**

Comparative approach in (historical) mortality and the importance of household members

Aim of this PhD-project: include the effect of siblings on mortality chances of infants and children

### **Chapter 1: Theoretical Framework**

The role of young siblings (age 0-5) within the household: resource dilution, competition and biology

The role of adult siblings (age 15+) within the household: support versus competition

**Research question & hypotheses:** Does the number of siblings have an influence on inequality in life chances? And if so, does their influence really differ as much between Eurasian households as scholars have assumed?

### **Chapter 2: Approach: Research sites, Sources & Methodology**

**Research sites:** The Netherlands (Noord-Holland, Noord-Brabant, Achterhoek) & Taiwan (Hai-shan & Donggang)

**Sources:** Dutch Population Registers (HSN: Linked Lives) & Taiwanese Household Registers (Academia Sinica Database).

**Methodology:** Event History Analysis (Cox proportional hazard models)

### **Part 1: Regional dimensions: The Netherlands**

**Chapter 3:** Did the number of siblings affect infant and child mortality (0-5 years) within Netherlands during the period 1860-1912?

**Chapter 4:** How and why did the influence of siblings on mortality patterns across these three regions differ?

### **Part 2: Regional dimensions: Taiwan**

**Chapter 5:** Did the number of siblings affect infant and child mortality (0-5 years) within Taiwan during the period 1906-1940?

**Chapter 6:** How and why did the influence of siblings on mortality patterns differ across these two regions?

### **Part 3: Global dimensions: The Netherlands & Taiwan**

**Chapter 7:** How and why did the influence of siblings on mortality patterns differ across these two areas?

### Conclusions

What can we learn by comparing the results from Taiwan and the Netherlands regarding the influence of siblings on inequality in life chances both regionally and globally in order to gain understanding about the influence of the number of siblings on infant and child mortality (0-5 years) outcomes? In short, does household composition matter?

How do these findings fit into the debates of the economic and demographic uniqueness of the West and the sameness of the Rest (mainly China)?

### 6. Time schedule and research priorities

2013-2014	September	October	November	December	January	February	March	April	Mai	June	July	August
Literature: Writing SQ, Papers NWP and learning statistical methods											Writing Source section	
					Check SV				Check SV		DB Taiwan	
			GSH: Designing PhD			GSH: Education in a Nutshell					SS	SS
			Groningen: EHA			GSH: Opfrisstatistiek						
					GSH: Writing Group							
	TSP			NWP		PR			NWP			PR
				C HD				C ESSHC		C NWP		
					Vacation					Vacation	Taiwan	

2014-2015	September	October	November	December	January	February	March	April	Mai	June	July	August	
Analyzing: the Netherlands													
	Check SV	Rewrite SQ	Writing CP 1					Check SV	Re-writing CP 1				Check SV
	GSH: Advanced Coversion					GSH: Presentation Skills							
	GSH: Writing Group					GSH: Academic Writing							
									SS		SS		
		NWP	GSH SQ		NWP	GSH PR						GSH PR	
				C HD						C NWP			
					Vacation							Vacation	

2015-2016	September	October	November	December	January	February	March	April	Mai	June	July	August
Analyzing Taiwan												
	Writing CP 2				Check SV	Writing CP 2					Check SV	
				Revise & Submit publishing CP 1					Re-write CP 2			
						GSH: Advanced Academic Writing / BKO						
			CP ASSH	CP HD		NWP			CP ESSH	C NWP		GSH PR
	In Taiwan: Academia Sinica				Vacation							Vacation

2016-2017	September	October	November	December	January	February	March	April	Mai	June	July	August	
Analyzing the Netherlands and Taiwan													
	Revise & Submit for publishing CP 2				Check SV	Writing draft / outline version PhD dissertation					Check SV		
	Writing co-author article with Hao Dong / Xingchen Lin, CP3												
			Revise & Submit publishing CP 1						Revise and Submit for publishing CP 2				
	GSH Career												
	C ESHD			CP HD		GSH PR				CP NWP		GSH RP	
					Vacation	In Taiwan: Academia Sinica						Vacation	

2017-2018	September	October	November	December	January	February	March	April	Mai	June	July	August
Rewriting all papers to final dissertation												
	Re-writing Part 1		Re-writing Part 2		Re-writing Part 3		Writing Conclusion		Writing Introduction		Rewriting all	
			Check SV		Check SV		Check SV		Check SV		Check SV	
		Re-writing CP 3		Revise & Submit publishing CP 2				Revise & Submit for publishing CP 3				
	CP ESHD			C HD		GSH PR		CP ESSH	C NWP			GSH RP
					Vacation							

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