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**Cultural beliefs and thermal care  
of infants: protecting South Asian  
and white British infants in  
Bradford from heat and cold**

**Anna Cronin de Chavez**

**Department of Anthropology**

**2011**

**Thesis submitted to  
Durham University  
for the degree of  
Doctor of Philosophy**

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**Anna Cronin de Chavez**

Date: \_\_\_\_\_

# **Cultural beliefs and thermal care of infants: protecting South Asian and white British infants in Bradford from heat and cold**

## **Abstract**

Maintaining an adequate body temperature is essential for human survival, yet infants are born with significant thermal challenges. Thermoregulation of infants is achieved through both physiological processes and through the thermal care behaviour of their caregivers. Little attention has been paid to infant thermal care beliefs and how thermal care is provided in practice. Thermal care beliefs vary across the world. Humoral beliefs that prescribe thermal balance to maintain health are extremely common globally, but less so in the UK.

## **Methods**

This study primarily employed a mixed methods approach, using semi-structured and structured questions in interviews to explore ethnic differences in infant thermal care beliefs and practices of white British and South Asian mothers in the Bradford District, West Yorkshire, England.

## **Results**

White British mothers were found to use significantly more bedding in winter for their infants than South Asian mothers (Man Whitney U  $p < 0.001$ ). White British and South Asian infants were found to sleep in different environmental conditions. Mothers used several physical and behavioural cues to identify thermal stress in their infants and reported 24 different infant health problems caused by heat stress and 21 by cold stress. White British mothers were significantly more likely to be

concerned about their infant getting too hot than too cold and South Asian mothers about both (Pearson Chi squared  $p < 0.001$ ).

### **Conclusions**

This thesis has demonstrated that thermoregulation of infants is achieved through internal physiological processes but also cannot be removed from the thermal care behaviour and beliefs of their caregivers. By exploring health beliefs and practices in other cultures, bias in the choice and focus of clinical research in the UK can be understood and addressed.

### **Implications**

This thesis provides evidence to inform future directions for research, and policy on infant thermal care and manufacture of infant bedding in the UK.

# Acknowledgements

I would like to thank the mothers in Keighley in Bradford for spontaneously giving up their time to participate in this study, even if it meant coping with the demands of caring for their babies and toddlers at the same time.

This thesis would not have been any more than an idea if it was not for my supervisor Professor Helen Ball. The seemingly insurmountable practical, academic and personal problems were somehow resolved with Helen's rare talent of seeing straight through problems to workable solutions. Working with Helen was an entirely inspiring experience with her capacity to become a friend yet at the same time an exceptional teacher. Many people recommended before I considered taking on a PhD to ensure I found a good supervisor, but Helen surpassed any expectations. I am grateful for her honesty, pragmatism, creativity, breadth and depth of knowledge in several disciplines and kindness. I felt she was always on my side even if she pushed me to go beyond what I felt possible.

I would also like to thank my second supervisor Dr Martin Ward-Platt for being a truly inter-disciplinary clinician, teaching me infant physiology and how it is essential rather than just desirable to enhance clinical science with perspectives and evidence from outside disciplines. His optimism throughout the research was infallible.

The challenge of getting to the end of a doctorate as a mother of school age children would have been unthinkable without the support of my husband Carlos, who never stopped believing I could complete it, made sure I had the time I needed to work by seeing to the boys' needs and cooking a myriad of some of the most delicious and nutritious food to sustain any fretting PhD student. As usual, he teaches me to survive anything. The years since first applying for this PhD have been exceptionally testing, and I cannot thank him enough for being there for me through it all.

The journey of this thesis started on the day my first son was born, and through its fruition I have seen my three sons growing up into young people to be proud of,



never surprising me with their exceptional talents and generosity. They listened and questioned throughout the years of my multiple minor discoveries and revelations in the research and acted as sounding boards for my ideas and plans with a maturity and patience beyond their years. Without their tolerance for my highly unsociable working hours I would not have achieved the concentration and hours required to complete any stage of this doctorate.

I would like to give an extra special thanks to my mother and father. My mother taught me to persist despite what the world throws at you, with the sympathy required to help you get up after a fall, but the ideas and encouragement to move on. I am also grateful for a listening ear in the many practical and academic trials of the past years and for the final stage helping check the final document. I would like to thank my dad for teaching me compassion and understanding of every person I meet. He is one of the wisest, most compassionate and undiscriminating people I know. He has taught me not to see difference in people but to understand it. Without his perspective on the world I would not have come to love the field of anthropology and its power to overcome difference with scientific knowledge and discourse.

My brothers, even at a distance responded to any request for help, Sean with his practical approach to enduring a doctorate from beginning to end and to David for instant responses to requests for formatting help on his days off.

I am thankful to the people I got to know in Guatemala and how they helped me think differently about mothering and my own culture. I am eternally grateful to Rufina, Lourdes, Lucia, Mary, Joaquin, Humberto, Axel, Leonel and Flor de Maria for tolerating my strange ways and always supporting me with their friendship and care.

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Without the special devotion of the interpreters not just interpreting but taking it on themselves to find me participants the results would not have included some of the families that rarely participate in research. If it was not for Mwenza Blell I would not have found such dedicated mother and daughter team for formal interpreting.

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Without question this PhD would not have been practically possible if it was not for the ESRC/MRC Interdisciplinary Studentship and the extra training provided by the ESRC to enhance the research experience of their students.

Durham University is one of the most prestigious Universities in the UK, and world, and is set in spectacular, awe inspiring surroundings. Despite its esteemed reputation I found Durham University to be supportive beyond any obligation on a very practical level. I found Durham University to take as much interest in the wellbeing of its students as its staff have in inspiring the academic excellence it is famous for.

The Durham University Anthropology Department is perhaps one of the most exemplary inter-disciplinary traditions to be found anywhere and it has been a pleasure to have benefited from their expertise and passion for the practical application of anthropology in many settings.

The time management needed for the work required for a doctorate, care for a family and in the end stages a full-time jobs seemed at some times unachievable. I am grateful to Sue Jack for the countless ideas and her interest in how to achieve the impossible milestone, by milestone, and for helping me make it possible.

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At times it seems that doing a PhD is a rather lonesome occupation. On the contrary, it is impossible to achieve without the commitment, company and sacrifice of many people involved in the practical, personal and academic support of the doctoral student. I am indebted to all of the people above and many others I haven't mentioned for the support they haven't hesitated in providing.

## *Dedication*

*For my husband Carlos and sons Ian, Chris and Sam*

*and*

*my mother and father*

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# Chapter 1 Introduction

Maintaining an adequate body temperature is essential for human survival, yet infants are born with significant thermal challenges. Due to their body proportions and immature thermoregulatory systems, human infants are substantially dependent on caregivers to help them maintain thermal balance (Fleming and colleagues 1992; Wailoo et al 2003). Thermoregulation of infants is achieved through both physiological processes and through the thermal care behaviour of their caregivers. The focus of research on heat stress has been on the link between overheating and SIDS, and the effects and management of fever (Blatteis 2002; Ponsonby and colleagues 1992a). The focus of research on cold stress has involved temperature maintenance of infants in incubators and the potentially fatal sequelae of neonatal hypothermia (Ellis 2005; Mathur and colleagues 2005).

Ensuring that an infant maintains an adequate temperature involves an interaction of a) the infant's internal state and ability to thermoregulate, b) its caregiver's ability to interpret the infant's thermal needs, and c) the caregivers' beliefs regarding correct thermal care of infants and their thermal care priorities for a given set of environmental conditions. Research into the interaction of health and caregiver thermal care beliefs and practices, with a focus on SIDS, has not previously been attempted. This thesis takes an interdisciplinary approach to the exploration of how thermal care is provided to infants by caregivers in different cultures, and how this might affect infants' health and wellbeing.

With a few notable exceptions (e.g. Ball 2003; Gantley et al 1993; Hilder 1994; McKenna 1996), medical anthropology has had relatively little input into SIDS research. This deficiency means there has been insufficient knowledge generated on the behaviour and beliefs of infants' caregivers, which may knowingly or unknowingly put infants at risk for SIDS. Neither has it been completely understood why some ethnic groups, such as South Asian communities, have low SIDS rates (Ball 2011; Gantley and colleagues 1993 ). This raises the question of whether there are culturally-driven practices among South Asian

communities that protect infants from the risk of SIDS. Identification of these practices could lead to their promotion and application in other communities. Medical anthropology has the potential to contribute greatly to understanding mechanisms for the prevention of SIDS, complementing quantitative epidemiological research which is less equipped to address health beliefs and cultural practices. As thermal care is also relevant to protection from infection, understanding beliefs and practices regarding thermal care and respiratory disease prevention are also urgent because of the millions of children dying each year from pneumonia (Wardlaw and colleagues 2006).

Anthropological methods can contribute to research on SIDS and infant pneumonia by providing data not only on what people say they do, but by observing what they actually do in practice. There are many reasons why people say they do one thing but in practice do something else. This discrepancy between reported and observed behaviour raises some doubt on the validity of data obtained solely by structured questions that are not supplemented by qualitative data (Flyvbjerg 2001). Medical anthropology also provides a different approach to analysis compared to other disciplines. Contextual factors, including multiple social, cultural, economic, political, and historical factors, are considered. Anthropology therefore 'reaches far beyond the clinical gaze' (Agdal and colleagues 2010). A broader qualitative approach provides a deeper explanation of health-related behaviour, which is here used to explore the practices and beliefs surrounding thermal care of infants.

Inhorn (1995) argues that the use of opposing approaches to study the same medical topics can lead to a greater understanding of health-related behaviour. For example, epidemiologists study biomedically defined diseases and anthropologists study the experience of illness. Similarly, epidemiologists and clinical scientists seek to identify risk factors and medicalise life, while anthropologists are more likely to critique risk by looking at bias in choice of evidence and the whole socio-economic and political context. The contribution of medical anthropology to epidemiology is sometimes underappreciated even by anthropologists. Indeed, "anthropologists have not recognized that the roots of epidemiology place the field

squarely in the anthropological tradition of understanding how the wellbeing of human beings is directly affected by their physical, social and cultural environments. By not availing ourselves of epidemiological training or perspectives and by engaging in the all-too-familiar occupational hazard of talking to ourselves about the problems of other disciplines, we lose a valuable opportunity to move our discipline in exciting new directions.” (True, quoted in Inhorn 1995: 289)

This thesis aims to provide a new perspective on our understanding of infant thermal care by exploring different beliefs and practices involving such care in two co-resident ethnic groups, and by examining how infant thermoregulation might be affected by cultural beliefs and practices.

Following this introduction, Chapter 2 explores the cross-cultural literature relevant to thermal care, and presents a case study of how thermal care is provided to infants in Guatemala City in a context of high infant mortality. Beliefs about the inherent dangers of heat and cold to vulnerable individuals such as infants, the sick, and the elderly vary worldwide. Humoral beliefs that emphasise the critical importance of maintaining thermal balance as a protection from disease are widespread and exist on almost every continent (Charaly 1999; Kim-Goodwin 2003). In many societies, cold is believed to be inherently dangerous to infants, and caregivers go to great lengths to ensure that infants remain well wrapped (Charaly 1999; Cominsky 1994). In other societies, such as in the UK (Hiley and Morley 1994), caregivers are more concerned about the effects of fever and the problem of infants overheating, which is thought to lead to SIDS. Although there are differences between cultures that are influenced by humoral beliefs, they are all similar in that they believe cold causes respiratory illnesses while exposure to heat is responsible for skin and stomach conditions.

Cultural beliefs about the nature of illnesses and other physical conditions that are understood to result from exposure of an infant to cold or heat inform how caregivers prioritise and provide thermal care for infants. These beliefs are therefore central to understanding how to keep infants at temperatures optimum for their health. The case study of infant thermal care in Guatemala illustrates this

point. Humoral beliefs are widely held in Guatemala through the influence of both indigenous and colonial cultural beliefs, and the effects of heat and cold are used to explain several infant conditions. However, in this cultural context there is an overwhelming bias towards protecting infants from cold through attempts to eliminate even minor draughts, changes in temperature, and dampness by providing several layers of clothing even in a warm environment. This preoccupation with the threat of cold to infants can be explained as a consequence of high rates of infant deaths due to respiratory infections and the common belief that cold causes these infections.

Chapter 3 explores the clinical literature regarding thermoregulation of infants, evidence of illnesses and causes of death linked to heat and cold, and how clothing and bedding impacts infant thermoregulation. An example of research on infant thermoregulation is the research conducted on neonatal hypothermia in the past few decades (Hawdon 2006; Lyon 2006; World Health Organisation 2007). After the neonatal period, however, much less research has focused on how infant health is affected by different types of thermal care, the exceptions being research on SIDS and fever in infants, with an overwhelming emphasis on heat stress. The clinical review uncovered very little research regarding whether cold stressed infants may be at higher risk of SIDS. Logically, thermal stress of any kind could have the potential to both physiologically and psychologically challenge an already vulnerable infant. The interaction between clothing and bedding and the infant's thermoregulation appears to be much more complex than perhaps has been previously appreciated.

Chapter 4 summarises the specific research questions emerging from the clinical and cultural literature and explains how an inter-disciplinary approach is well suited to exploring these questions. The research questions are designed to address differences in beliefs and practices regarding the provision of infant thermal care among mothers of South Asian and white British origin in the District of Bradford, West Yorkshire, England. South Asian mothers were chosen to compare with white British mothers because of the very low SIDS rate in South

Asian infants in the UK, and because of the potential for humoral beliefs to influence their thermal care behaviours.

Chapter 5 describes and explains the methods used in this study. By employing an inter-disciplinary, mixed methods approach, this research study benefited from not being wholly restricted to any one particular method or paradigm. The perspective of medical anthropology, including its use of mixed methods, is an ideal approach for exploring a topic that involves the study of infant health as well as an analysis of caregiver beliefs. This chapter describes the lessons learnt from the pilot study and how the final fieldwork was planned and implemented.

Chapter 6 describes the characteristics of the sample of mothers. This includes a summary of relevant data obtained on their income, education, employment, age, country of birth, country of parents' birth, language, smoking, environmental conditions, where and with whom the infant sleeps, and the infant's birth and health. These data were used to identify differences between and within the two groups to analyse different levels to identify differences within the two groups of South Asian and white British mothers.

Chapter 7 presents results of data collected on the insulation value provided by South Asian and white British mothers' use of clothing and bedding for their infants at night during winter and summer. The data are used to examine differences in insulation by ethnicity, and were then analysed by first or second generation for the South Asian mothers and by bedding type (i.e. infant duvets, blankets, or infant sleeping bags).

Chapter 8 examines the environmental conditions in which infants slept. This chapter presents results on humidity, air currents, and other factors that are also relevant to an infant's thermal care. Reasons for providing a specific environment, or for not being able to change the environmental conditions, are explored. There were several competing factors affecting the environmental conditions where the infants slept, including the thermal needs of other members of the household or the habit of keeping windows closed on hot days for security reasons.



Chapter 9 investigates how mothers interpret whether their infant is experiencing thermal stress and how they determine when to adjust thermal care. The methods described take into account many factors over and above the use of room thermometers as recommended for SIDS prevention. This chapter provides insight into how mothers decided when and how action should be taken to protect their infants from the adverse effects of heat and cold. It also explores the infant's role in influencing the thermal care provided by their mothers.

Chapter 10 discusses how mothers thought heat and cold could harm their infants, which illnesses and physical conditions could be caused by heat and cold, and what they were worried about most. The chapter explores some of the predictions regarding the likely thermal care priorities of South Asian and white British mothers arising from the reviews of literature. For example, it is typically assumed that white British mothers are preoccupied with heat causing death (by SIDS and fever) while South Asian mothers are focused on maintaining thermal balance and are less worried about SIDS. The current study provides further evidence in support of these views.

Chapters 11 presents a discussion of the results of this study, and chapter 12 provides a summary and conclusions. Together, these chapters provide a holistic view of the differences between how South Asian and white British mothers provide thermal care for their infants in Bradford, and discuss how cultural beliefs inform the practice of thermal care for both groups. I conclude by considering the implications of my study for infant health care policy and practice, and offer recommendations for future research.

# Chapter 2 Cultural beliefs regarding the thermal care of infants

“Humoral medicine is probably the most widely influential belief system in the world” (Kashiwasaki et al 1995).

## *2.1 Introduction*

Thermal care is one of the basic survival needs of human infants. Yet the provision of this care is understood in different ways within different cultures. This chapter explores the literature on the beliefs regarding thermal needs and related infant care practices in different cultures. It also provides a detailed case study of infant thermal care in Guatemala where my interest in thermal care of infants originated.

The extremes of thermal stress are universally understood to threaten life, but beliefs vary over whether heat or cold is the most dangerous element. In some cultures, such as in Bolivia, there is widespread concern about the potential harm caused by becoming too cold (Charaly 1999; Cominsky 1994). Some societies, such as the UK, are concerned to a similar degree about the potentially harmful effects of heat (NCT 2005). Other cultures, such as those in South Asia, may be equally worried about both (Nichter, 1987). Infants, the sick and the old are usually seen as the most vulnerable to extremes of heat and cold. How well an infant has been protected from thermal challenges is often used as an explanation for illness that at times can only partially coincide with clinical explanations (Pool 1987). There are many cultural explanations of the effects of temperature upon an infant such as through dampness, wind, contact, environment, sunshine etc (Nichter 1987; Nichter 1996; Pool 1987; Urnaa et al 2006). Some of the explanations correspond to the scientifically established mechanisms of heat transfer, including evaporation, convection, radiation and conduction (Hawdon, 2006), but other beliefs may also include supernatural explanations that contradict scientific theories. For example, some supernatural theories are based on the belief that cold air brings evil spirits that cause disease (Scarpa 2004).

As infants undergo rapid physiological change, people of different cultures interpret their vulnerability and risks differently. These interpretations are discussed in greater detail below. Regarding thermal care of infants, there are two emerging and important concerns about the most significant threats to infant survival. One, found mainly in high-income countries, is based on the fear that overheating causes Sudden Infant Death Syndrome (SIDS). The second, primarily common in lower-income countries, is based on the fear that cold causes respiratory infections and influenza.

## ***2.2 Thermal care beliefs – humoral beliefs and explanation of disease***

### **2.2.1 Humoral beliefs and humoral pathology around the world**

Humoral belief systems exist in most parts of the world and in some cases have influenced health behaviours for thousands of years. These belief systems are based on ideas of balance, suggesting that good health depends on the ability to maintain a balance of the humors. Humoral belief systems usually link internal fluids to the environmental elements of earth, fire, water and air. For example, in ancient Greek medicine the humors were associated with yellow bile, black bile, phlegm and blood. This medical belief system has had a huge impact on the development of humoral beliefs in many cultures. It preceded modern biomedicine and has become established in the medical beliefs of several cultures (Kim-Godwin 2003). Humoral beliefs prescribe equilibrium to be maintained between extremes of heat and cold and wet and dry, and hold that a person's equilibrium can be affected by their age, health, climate, lifestyle and diet (Anderson 1987; Ember and Ember 2004).

These systems may be named 'humoral systems' because of the beliefs in balance of these humors, however in different cultures illnesses attributed to imbalances may differ widely. Humoral beliefs emphasise the importance of maintaining a neutral body temperature and that extremes of heat or cold bring risks to certain illnesses or risk of death. This concept of heat and cold is not identical to scientific concepts of physical thermal properties. People, food or

objects are all thought to have 'hot' or 'cold' properties regardless of their actual physical temperature.

Metaphorical and physical properties of people; food and environmental conditions are therefore considered in humoral theories of disease. People at different ages and conditions are also considered to have varying hot or cold properties, again regardless of actual physical temperature. For example, infants are thought to be born cold and warm up as they become adults. They are therefore considered to be extra vulnerable to the cold and in need of more insulation than adults (Anderson 1987; Ember and Ember 2004; Kashiwazaki H and colleagues 1995; Kim-Godwin 2003). Special care is given to those who are most vulnerable to thermal imbalance – the sick, very young, old and women who have recently given birth. Pregnant women are often considered to be hot and therefore should avoid 'hot' foods to maintain their balance (Kim-Godwin 2003). However women who are in labour or who have recently given birth are often considered to be cold, and should avoid 'cold' foods to avoid further exposure to the effects of the cold (Liamputtong 2007). An example of balancing the body through diet can be seen among postpartum women in the Fujian Province of China, who practice the Chinese humoral theories. These women are encouraged to eat meat and eggs, which are regarded as 'hot' foods, and are encouraged to add wine or vinegar to foods to make them 'warmer.' They are also instructed to avoid fruit and vegetables because they are 'cold' foods.

"We have to eat more hot food because we bleed at delivery. Hot food will enrich the blood and help the recovery process. Cold food will stop this from happening" (Mother, rural family 4). (Raven et al 2007:5)

Humoral theory is widespread and is present on all continents. Various theories have been proposed as to why there is so much similarity among humoral belief systems across cultures. Humoral beliefs in Latin America were assumed to have been introduced by the Spanish conquistadores, but Foster (1987) and de Montellano (1987) argue that similar beliefs already existed in indigenous cultures. Therefore, the humoral beliefs of the Spanish did not conflict with the existing

belief system, and indigenous groups did not reject the introduction of Greek-Persian humoral pathology. Bastien (1989) also argues that, while indigenous cultures in Latin America may have adopted some of the humoral beliefs of Greek/Persian/European origins such as the wet/dry classification, they had developed their own humoral classification system prior to the arrival of the conquistadores. These beliefs are still held among several Latin American cultures today. For example, the Kallawayas Andeans of Latin America have a humoral system but topographical-hydraulic model, understanding fluids in centripetal and centrifugal motion rather than in terms of balancing body fluids (Bastien 1989).

Across Latin America, Asia, the Middle East, and Northern Africa, cultural beliefs about hot and cold states have been reported, and these beliefs underlie how and why people protect themselves from heat or cold (Barrett and Lucas 1994; Charaly 1999; Joralemon 1999; Kim-Godwin 2003; Kresno and colleagues 1994; Laderman 1987; Pachter and colleagues 2002; Pool 1987; Real and colleagues 1982; Scarpa 2004; van Sleuwen and colleagues 2003). Pool (1987) claimed that too much emphasis in the area of hot-cold cultural theory research had focused on diet alone and not enough on the underlying reasoning for different hot and cold categories which he suggests are primarily aimed at disease prevention. He notes that “hot-cold beliefs should be seen as an explanatory model which seeks to make the puzzling and threatening phenomena of disease more acceptable and predictable” (Pool 1987: 389).

The cultural similarity of humoral beliefs is a global phenomenon. In the table below I have listed peer-reviewed research articles found during my literature search which have focused in some way on humoral hot-cold beliefs in different countries. These studies have documented hot-cold beliefs in over 40 countries, covering every continent and where almost 70% of the world’s population live. This search indicates how widespread the beliefs are, and documents the fact that humoral beliefs, to a lesser or greater extent, influence people in most countries in the world. The most notable absence of the influence of humoral, hot-cold beliefs is in Northern Europe.

**Table 1 Extent of hot-cold beliefs as cited in research literature**

<b>Country where research articles have documented hot-cold beliefs</b>	<b>Reference(s)</b>
<b>Argentina</b>	Kresno et al 1994; Scarpa 2004
<b>Bangladesh</b>	Bhardwaj and Bimal 1896; Gardener 1997; Stewart et al 1994; Winch et al 2005
<b>Bolivia</b>	Charaly 1999
<b>Brazil</b>	Foster 1993
<b>Colombia</b>	Foster 1993
<b>Cote d'Ivoire</b>	Gottlieb 2004
<b>Ecuador</b>	Finerman 1989
<b>Egypt</b>	Kim-Godwin 2003
<b>Ethiopia</b>	Gelaw et al 2001
<b>Greece</b>	Scrimshaw 2006
<b>Guatemala</b>	Baer et al 1999; Burleigh et al 1990; Cominsky 1994; Kim-Godwin 2003
<b>Haiti</b>	Foster 1993
<b>Honduras</b>	Hudelson 1994
<b>India</b>	Chand et al 1994; Kim-Godwin 2003; Lyengar and Bhakoo 1991; Pool 1987; Ramakrishna 1979; Spiro 2005; Walter 2005
<b>Indonesia</b>	Kashiwazaki et al 1995; Kresno et al 1994
<b>Iran</b>	Beeman 2006
<b>Italy</b>	Scrimshaw 2006
<b>Japan</b>	Kashiwazaki et al 1995
<b>Jordon</b>	Kim-Godwin 2003
<b>Lebanon</b>	Kim-Godwin 2003
<b>Malaysia</b>	Foster 1993; Kashiwazaki et al 1995; Laderman 1987

<b>Mexico</b>	Foster 1985; Kim-Godwin 2003
<b>Malawi</b>	Munthali 2007
<b>Mali</b>	Randall 1993
<b>Morocco</b>	Greenwood 1992
<b>Nepal</b>	Stapleton 1989
<b>Nicaragua</b>	Coe and Anderson 1996
<b>Nigeria</b>	Bastian 1998
<b>Pakistan</b>	Mull and Mull 1994; Nizami and Bhutta 1999
<b>Palestine</b>	Kim-Godwin 2003
<b>Peru</b>	Escobar 1983
<b>Portugal</b>	Scrimshaw 2006
<b>Philippines</b>	Kashiwazaki et al 1995
<b>Puerto Rico</b>	Harwood 1971; Pachter et al 2002
<b>People's Republic of China</b>	Anderson 1987; Kim-Godwin 2003; Raven et al 2007
<b>Republic of China (Taiwan)</b>	Kashiwazaki et al 1995
<b>South Korea</b>	Kim-Godwin 2003
<b>Spain</b>	Scrimshaw 2006
<b>Sri Lanka</b>	Nichter 1996
<b>Trinidad and Tobago</b>	Foster 1993
<b>Vietnam</b>	Hinton et al 2001

In addition to individual countries, humoral beliefs have also been documented for some particular cultural groups: South American indigenous (Colson and de Amellada 1983); Carib speaking indigenous (Colson and de Amellada 1983); South American Creole (Colson and de Amellada 1983); and South Asian (Dein and Sembhi 2001).

It is very likely that these beliefs are found in countries where studies have not been undertaken, or not found in my search. For example, those countries that have some past and/or present common cultural roots such as in Latin America and European culture, have previously been heavily influenced by Greek humoral beliefs and Middle Eastern culture by Persian humoral beliefs (Foster 1987). There are also immigrant communities that have maintained their humoral belief systems. The Hmong Chinese immigrants in the USA (Capps 1994) are one example. There are probably few places in the world that have not been influenced by humoral beliefs. The attribution of disease aetiology to influences of heat and cold therefore represents a major global model of disease that has implications for health and behaviour.

There has also been some debate as to exactly how much these humoral beliefs influence beliefs around the world. Such beliefs may be readily denied as belonging to past generations as people fear they will be considered ignorant for retaining their humoral beliefs (Messer 2008). Nevertheless, there is evidence that these beliefs are still either explicitly or unconsciously influencing health-related behaviours among much of the world's population (Anderson 1987; Ember and Ember 2004; Kim-Godwin 2003).

### **2.2.2 Humoral beliefs in South Asian cultures**

A primary focus of this thesis is to explore the existence of hot-cold beliefs among South Asian communities in the UK and the relation of these beliefs to thermal care ideologies and practices. This section describes humoral beliefs that are still practiced in some parts of South Asia and that also continue to influence South Asian cultural groups living in the UK. Humoral beliefs in South Asian countries are mainly influenced by Ayurvedic (Zimmerman 2008) and Unani medical systems, which have ancient Greek and Arabic roots (Winch and colleagues 2005), and Siddha medicine, which has Tamil-Dravidian (Southern Indian) roots (Walter 2005; Winch and colleagues 2005). Ayurvedic medicine uses a concept of aiming to maintain conditions in the body in an 'intermediate zone' and therefore the concept of balance is extremely important. By remaining in the intermediate zone this ensures no one can be exposed to any of the extremes in



order to maintain health. Of the three humors (rather than four as in humoral beliefs with Greek origins), the elements that balance the body, in Ayurvedic medicine (wind, bile and phlegm), wind is the most important because it can carry the other two humors that are also disease causing (Zimmerman 2008).

However, Ayurvedic medicine is only one medical belief system in South Asia. There are other similar beliefs in South Asian cultures that classify people into hot and cold body states (Nichter 1987; Pool 1987), where people with a 'hot constitution' are said to be prone to 'hot' diseases such as skin rashes and diarrhoea. By contrast, people with a 'cold constitution' are said to be vulnerable to the more internal 'cold' diseases such as respiratory infections and joint pain. Thus, they aim to manage their diet and thermal care appropriately to avoid allowing their body states to reach either extreme: According to Zimmerman (2008), "medicine [Ayurvedic] is the art of establishing harmonious yoga or samyoga 'junctions' or 'articulations' between man and his environment through the prescription of appropriate diets and regimens" (Zimmerman 2008). In some cases, such as with Ayurvedic medicine in South Asia, humoral-based medical systems and practitioners are so popular that 'Ayurvedic tourism' exists, where people from outside South Asia come from around the world to study it or receive treatment (Zimmerman 2008). This indicates that humoral beliefs are not something of the past, and continue to flourish within South Asian culture.

More evidence regarding a continued adherence to humoral beliefs in Pakistan is provided in Nizami and Bhutta's (1999) study. They found that more than 70% of new mothers could classify food as either cold or hot, although the ability to classify all foods into hot and cold was uncommon. Foods classified as hot or cold in Nizami and Bhutta's study are listed in appendix 1. Foods that were thought to be very hot were egg; beef; chicken; mutton; liver; aubergine and mango. Foods thought to be very cold were rice; oranges; yoghurt; ice cream; carrots; bananas and cucumber.

More evidence that humoral beliefs have influenced the older South Asian generation, who have influence over thermal care of newborns at present, is given

in Nichter's (1987) example of a Sri Lankan mother. In this case, the mother persuades her son, who was thought to have a cold constitution, not to leave home to get a job in another town because he would become too vulnerable to cold illnesses, and so the son stayed. This shows how much importance is given to protecting individuals in this culture from imbalance. The mother may have been using his perceived vulnerability to cold to keep her son at home, but her reasoning was based on a plausible explanation of risk of disease in her culture.

Whilst some individuals are thought to have cold or hot constitutions in South Asian cultures, there are also particular phases over the life course of all individuals that put people at risk of cold (Surinder and Kanti 1986; Gardener 1997). Individuals with particular vulnerability to illness because of their cold state include newborns, mothers who have recently given birth, the elderly and the infirm. The cold state of the newborn puts its survival at risk in an environment of high infant mortality. Therefore newborns are taken out as little as possible for the first few months so they are not exposed to people and illnesses (Maharaj 2007). At the same time this mother who has just given birth is also considered to be in a highly dangerous cold state. This vulnerability to illness one of the explanations for maternal mortality, which is high in all South Asian countries, justifying the concern over the mother's survival.

Winch and colleagues (2005) investigated local knowledge and practices relating to newborns in the Sylhet Region of Bangladesh. The authors examined perceived threats to the infant's well-being and how the families sought to protect newborn infants from cold using data from a household survey of 6050 women who had recently given birth. They found that newborns in this area were considered to be extremely vulnerable to cold air entering their bodies, contact with a cold substance or cold being passed on to the infant through the mother ingesting a cold category food. Cold was believed to be a malevolent force that was responsible for infant deaths, and was therefore considered extremely dangerous. In contrast to the fatalism reported in other communities with high infant mortality such as in Brazil (Scheper-Hughes 1992), these Bangladeshi mothers were found to actively protect their infants from perceived threats, such as from cold, in a way

that needed few resources even for the poorest families. This fatalism has been disputed in other areas of high infant mortality (Nations and Rebhun 1988). Whilst protecting infants from cold, and the illnesses the cold are thought to bring may be disputed by medical professionals, these Bangladeshi mothers cannot be accused of resigning themselves to the inevitability of infant death.

In Pakistan Nizami and Bhutta (1999) conducted a questionnaire survey with doctors and their patients in which 10% of physicians said they believed in hot-cold theory and gave dietary advice based on this despite their understanding that it did not have a scientific basis. It is possible that even more of these doctors held hot-cold beliefs but because of their professional status some may have been hesitant to express them, depending on whom they were addressing, or to admit they provided advice based on non-scientific principles. It is anticipated that physicians everywhere are influenced by their own culture, and they recommend non-scientific remedies where scientific medicine cannot always help. Winch and colleagues (2005) found that amulets, bracelets believed to ward off evil spirits and illness, were sometimes given by doctors to infants and their mothers in Bangladesh where extra protection was considered necessary (Winch and colleagues 2005). The use of amulets to protect from the “evil eye” and other malevolent forces is as widespread a global phenomenon as humoral beliefs. Whilst adherence to humoral beliefs differs among groups and individuals in South Asia, and also among South Asian groups in the UK, it is important to understand that these beliefs may to a greater or lesser extent still influence their understanding of the aetiology of disease. Although no research has been conducted on the thermal care beliefs of South Asians living in the UK, humoral beliefs regarding hot and cold foods were documented by Griffiths and colleagues (2001) in a comparison of South Asian and white British hospital admissions for asthma. They found that “some South Asians used traditional medicines or dietary changes consistent with Islamic or Ayurvedic humoral systems, particularly hot food spices such as ginger or turmeric, reflecting a view that cold foods were a cause of asthma” (Griffiths and colleagues 2001:4). Roseanna Pollen’s ethnography of the Bengali community in Bethnal Green, London did not reveal any humoral beliefs but did find that magico-religious beliefs, such as a belief in the evil eye, were common. However,

identifying who held these beliefs and to what degree was not easily discernable (Pollen 2002). This difficulty in defining the beliefs of South Asian mothers in the UK exists because of the plurality of health beliefs and because the manner in which people explain diseases can vary depending on the context in which they are living. In the UK, South Asian communities are not stuck between two cultures but are able to draw on more than one belief system in order to make sense of illnesses that threaten or afflict their infants (Reed 2003).

### **2.2.3 Infant thermal care beliefs of Northern European cultures - Nordic and UK**

In contrast to the balance valuing, heat and cold fearing cultures influenced by humoral beliefs described above, in this section cold cultures in Northern Europe that value cold are discussed. Cold in these cultures is not always believed to be dangerous for infants. Indeed, although it is believed to cause colds and flu, it is also thought to be beneficial for infants. Infant thermal care beliefs and practices in Nordic countries are explored first, followed by a discussion of thermal care beliefs and practices in the UK. Northern European cultures are examined specifically, rather than including other European culture, since evidence exists that Euro-Mediterranean cultures differ from Southern European cultures and are more influenced by hot-cold humoral beliefs (Scrimshaw 2006).

#### **2.2.3.1 Thermal care beliefs in the Nordic Countries of Finland, Iceland, Norway and Belgium**

**Figure 1 Infant sleeping on balcony, Iceland**



(Vidardóttir 2007)

In the above photograph, an Icelandic infant is sleeping on the balcony of a flat in the snow. The practice of putting infants to sleep outside in extremely cold temperatures is common in Finland (Tourula 2007), Iceland, Norway and Belgium (EP 2007).

Mothers in Finland, a country with one of the lowest infant mortality rates in the world, routinely put babies to sleep outside in temperatures as low as  $-27^{\circ}\text{C}$  (Tourula 2007). One mother reported, “I used to keep  $-20^{\circ}\text{C}$  as the line. Then one day I went to day care to pick up mine during napping time, and it was  $-24^{\circ}\text{C}$ . There was a line of prams outside, and I was sure that they had frozen my baby. Nope, he was almost sweaty” (EP 2007). Many Finnish mothers report health benefits of their child sleeping outside in sub-zero temperatures, including a better appetite and increased levels of activity (Tourula 2007).

Several years ago, the Finnish government distributed a guide to all new mothers with instructions on how much clothing to put on an infant at different temperatures (Ministry of Labour 1997). They advised that just three layers on the infant’s torso were sufficient in  $-20^{\circ}\text{C}$ . This amount of clothing for such cold temperatures would be considered to be grossly insufficient by mothers in many parts of the world. The Finnish Government also advised that newborns should be at least two weeks old before they sleep outside in sub-zero temperatures, and reinforces the belief that sleeping outside is good for infants. The full, illustrated advice of exactly how to dress infants according to the Finnish Government is given in appendix 2.

It is no surprise that healthy infants can cope with extremes of temperature since human infants have evolved and survived in wide-ranging extremes of climate with the help of their care-givers. However, we cannot assume that infants everywhere would be as able to cope with sleeping outside in these extremely low temperatures. Infant mortality in Nordic countries is low (Monnier 2004) compared to many of the countries where humoral beliefs are held. Far more common than exposing infants to such extremely cold temperatures (Charaly 1999; Kim-Godwin

1993) are practices designed to protect infants from cold. This is not surprising given that newborns are clinically proven to be vulnerable, especially to cold. In fact, neonatal hypothermia is the cause of thousands of infant deaths worldwide (W.H.O 1997). Infants are vulnerable to cold and heat because their thermoregulatory systems are still immature and they are heavily dependent on their care-giver for support with their thermal regulation (Hawdon 2006; Lyon 2006; World Health Organisation 1997). This is discussed in more detail in Chapter 3 below. Given a newborn's vulnerability to cold, it is surprising that Nordic newborns apparently suffer no ill-effects from sleeping in such extreme conditions, even if they are well clothed.

### **2.2.3.2 White British Thermal Care Beliefs**

Modern biomedicine in Europe was founded on the humoral medicine of the Ancient Greeks and practiced until the early nineteenth century. The four humors, yellow bile, black bile, blood and phlegm, were associated with the essential qualities of the human body, which were thought to include wet, warm, cold and dry (Balzar and Eleftheriadid 1991). However, there does not appear to be any evidence that lay White British explanatory models of disease were or are heavily influenced by these humoral theories. The sole exception involves the belief that cold can cause colds and influenza. Humoral theories propose that imbalance, such as cold exposure, can cause disease. Curiously there is evidence that the belief cold causes colds and flu, which has similarities with humoral belief systems, is still common in British culture today. In Prior and colleagues' (2010) study of how lay people in South Wales describe symptoms and causation of colds and flu, getting cold, wet or damp was given as a direct cause of colds and flu:

Interviewer: "OK, good. How do you think you catch the flu?" R:39 "Ah. The 65 dollar question. Well, I would catch it if I was out in the rain and I got soaked through. Then I would get the flu. I mean my neighbour up here was soaked through and he got pneumonia and he died. He was younger than me: well, 70. And he stayed in his wet clothes and that's fatal. Got pneumonia and died, but like I said, if I get wet, especially if I get my head wet, then I can get a nasty head cold and it could develop into flu later." (Prior et al:2010:5)

Heat has also historically been cited as a cause of disease in white British culture. For example: “they [the British] had known for centuries that high altitudes meant cooler weather, and they had associated heat with putrefaction and hence with disease. In India officials had retreated to the ‘hill stations’ in the warm season since the beginning of the 19<sup>th</sup> century.” (Feierman and Janzen 1992: 235).

Despite remaining associations in British culture of both heat and cold imbalance causing disease, over the centuries a focus on the health promoting properties of cold has emerged from Ancient Greek and Roman influence in Britain (Ayriss 2009). Ayriss (2009) traced the British fascination with cold water bathing to Roman influences, where cold water was believed to toughen up infants. A description of typical 18th century beliefs included this adage: “Strong from the cradle, or a sturdy brood, we bear our newborn infants to the flood; There bathed amid the stream our boys we hold, with winter hardened and inured to the cold” (Dryden, quoted in Ayriss 2009:12).

In the 18th and 19th centuries cold water bathing was believed in Britain and Ireland to cure various ailments and make sick children stronger, a practice that was referred to as “the cold water cure” (Durie 2006). Around this time, seaside and spa towns became increasingly popular with people seeking the health-promoting properties of cold water, and from that time on there was an increasing interest in and provision for swimming and bathing among all social classes. This led to a peak in popularity of open air, cold water lidos in the 1930’s. Although in the past few decades concerns about accidental drowning in open water have resulted in open water swimming being actively discouraged, a fascination with cold, open water swimming remains a peculiarity of British culture (Ayriss 2009).

The health-promoting properties of cold water were used to keep infants healthy. Locke and Rousseau (in Hardyment 1983)<sup>1</sup> were influential in prescribing infant care advice to parents in the 17th, 18th and 19th centuries regarding the need

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<sup>1</sup> Locke’s *Some thoughts Concerning education* was published in 1693 and Rousseau published *Emile* in 1782 detailing how infants should be cared for (Hardyment 1983).

to 'harden up' infants through cold baths, light dressing and uncertain mealtimes (Hardyment 1983). However these 18th and 19th Century practices were not received without criticism, such as the following: "to see an infant washed up to the breast and loins in cold water, exposed for several minutes, perhaps in the middle of winter itself, in one continued scream, and the fond mother covering her ears under the bedclothes that she might not be distressed by its cries, has ever struck me as a piece of unnecessary severity" (Underwood, quoted in Hardyment 1983: 24).

Until recently, cold air as well as cold water was thought to be health-promoting for infants. Infant care in the UK over the past 200 years has promoted several practices that involved infants being exposed to cold air by being put outside to sleep, being exposed to open windows, and being given cold baths (Fomon 2004; Hardyment 1983; Jordan 1987). The objective of putting infants out in the cold was not necessarily to expose infants to cold environmental temperatures, but rather to allow them to gain the benefits of fresh air and sunlight. This was especially so in times when tuberculosis and rickets were common and fresh air was regarded as a cure for these ailments (Jordan 1987).

By the 1960s, doctors became concerned about the number of infant cold injuries (including frostbite, accidental hypothermia, and chilblains) they were treating, and advised mothers to wrap their babies up more (Arneil and Kerr 1963; Ward-Platt 2007). Mothers did start to follow this advice, and in subsequent decades putting infants to sleep outside came to be considered cruel by most mothers and continues to be rarely practiced today. In considering the development of thermal care beliefs in white British culture, there is evidence that the belief in the health-promoting properties of cold have lead to a complacency about its dangers which still persists today.

In 2005, Professor Peter Donnelly, Scotland's Deputy Chief Medical Officer, warned about a worrying new phenomenon of scantily clad young people being admitted to accident and emergency units with hypothermia. Alcohol contributes to the development of hypothermia by lowering the body temperature and making the



person less sensitive to cold, and its symptoms can be confused with alcohol intoxication (Laing 2005). Hypothermia is not something traditionally associated with young people, but “a combination of insufficient protection against the bitter cold and too much drink can bring on the potentially lethal condition more associated with cash-strapped pensioners and climbers lost in the Cairngorms” (Laing 2005).

The same lack of concern of the dangers of cold in British culture could also explain why there is little focus on the higher number of winter deaths in the UK compared to colder European countries. Between December 2008 and March 2009, there were 36,700 excess winter deaths in the UK (ONS 2009), most of these due to cardiovascular complications of cold stress (Mercer 2003).<sup>2</sup> Given the thousands of excess deaths due to cold, coupled with a general lack of awareness and lack of concern about these deaths, it seems that there must be an explanation for such complacency. The lack of urgency could be explained by clinical research into the thermal care and thermoregulation of infants having been influenced by cultural beliefs regarding thermal care in the UK, just as humoral beliefs was shown above to influence biomedical doctors in Pakistan.

Medical research cannot be organised in a cultural vacuum and therefore choice of research priorities are not immune to cultural beliefs and assumptions about the cause, or the likely cause of disease. This thesis therefore is a rare and valuable attempt to combine clinical and epidemiological research with anthropological data and analysis (Inhorn 1995). More about medical anthropology as a method is discussed in chapter 4 (methods). The promotion of ‘healthy’ infant care is also particularly vulnerable to cultural bias because advice is given partly based on the health workers’ opinions and experience of infant care and not on strong scientific evidence (Closs and Cheater 1999). Where professionals are in the

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<sup>2</sup> Factors considered indicators of risk for cardiovascular disease which have been shown to have clear seasonal variations include winter increases in plasma cholesterol, plasma fibrogen, blood pressure and red and white blood cell counts.

position to give advice, and where hard scientific evidence is not available to offer empirical evidence on all topics, practice inevitably falls back on findings drawn from less rigorous studies and even from personal opinions which are heavily influenced by culturally-informed beliefs.

In contrast to the complacency about the dangerous effects of cold typical of white British populations, among both medical professionals and lay people there exists another phenomenon involving thermal beliefs that is referred to as ‘fever phobia.’ This term, coined by physicians, refers to an exaggerated fear of fever among parents; indeed, fever is one of the most common reasons that parents seek medical attention for their children (Crocetti and colleagues 2001). Since this phenomenon is influenced by thermal beliefs, parents’ views about the dangers of different levels of fever do not coincide with clinical evidence. According to Crocetti and colleagues (2001), this occurs because parents perceive fever to be a disease in its own right, rather than a symptom of disease. Blumenthal (1998) documented some of the beliefs held by parents about the outcomes associated with fever, and found that 81% of parents in the UK thought untreated fever led to brain damage or fits, and 7% thought fever led to death. Therefore, parents perceive fever as being very dangerous for their children (Crocetti and colleagues 2001).

Western biomedical physicians have been accused of having the same ‘fever phobia’ as parents, similarly based on thermal beliefs rather than clinical evidence. A study by Ipp and Jaffe (1993) found that 12% of Canadian physicians believed fever could cause brain damage, and 49% thought it could cause seizures. Anti-pyretics were commonly prescribed for fever, although this was done for a patient’s comfort as well as for fever-reducing effects. This common practice has the potential to cause significant problems when extended to developing countries, where the cost of such drugs can be extraordinarily burdensome without producing health benefits for patients (Russell and colleagues 2003).

Culturally-informed beliefs about the effects of heat and cold are particularly relevant to discussions of the aetiology of SIDS, which is discussed in greater detail in chapter 3. However, it is worth noting here that the changing cultural beliefs

described in this chapter have indeed affected risk factors for SIDS. Following advice given to mothers in the 1960's to avoid exposing infants to excessive cold, it appears that a shift toward overwrapping of infants occurred. Indeed, the danger of hyperthermia caused by overwrapping was identified as a significant risk factor for SIDS in the late 1980's (Fleming 1992). As part of the UK Department of Health's 'Back to Sleep' campaigns of the early 1990's, which focused on having infants put in a supine position for sleep, advice to prevent infants from getting too warm also became a central theme of the campaign (Blair and colleagues 2006).

An evaluation of the Back to Sleep campaign showed that 31% of mothers were worried about their infants getting too cold which was reduced to 19% after the campaign (Hiley and Morley 1994). The number mothers worried about the infant getting too hot increased from 24% before the campaign to 37% afterwards (Hiley and Morley 1994). This was a fairly robust study with a 385 out of 450 mothers returning questionnaires before the campaign and 399 out of 450 after the campaign and demonstrates that the campaign did have an effect of reducing mothers' concern about their infants getting too cold and increased concern about them getting too hot. Although no data was published regarding ethnicity of the sample, the study area was Cambridge, Huntingdon and Bury StEdmunds and so it is not expected that there would not be a large South Asian population in these areas and that the respondents were mostly white British mothers. An improved attitude to preventing overheating as a result of the campaign was evaluated but not risk of cold stress. Fewer mothers worrying about their infants getting cold was not seen as negative:

“The Department of Health's campaign was associated with improvements in sleeping position, use of bed coverings, and attitudes to heating.” (Hiley and Morley 1994 :703)

SIDS prevention advice today continues to stress the dangers of overheating, and places little or no emphasis on any harmful effect of the infant getting too cold (Foundation for the Study of Infant Deaths date nk). This could be a negative outcome resulting from the SIDS campaigns, which has emphasised the dangers of

overheating to the exclusion of information about similar dangers caused by excessive cold. This campaign may have served to reinforce contemporary and historical cultural beliefs that cold can actually be beneficial for infants.

In conclusion to this section, humoral theories have had little influence on thermal care beliefs among white British culture. What has emerged instead is a belief system which holds that heat is more dangerous than cold, and indeed rather than being life-threatening, cold is often believed to be health-promoting. This bias has possibly contributed to the phenomenon of ‘fever phobia’ among parents and physicians, and has influenced the focus on overheating as a major risk factor for SIDS. The potential bias involved in generating research on the relationship between overheating and SIDS versus exposure to cold and SIDS is discussed in the context of the clinical literature, presented in chapter 3.

The next section of this chapter provides a case study into thermal care of infants and the cultural beliefs that influence this care. The utility of considering thermal care beliefs across cultures is augmented by an in-depth look at one particular culture in order to more fully explore the process by which thermal beliefs are translated into infant care practices. The case study provided below is also important because it is what originally led me to choose to do a doctoral study on the thermal care of infants and to question what ‘correct’ thermal care of infants actually is. Undertaking this topic of study seemed particularly important since so little research has been done in this area in the past.

## ***2.3 Case study of thermal care beliefs in Guatemala - a culture with a humoral belief system***

### **2.3.1 Introduction**

As a recent graduate in social anthropology living in Guatemala City, Guatemala when my first two sons were born in 1995 and 1997, I found I had a unique opportunity to apply ethnographic methods to an opportunistic study of infant care in a cultural environment few outside anthropologists were able to access. The decision to carry out this small research exercise was based on two

main factors. One was that, despite being a recent anthropology graduate looking to advance my career in anthropology, it was too dangerous to work formally as an anthropologist in Guatemala at the time due to the ongoing civil war where anthropologists were targeted, as they were considered by the military to side with the poor and therefore with the insurgents (Nelson 1999). The second factor was that several of my own infant care beliefs, informed by my own white British/Irish origins, were in direct conflict with the beliefs held by those I depended on for support in bringing up my children. A major difference in our belief systems involved how much protection from the cold or heat my sons were thought to require. I considered the climate to be hot and therefore only lightly dressed my children to avoid them getting overheated.<sup>3</sup> My Guatemalan peers, however, considered all infants to be in constant danger of fatal respiratory infections caused by draughts, dampness and a cool environmental temperature.

To constantly confront these highly emotive differences about the safe and correct care for my sons would risk a breakdown in support and communication among those I was wholly dependent upon whilst bringing up two young children in a foreign, economically and politically troubled country. I decided to make use of being constantly criticised for my ‘incorrect’, ‘irresponsible’ and ‘dangerous’ thermal care practices for my sons by recording everything I was told about ‘correct’ thermal care of infants over the years 1995 to 1997. Having recorded advice and explanations on the beliefs of infant thermal care in Guatemala from over 100 individuals, I began a thematic analysis of these data for my doctoral thesis. This study looks only at thermal care in the temperate climate of Guatemala City, and not at sea level areas in Guatemala where the climate is tropical and thermal care patterns are different. I was exposed to these differences in infant care practices between regions of Guatemala when I went down to a sea level town where the temperature was over 35°C. While there, I covered my son with a shawl to protect him from the sun, only to be scolded by a bus driver for covering him up so much. However, since the vast majority of my time was spent in Guatemala

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<sup>3</sup> The average maximum temperature in Guatemala City is 25°C (WMO 2011).

City, this case study focuses on infant thermal care practices in a temperate climate, albeit a much hotter climate than the one from which I originated.

### **2.3.2 Methods**

I was confronted by the differences between my own, white British, thermal care beliefs and Guatemalan beliefs from the day my first son was born. As soon as he was born the hospital nurses took charge over the care of my firstborn son. They clothed him in clothes owned by the maternity hospital and swaddled him in two shawls. The daily outdoor temperature around this time was approximately 24°C (World Meteorological Association 2011) and even hotter indoors in the enclosed rooms of the maternity hospital. Under these circumstances, I was surprised that they had put so many layers on him.

**Figure 2 Photograph of my newborn son swaddled in the clothing and blankets administered by nurses in the maternity hospital in Guatemala**



The picture above shows my son dressed by hospital staff according to standard Guatemalan thermal care practices. Prior to taking this picture, I had opened up the swaddling blankets slightly. Note that the nurses had crafted the outer shawl around my son's head to keep his head warm and to protect him from currents of air.

Having been hospitalised for a number of days, during which time my son's thermal care had been in the control of the nurses, I looked forward to the day I could take him home and had brought with me a specially chosen 'leaving hospital' outfit which consisted of one vest, one baby-gro and a cotton shawl, which I judged

to be appropriate for the climate. However, just before being discharged several female Guatemalan in-laws arrived and took over this long-awaited moment to dress him. I was horrified that the clothes I had especially set aside were disregarded, and instead they dressed him in what I considered to be an excessive amount of uncoordinated clothing and bedding. This included a vest, trousers, a woollen cardigan, a woollen hat, gloves, and socks. They went on to swaddle him in a cotton shawl, and then a thick cotton duvet. At that time, I was weak and too shocked to argue. This inner conflict, turmoil and alarm over having my baby dressed so improperly and without my consent was just the beginning of an ongoing conflict between my norms of thermal care and the beliefs about infant survival held by everyone around me in Guatemala.

Prior to the birth of my first son, I had worried that I knew nothing about looking after a baby. The strength of my convictions about ‘correct’ infant thermal care therefore came as a complete surprise to me. I discovered quickly that another version of ‘correct’ thermal care of vulnerable individuals, such as infants in Guatemala, was going to be forced upon me and that I was up against equally strong convictions. Although I seriously considered attempting to constantly refuse their advice, I recognized that as a first-time mother who was outnumbered and who was dependent on their support, I needed a positive solution to the conflict. It was not only my in-laws who felt they had to intervene, but acquaintances, people on buses, people passing by, anyone who saw me. I caused alarm and shock wherever I went, and I was treated as if I was harming my son(s). One friend called me an ‘unnatural mother’ for not knowing how to protect my son(s) from the elements and safeguard his health and life. The reactions I received when I ‘underdressed’ my son(s) seemed exaggerated to me, as if it was a matter of life and death.

It was only later that I realised that in Guatemala it was actually a matter of life and death. Guatemalan cultures (including Ladinos<sup>4</sup> and the several indigenous

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<sup>4</sup> Guatemalans of mixed Spanish and indigenous origins

cultures) hold humoral beliefs that cold is dangerous to infants who are already thought to be ‘cold,’ and that cold can cause colds, flu and pneumonia (Burleigh and colleagues 1990; Cominsky 1994). Pneumonia causes the death of thousands of infants in Guatemala, so the perception about what constituted a threat to infant survival was drastically different from what I had been exposed to growing up.<sup>5</sup> Thermal care in Guatemala is actually a matter of life and death, and the cold air they feared my son would be vulnerable to was something they saw as far more dangerous than I did in my complacency about cold. I came from a culture where SIDS is the main cause of post-neonatal infant death, and overheating is believed to contribute to SIDS. I was bringing up my sons in a country where pneumonia was the main cause of post-neonatal infant death, and the cold was believed to contribute to this. Furthermore, most people’s lives in Guatemala had been touched by infant death. The infant mortality rate at the time was 75 per 1000 live births, and only 15 years prior it was as high as 139 per 1000 (World Health Organisation 1996). It is no surprise, in retrospect, that my thermal care beliefs clashed so fiercely with those in Guatemala, but that did not mean the strength and conviction of my beliefs were any less.

To avoid this conflict and to keep from upsetting so many people, I therefore modified my thermal care practice to make my sons appear to have more layers on, whilst confident that I was not putting them at risk of overheating.<sup>6</sup> Nevertheless, I was still judged to be underdressing my sons, which warranted continued advice on correct thermal care. To motivate myself to receive this daily advice with tolerance

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<sup>5</sup> 15% of under-5 deaths in Guatemala are caused by pneumonia. Guatemala has the third highest % of under-5 deaths from pneumonia in Latin America, just after Bolivia and Haiti (Wardlaw 2006). Pneumonia is the main cause of death in Guatemala for under 5’s after the neonatal period (W.H.O. 2006). At the time I was collecting data pneumonia was estimated to kill 33% of infants under the age of one (Benguigui 1999).

<sup>6</sup> For example, I put a baseball cap on my son instead of a woollen one. People were happy his head was covered and I was happy he was protected from the sun. I also tried to miss out layers underneath shawls, etc., but I would usually get ‘found out’ and corrected.



I found recording the beliefs and practices a useful release, and even a reason to go into in-depth discussions about what I was doing wrong and the reasoning behind the thermal care practices on which I was being instructed.

This became the ideal opportunistic study of Guatemalan infant care culture at a time when few foreign anthropologists were allowed by their institutions to travel to Guatemala because of the armed conflict. Having the status of a new mother I had privileged access to information on infant care beliefs and practices that I would not have had such extensive access to if I was single, male and without children. It was a perfect opportunity for participant observation in another culture. Although it was not a supervised study, I had recent experience in conducting fieldwork in Latin America for my undergraduate thesis, so I applied the ethnographic techniques and theory to my thermal care study in order to ensure that the data were accurate and rigorously collected.

I documented 'correct' thermal care advice from over one hundred people. These included: the large extended family of my in-laws; families attending a social project; friends and work colleagues; contacts made through obtaining services (landladies, hairdressers, market sellers, cafes, supermarkets, banks, immigration office, bakeries, grocery stores, doctors, and nurses); and general contacts (family members of acquaintances, crowds outside a church, bus passengers, customers in banks and shops, and other passers-by). I had access to a wide range of indigenous and Ladino groups of different socio-economic backgrounds.

The general level of suspicion in public places typical of Guatemala City meant that people in the street would not normally talk to strangers. This suspiciousness was the result of decades of civil war, when government spies were used to oppress the indigenous Guatemalans, the poor and their sympathisers. In this background of oppression there were also an increasing number of violent street muggings initiated by seemingly innocent requests by strangers for help in the street (Green 1999; Sanford 2004). Even within this context, however, the general level of concern devoted to protecting infants from cold still led many

strangers to break this silence and approach me about infant thermal care. On a routine basis, strangers in the street would expect me to stop and listen to their explanations of what I was doing wrong. Friends and in-laws likewise tried to change my thermal care practices, usually to no avail.

For three years following the birth of my first son, I diligently listened to and recorded all the advice and explanations I was given on appropriate thermal care. Because these data were gathered opportunistically rather than formally, there are some limitations to their use. However, the data I acquired are useful for the purpose of this doctoral study, and provide a case study on the range and depth of thermal care beliefs and practices found in one culture. This case study has been used to inform the broader subject of this thesis, which examines infant thermal care practices in a different cultural setting.

### **2.3.3 Results**

I analysed the data using a thematic analysis. Below are the results on the rules governing how infants should be protected from cold, water and wind; how illness and discomfort is explained; the ill-effects of heat; and how evidence contradicting these cultural beliefs is negotiated.

#### **2.3.3.1 Infant clothing in Guatemala**

The layers used as a minimum for all conditions in the city included a cotton t-shirt, trousers, woollen sweater, woollen hat, woollen mitts, socks, cotton shawl, and a cot duvet. If infants were carried in a pouch, the cot duvet would not be used. Ladinos tended to carry infants in their arms and indigenous mothers carried their infants in pouches.

#### **2.3.3.2 The indigenous pouch for carrying infants and the Ladino shawl**

Most Ladino mothers carried babies in the arms and kept them completely covered by a shawl, while indigenous mothers usually carried their infants on their back in a pouch. Despite appearing to involve different conditions for the infants, in fact the internal thermal environments were almost identical. Both infants had the same number of layers on, as described above, and were swaddled in a blanket

and then completely enclosed, protected from any currents of air either by the pouch or a second shawl. The Ladino mothers tucked one end of the shawl under the baby they were holding and threw the other side over their shoulder so that the baby was enclosed inside. The set-up in both cases almost simulated a womb environment, where the baby was totally enclosed and held close to the mother's body. The only difference between the two conditions was that the Ladino shawl system involved constant adjustments because the shawl would often fall directly on an infant's face. This was sometimes left on the infant's face if she was sleeping as to not wake her.

Below is a series of photographs taken in July 2011 demonstrating how an indigenous infant is dressed and wrapped in Guatemala to go outdoors. The family is from the K'iche' ethnic group and live in Santa Clara La Laguna, Guatemala. This village has a similar climate and altitude to Guatemala City. Note that the mother has only two layers on her upper body (blouse, sweater) whereas the infant is given five (one t-shirt, two sweatshirts, two shawls), plus a hat, indicating that the infant is thought to require more protection from the cold than an adult.

Figure 3 Photographs showing how an infant from the K'iche' indigenous group is dressed to go outdoors

- a. The infant is dressed in a long sleeved t-shirt, sweatshirt, socks, linen nappy



b. The infant is given another sweatshirt



c. The infant is given a hat



d. The infant is given trousers



e. The infant is swaddled in a fleece shawl.



f. The infant is put on the mother's back



g. The infant is wrapped in another shawl and the face is covered



The method used by indigenous mothers in Guatemala to wrap and carry their infants is identical to that used by the Quechua in Peru (Tronick and colleagues 1994), as illustrated below. Many indigenous Guatemalan communities live at altitudes around 6000 or 7000 feet, with the highest communities at 10,000 feet, at which altitude they encounter environmental challenges for their infants similar to the Quechua.

Figure 4 Photographs showing how a Peruvian infant is dressed and placed in a pouch

- a. The infant is dressed in a babygro, sweater and hat by Guatemalan and Peruvian indigenous mothers, in an identical way to indigenous Guatemala mothers



- b. The infant is placed in a light shawl



- c. The infant is placed in a pouch



- d. The infant is completely enclosed in the pouch



Photos: Tronick et al: 1994:1007

The Ladino shawl and indigenous pouch systems for carrying infants represent a form of identity. Ladino mothers have rejected the use of the pouch so they are not identified as indigenous, since they consider the indigenous people to be inferior. The Ladino method of using shawls could, however, constitute a higher-risk method of carrying infants because there is such a small space between the infant's face and the covers compared to the indigenous pouch. There is no conceptual conflict between Ladino and indigenous cultures in completely enclosing the infant and in humoral beliefs because these beliefs have origins in both indigenous and Spanish culture. They are still held by both Ladino and indigenous cultures.

### **2.3.3.3 Protection from cold temperatures**

Infants were protected from the cold by being dressed in a prescribed number of layers when taken outside at any time of day, even on hot days. 'Cold' was a subjective judgement, and could mean a slight drop in temperature or a colder than usual temperature. It did not mean the near zero temperature that I would describe as 'cold.' In addition to protecting infants from cold through the use of clothing and bedding, mothers would avoid going to cold places with their infants. Because of the variation in altitude in different locations in Guatemala, ranging from sea level tropical towns, Guatemala City at 5000feet and highland villages up to 8000ft, it was common knowledge that colder temperatures occur at higher altitudes. Every Saturday, I attended a women's project that was on the outskirts of the city, on slightly higher ground than the rest of the city. Women would talk about not wanting to take their babies there because it was cold, or if they did do so then they needed to wrap them up with extra layers. The location of the project was a problem for women who had no one to look after their infants at home. People also talked about relatives coming back from living in cold places like New York because of a fear that they were at risk of dying from the cold there.

Other than infants, people who were ill, older people and mothers who had recently given birth or were breastfeeding were thought to be vulnerable to cold. The scenario below illustrates one mother's awareness of their infant's vulnerabilities to cold.

The car of the Ladino couple was under a tree to be in the shade from the strong midday sun. The mother had just changed her 6-month old baby's nappy, redressed her, and put a cardigan on her. The father questioned his wife about why his daughter needed a cardigan on a hot day.

Father: "Won't she be a bit hot?"

Mother: "You may be hot but she feels the cold, there's aire (a breeze)."

Father: "Yes but . . ."

Mother: "You don't know what she feels, don't compare her with yourself!"

If the infant was exposed to cold, a restoration of temperature was urgent. For example, an infant needed to be dressed immediately after a bath, including socks. Being underdressed in combination with being wet put the infant at extra risk of getting cold. Cold in the humoral system can be metaphorical as well as physical. Cold substances, in the humoral and physical sense, were avoided by those in cold states. Young children talked regretfully about having to avoid eating ice cream at times when they were already vulnerable to cold from having gone swimming, having had a bath, or having been ill. One four-year-old girl said she wished she could find a hot ice cream so she would be allowed to eat it!

#### **2.3.3.4 Protection from water**

Cultural conceptions of what constituted dampness were again subjective, and were vastly different from what I considered to constitute dampness or rain. Drizzle was more of a concern than I was used to in the UK, and sometimes what I called drizzle (*lluvisnita*) Guatemalans would classify as rain (*lluvia*). Water, through rain, drizzle or dampness, was thought to make infants cold. Water and cold in humoral theory are the opposites of fire and heat. Protecting infants from water in Guatemala included avoiding any slight trace of dampness, or association with dampness. Dew was detected and was as much of a concern as rain and was thought to make infants cold. To avoid the dangers of dampness and water meant infants were not allowed to be left in a pushchair on a recently washed floor, be taken over a puddle, or be taken outside on a day they had a bath. Guatemalan



mothers believed their children to be ‘allergic to humidity.. In the primary school where I worked, six out of nineteen mothers of four and five year olds listed allergy to humidity in their child’s health information sheets collected by the school on enrolling.

Whilst walking with my son down a street a lady came up to me wagging her finger saying, “Cover his head up – it’s raining!” I couldn’t see or feel any rain, and although there was perhaps the faintest of drizzle there was nothing I thought could make anyone wet or cold. I was told on many occasions that I should have my son more covered up, or that he should not be out at all in such conditions of ‘rain.’

Given that drizzle was considered dangerous to infants, it was interesting to observe how people reacted when I took my son out in a heavy downpour. One evening I got caught in a downpour with one of my sons in his pushchair, and sought refuge under some tarpaulins on some food stalls in a square outside a church 100 metres from my home. Before reaching the shelter, four people shouted at me to cover his head and not let him get wet. Whilst taking shelter with others under the plastic, a lady took a corner of his shawl and made sure his legs were completely covered whilst everyone stared at me. After twenty minutes, I grew impatient of waiting and decided to make a dash for home. My logic was that in a few seconds the rain would not reach through to my son’s inner layer of clothing so he would not really get wet, and if he did I would just change him as soon as we got home. As I ran, a group of teenage boys taking shelter in a doorway all shouted to me, asking what on earth I was doing taking a baby out in the rain and telling me that the rain was about to stop. As I reached the entrance to the building where I lived, several people sheltering there stared at him in surprise saying, ‘he’s soaked!’ The public outcry resulting from my ‘inappropriate’ thermal care of my son was unequivocal: nobody takes a baby out in the rain!

#### **2.3.3.5 Protection from wind**

Wind was also a source of cold, both as a source of physical coldness as well as a vector of illness that was capable of affecting a child or other vulnerable person. Just as dampness was believed to be almost as dangerous as rain to infants,

so too were very slight air currents looked upon as being almost as dangerous as wind itself. I was expected to protect my sons from even the slightest of air currents that could expose them to a cold ‘golpe de aire’ (blast of wind). I was not allowed to answer the door if I was holding my son, and doors and windows had to be shut if he had a bath. On a bus, a man next to me asked if I wanted the window shut. I said no, to which he replied, ‘no, for the baby.’ He thought the draught from the open window might harm my son and that I might be worried about it. Similarly, at the women’s project on several occasions I needed to go from one building to another to go to the kitchens. I was stopped by several women insisting I should not take him across the ‘pasadita’ (gap) because he would be exposed to a gust of wind and he could get ill. My definition of wind was again different to theirs. In the above situation, they meant currents of air, but in my opinion these currents were hardly detectable, much like the drizzle, and they certainly didn’t warrant stopping me from going outside for a few minutes with my son. The other women said they would prefer that I stayed where I was, and offered to bring me anything I needed since they did not want to put my son at risk from the cold.

**Figure 5 “Maria's waters have just broken.”**



(Wint/UNFPA 2008)

The above photograph shows how the woman in labour has her back covered by a towel to keep her warm, but her companions do not have this extra layer. This is because Guatemalan women in labour, as well as those who have recently given birth, are thought to be vulnerable to cold. This extra layer is added because the

main objective is to protect the woman from respiratory infections to which they believe women in labour are extra vulnerable. Since cold is believed to enter the lungs from the back, keeping the back warm is therefore a priority. A towel in Guatemala is used to provide warmth, whereas in white British culture a towel would not be used for such a purpose because of its association with being damp. The pouch used by indigenous mothers to carry their infants also serves to keep mothers' backs warm, thereby preventing cold air from getting into the mother's lungs and making her ill or affecting her milk.

As most women carried their babies in their arms or in a pouch, my baby-carrier sent from the UK was a source of controversy. One woman working on a supermarket customer service desk I was talking to whilst my son was in the carrier, said that her mother would not allow her to use a carrier for her baby. This was because she had found a front facing baby carrier and the wind would 'hit' the baby in the face and give him a sore throat.

Another example of wind entering the body was when a fellow teacher warned me about holding my son in my arms and swinging him from side to side because wind could get into his head through the fontella and give him flu. Draughts therefore, of any intensity, were a source of cold and illness to an infant from which they needed complete protection. Because of the dangers of wind and draughts, clothing and bedding were not only a source of insulation for the infant but a barrier from cold air that brought illness. Therefore, infants had to be completely covered, including the face, so that air could not enter from any point.

I was told constantly by strangers on buses, in shops, and on the street to cover my son. This always meant he had to be entirely covered up, that his head should be covered, but also not one tiny part of his body could be uncovered. Sometimes men and women, young and old, would alert me that part of his leg or other body part was uncovered, as if I hadn't noticed. If I took no action, some people would cover up the exposed skin for me. Everyone helped to make sure infants stayed covered up.

### **2.3.3.6 Explaining infant illness and discomfort**

Cold was usually considered to be the most likely explanation of an infant's illness or discomfort. A fellow teacher told me that the reason why her three-month-old baby developed a fever was because she bathed her baby at night when she got back from work. There was a similar explanation from a friend who said her baby had a cold again because she had bathed her at night. When my toddler son had a cold, friends, in-laws and others provided various theories about how he must have gotten cold, such as having walked on a cold floor with only socks covering his feet.

Discomfort was first explained by cold exposure. If my son was irritable, not sleeping or sleeping too much, cried or had a runny nose, the immediate explanation was that he was cold. One day I visited a sea level town, where the climate was tropical not temperate like where we lived in Guatemala City and took my son with me. The town had a tropical climate, a strong sun and the temperature was 40°C. In the evening, my son had red cheeks, which I said were due to sunburn. My in-laws disagreed and said he was burnt from the cold coming back to the city. On another occasion when he choked on some milk because he drank it too fast, I was told the milk, being a cold food, had given him a cough. Because of the dangers believed to be involved, exposing an infant to cold food in the city or highlands was avoided. However, because of my differing beliefs, my sons had been, in their view, regularly exposed to the cold. I therefore hoped that I might disprove their theory that the cold causes illness. They explained my sons seeming ability to cope with cold as the result of being different, whereas not all infants would be as able to cope with it.

One day I wanted to go out with my son after it had stopped raining, but my husband's aunt disapproved because she thought I would get sick. My mother-in-law, who was becoming used to my strange behaviour, backed me up saying, "she goes out in all sorts and nothing happens to her . . . And look how healthy the baby is!" If my sons were visibly happy having little clothing on, this was not taken as evidence they did not feel the cold, and I would be told to cover them up because they did not know it would harm them. The local beliefs I encountered invariably

stood strong despite all evidence to the contrary. I had failed, despite so much effort, to change anyone's opinion about how vulnerable infants are to cold.

### **2.3.3.7 Evidence heat is also a concern**

Remembering that humoralist cultures believe heat to be a source of disease as well as cold, I found some reference to the problem of heat in Guatemala City, providing evidence that it was a sense of thermal balance that was valued, despite the overwhelming emphasis on protecting infants from cold. Mothers would not use plastic pants on a cloth nappy because it was thought to make them too hot. As described by one female administrative worker in the school, "it's that some babies are very delicate, they can't take the plastic, and it's too hot for them." When my son had hiccups, my husband's aunt gave him sugar, and she said it was because the sugar was hot and was able to counterbalance the cold in his stomach, which gave him the hiccups. She also wanted me to give my sons a bottle of water every day because she said they get a dry mouth from being 'heated up.' She often commented on how cold water made my son feel better, noting "see, yesterday the water was warmer and he kept scratching his ear from the heat all day. Today I bathed him in colder water and he's not scratching his ear."

My husband's grandmother, who lived in a sea level town with a tropical climate, told me we should get my son used to bathing in cold water because hot water makes your nerve endings rot. My sister-in-law, working in a rural indigenous area, said in Alta Verapaz children are not allowed to see a pregnant woman because she is very hot and her heat could harm the children. They believed this heat could damage the mother and baby. Eating chillies when pregnant was said to cause strawberry birth marks (infantile haemangiomas) because the infant was 'burnt' by the chillies. There was always a great discussion between women regarding what people believed about temperatures and what were actually plausible explanations. In other words, cultural explanations of disease were not always blindly accepted, and the validity of these beliefs was sometimes questioned.

### **2.3.4 Conclusion to thermal care of infants in Guatemala**

Guatemalan beliefs and practices regarding thermal care of infants clearly display humoral influences which hold that both cold and heat cause illness. However, because respiratory diseases take so many infant lives and these deaths are believed to be caused by the cold, protecting infants from cold in Guatemala was a far higher concern than protecting them from heat.

Whilst the lengths to which Guatemalan mothers and society go to completely protect infants from cold, wind and water may seem extreme to someone like me coming from a background characterised by low infant mortality, the context of high infant mortality caused by pneumonia could explain the prevalence of such concerns in Guatemala. In a context in which pneumonia takes the lives of so many infants in a population that has little access to health services, protecting infants from cold is one means of providing protection to infants that is within their control. This protection depends solely on the commitment of the mother, and not on income or medical assistance.

In Guatemala, despite an awareness of the ill-effects of heat, the emphasis seems to be almost entirely on avoiding the ill-effects of cold. Infants are possibly being over-wrapped in the effort to keep out the cold, and it is possible that Guatemalan infants are under-estimating the dangers of heat stress just as the focus on preventing overheating among White British mothers in an attempt to prevent SIDS might be underestimating the dangers of cold stress. Although statistics for SIDS are not available for Guatemala, statistics on gastro-intestinal disease are available, and these data indicate that such illnesses represent a major cause of infant mortality in developing countries (Monnier 2004). Often, the dehydration that results from gastro-intestinal diseases represents the primary contributor to infant mortality. Infants losing sweat in reaction to heat stress could be contributing to the potentially fatal complications of dehydration, but this possibility is being ignored based on an overemphasis on the dangers caused by cold. Human breast milk is adapted to environmental temperatures, and has a higher water content in higher temperatures, thus allowing for water loss through sweat (Sachdev and colleagues 1991). However, if an infant is hot due to clothing while the mother is

lightly dressed, the infant may not receive this extra water and could become dehydrated, especially if suffering from diarrhoea or vomiting.

Mothers feel empowered by protecting their infants from cold, whereas they cannot protect infant lives from other sources of threat. The experience of living in such a hostile social and physical environment, coupled with the relief brought by gaining some measure of control over infant health, may explain the hypervigilance with which infants are provided complete protection from the cold, but not from the heat, by individual mothers as well as the wider community.

I had first interpreted their thermal care practices to be exaggerated and unnecessary, but on understanding their practices more, I believe the practices to be positive and have important value. Instead of succumbing to fatalism, in the face of high levels of respiratory infections that pose real and potentially fatal threats to their infants, the community invests a huge amount of energy into thermal care practices believed to protect infants from these risks. Therefore, these practices allow parents to take a positive and proactive approach to protecting their infants even in the face of many serious threats to infant lives. No matter how poor an individual mother might be, she can nevertheless protect her infant from the fatal forces of cold through simple dressing rules. In this context, then, to do otherwise would represent a failure to take steps to ensure infant survival. This case study shows how much attention can be paid to infant thermal care in an environment which is perceived to be highly threatening.

#### ***2.4 Conclusion to cultural beliefs and practices in thermal care***

Humoral medicine is a major theory of disease and informs several behaviours related to disease prevention globally. Whilst humoral medicine in different cultures can vary slightly, its common themes are the focus on the dichotomies of hot/cold and wet/dry, and an understanding that these elements can cause disease through both physical and metaphorical channels. Coldness is characteristically believed to cause colds, flu and asthma, as well as heat problems of the skin and stomach. Cold air is believed to pass through the body and carry disease. Some people are regarded as having hot or cold constitutions, and so are

more vulnerable to one or the other extremes, but all people are thought to be vulnerable to the effects of heat and cold at certain life stages. Infants, the ill and the elderly, as well as women who are in labour or have recently given birth, are thought to be especially vulnerable to cold, while pregnant women and those who have recently had sex are thought to be vulnerable to heat.

Although Greek humoral medicine enjoyed a high profile among medical practitioners in the 18th and 19th centuries in the UK, it was not adopted to a significant extent among lay people. White British thermal care beliefs have more in common with those prevalent in Nordic countries. Infants' lives are thought to be endangered by heat through SIDS and fever, whereas cold is seen as less harmful and perhaps even beneficial for infants. This cultural emphasis on the ill-effects of heat may have led to a research bias towards investigating the negative effects of heat exclusively. Increasing concern about the harmful effects of heat among the general public have produced more research into the role of heat in infant morbidity and mortality, which can then become a self-fulfilling prophecy as more and more dangers are found.

There has been very little previous work on thermal care beliefs in recent decades. Although the Guatemalan case study provided here involved certain limitations since it was an independent piece of research, it still provides a unique and valuable insight into a culture focused on cold as a perceived cause of the very real threat of pneumonia to Guatemalan infants. Coming from a culture with opposing infant survival priorities which emphasised the importance of protecting infants from heat in order to prevent SIDS, in contrast with the Guatemalan culture which stressed the need to protect infants from cold in order to prevent pneumonia, it was inevitable that our views on such a highly emotive visceral subject would clash. Although this was a daily struggle for me as I was the only one in my environment who held such opposing beliefs, this conflict stimulated an innovative research agenda and ultimately, more than 100 Guatemalans agreed to teach me 'correct' thermal care of infants. Although there are several indigenous and Ladino groups in Guatemala, protecting infants from cold was a unanimously agreed



priority for all Guatemalans due to a common history influenced by humoral beliefs.

Bedding was used as a barrier against these dangerous air currents to shield infants from the dangers of their environment. The indigenous pouch and ladino shawl provided an almost identical internal environment in terms of temperature for the infant, almost simulating the womb with the darkness and being carried close to the mother. The Ladino mothers rejected the appearance of the indigenous pouch because of the low social status of the indigenous communities and the pouch was one of the identities of indigenous women. The Ladino mothers used bedding of Americanised designs and carried infants in their arms, whilst still managing to completely cover the face and provide a closed internal environment protected from the slightest of air currents. Humoral beliefs in Latin America are believed to have existed before the Spanish and Portuguese invaded and brought their own humoral belief system. The indigenous and Latin humoral beliefs were compatible and could even have been reinforced whilst many other beliefs would have clashed.

The strength of their convictions led me to question my own beliefs about whether heat was actually as dangerous to infants as I had supposed. I had assumed I was 'right' that heat was more dangerous to infants and that Guatemalan infants were being put at risk of overheating through having so many layers on in a warm climate. The basis for my assumption was that I believed my beliefs to be based on strong medical evidence generated by my culture, and that in the course of taking on doctoral research into this subject I would find evidence to support my cultural beliefs that heat should be regarded as more dangerous to infants, who are able to cope with more cold than Guatemalans typically believed. Instead, as is characteristic of anthropological inquiry, research on the 'other' revealed as much, if not more, about my own culture. Rather than proving that British thermal care practices are clinically informed, the reverse may in fact be true. The Guatemalan practices, which directly challenge the beliefs held by White British medical practitioners and the general populace, may actually involve benefits to infants. In the same way as medicines have been discovered through traditional healers in

indigenous communities (Elisabetsky and Costas-Campos 1996; Patwardhan 2005), it is possible that traditional infant care practices, especially where based on ancient medical systems, could serve to inform more effective thermal care of infants. The next chapter deals with the clinical evidence regarding infant thermoregulation and the harm caused by heat and cold.

# Chapter 3 Clinical literature on infant thermal care and thermoregulation

“Whoever wishes to investigate medicine properly, should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces for they are not at all alike, but differ much from themselves in regard to their changes. Then the winds, the hot and the cold, especially such as are common to all countries, and then such as are peculiar to each locality”. Hippocrates (c400BC)

## 3.1 Introduction

Sudden infant death syndrome (SIDS) is the leading cause of death of infants aged between one month and one year in the U.K (WHO 2006). However, a SIDS diagnosis is complex because it is by definition a non-specific cause of death.<sup>7</sup> SIDS research is therefore based on identifying risk factors that are more prevalent among infants who died without a known cause of death compared to living infants. Overheating is thought to be one contributory factor towards SIDS (Fleming and colleagues 2006). This chapter provides an overview of the clinical SIDS literature and describes the contribution of thermal stress to SIDS. It also provides background information relating to infant thermoregulation, and describes how it is affected by clothing and bedding.

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<sup>7</sup> One definition of SIDS is “the sudden death of an infant under one year of age which remains unexplained after a thorough case investigation, examination of the death scene, and a review of the clinical history” (McKenna 1996: 203). Another commonly cited definition is “the sudden death of an infant or child which is unexpected by history and in whom a thorough autopsy examination fails to demonstrate an adequate cause of death” ( Blackwell et al. 1995:73)

## ***3.2 SIDS and Infant Mortality***

### **3.2.1 SIDS Overview**

In the past few decades there have been great advances in understanding the risk factors for sudden infant death syndrome (SIDS), which is also commonly known as crib death or cot death, but still very little is understood about its causes. In some countries there has been a vast reduction in SIDS deaths of as much as 90% (Blair and colleagues 2006). This is believed to be the result of widely disseminated advice to place infants to sleep in a supine position instead of placing them prone (Blair and colleagues 2006; McKenna 1996).<sup>8</sup>

Despite widespread adherence to this medical advice, SIDS deaths still occur and the underlying mechanisms remain unclear. Current evidence suggests that SIDS mostly affects infants with specific vulnerabilities who are less able to recover from a combination or succession of physiological challenges to their respiration and internal regulation (Weese-Mayer and colleagues 2007). SIDS tends to occur where abnormalities of the infant's cardiovascular control system fail to monitor some combination of O<sub>2</sub> levels, breathing, heart rate rhythmicity, body temperature and arousal responses needed to initiate breathing after apnoea (McKenna 1996). Deaths are hypothesized to be the result of a combination of factors. In a vulnerable infant, there can be a number of predisposing endogenous factors and which are then affected by an exogenous trigger that lead to SIDS; this scenario is described as the triple-hit or triple-risk hypothesis. The accumulation of risk factors include general vulnerability, age-specific risks, and precipitating factors (Bajanowski and colleagues 2007).

There are a vast number of risk factors associated with SIDS. Heat stress is thought to be one contributory factor and was included in the 'Back to Sleep' campaigns of the 1990's in the UK, raising parents' awareness of the potentially

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<sup>8</sup> The supine sleeping position is on the back and the prone sleeping position is on the stomach.

fatal risks of SIDS in an overheated infant (Blair and colleagues 2006; Esmail and colleagues 1995). Low birth weight (LBW),<sup>9</sup> prematurity, being male, non-supine sleeping positions, genetic risk factors, lack of room sharing, absence of breastfeeding, and exposure to maternal smoking during pregnancy are all considered risk factors for SIDS (Blair and colleagues 2006; Hunt and Hauck 2006; McKenna 1996). However, not all these risk factors operate independently. For example, maternal smoking is a risk factor for both LBW and SIDS, rendering infants exposed to cigarette smoke particularly vulnerable to SIDS (Blair and colleagues 2006).

Researchers continue to test methods for predicting which infants are most vulnerable for SIDS with interventions designed to modify exogenous factors. Recently there has been a focus on genetic factors such as serotonin transporters, the autonomic nervous system, nicotine-metabolizing enzyme, and on the regulation of inflammation, energy production, hypoglycaemia and thermal regulation (Weese-Mayer and Ackerman 2007). However, the research has been hampered by a decreasing number of SIDS cases available to study and a lack of consistency in data collected during autopsies, discrepancies in diagnostic criteria, and lack of standardised definitions (Bajanowski 2007). However, even with higher levels of standardisation of autopsies and diagnosis, identifying ways in which SIDS can be prevented remains a considerable challenge because of the interaction between multiple, subtle physiological abnormalities and several temporary endogenous and exogenous factors (Leiter and Böhm 2007).

### **3.2.2 Infant mortality and context**

SIDS receives a great deal of attention in the UK because it is the main cause of death of infants between the neonatal period and one year of age (World Health Organisation 2006). Yet it is not a primary health concern for infants in a global context. This is because in many other cultural and geographical areas, other causes

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<sup>9</sup> Low Birthweight (LBW) is defined as an infant being born with a weight less than 2500g (UNICEF 2004)

of infant mortality are far more prevalent than SIDS. The main global cause of death in children under five is pneumonia, which kills two million children each year. Other significant causes of infant deaths worldwide include diarrheal diseases, measles, and malaria (Wardlaw and colleagues 2006).

Populations globally are well aware of these other threats to infant survival, especially in areas where rates of infant mortality in the past few generations have been particularly high. These relatively high rates of infant death in some countries may have shaped existing beliefs regarding infant care practices designed to mitigate risks and promote survival. It is logical, then, that for the majority of the world's population culturally-informed patterns of infant care have evolved to focus on preventing the most significant threats to infant health, such as respiratory illness caused by infectious disease. Given the lesser threat posed by SIDS in these contexts, it is also likely that infant care strategies designed to mitigate SIDS risk specifically will be relatively non-existent in all areas where infectious disease continues to overshadow other causes of death in infancy. Given the prevalence of pneumonia in early childhood, and given the fact that less than 20% of children with pneumonia receive the recommended treatment of antibiotics (Wardlaw et al 2006), we would also expect lay strategies to have evolved to protect infants from pneumonia, especially where access to and affordability of health services is lacking.

Global health research too often reflect biases toward examining the health concerns that are relevant in a Western, developed context, regardless of whether these same issues are as relevant or pressing for local populations (Lee and Mills 2000). Since SIDS is such a significant issue for infant health in Western countries, SIDS research has received relatively widespread attention and interest worldwide among health professionals, parents, and researchers. However, it is important to note that although SIDS is the leading cause of death among infants after the neonatal period in the UK, decades ago it was even more common. The decline is correlated with improvements in the general health of populations alongside other causes of infant mortality (Moore, 2005).

### **3.2.3 Does SIDS go undetected in non-Western Countries?**

The extent to which SIDS occurs in low and middle-income countries is extremely difficult to determine. This difficulty is due to the prevalence of multiple causes of morbidity and mortality, especially involving infectious diseases, high rates of infant mortality, and limited resources for systematically recording infant deaths compared to more developed countries. Infectious diseases are more likely to be cited as the cause of death, both because such diseases are indeed so common and because autopsies required to identify alternative causes of death are not widely available. There are further difficulties involved in finding resources for postmortem examinations or accessing reliable statistics.

In the UK, victims of SIDS are often noted to have had respiratory infections on the day of or leading up to the death (Ashild and Torleiv 1999), but autopsies are able to rule out if these infections were the cause of death. Where pneumonia kills thousands of infants and where there are few resources for post-mortem examinations or death-scene investigations, infection is likely to be recorded on a death certificate if the child had an infection at the time of death. SIDS can only be established after an autopsy fails to identify any cause of death. In developing countries, against the 'background' of high infant mortality, other causes of death are much more likely to be recorded (Bergman 2006). However this does not provide evidence that SIDS deaths do not occur in these countries, and there is reason to believe that efforts to prevent SIDS are of potential benefit to infants in these contexts as well as in western countries.

Efforts to address SIDS in developing countries are further complicated by the fact that risk factors derived from research in high-income contexts may not be applicable for other populations. Geib and Nunes (2006) explored risk factors associated with sleeping environments for infants from low-income backgrounds in Brazil, where there is a low incidence of SIDS. They found that infants were exposed to both protective and risk factors at night, suggesting that other factors should be considered in addition to those typically addressed in developed countries, such as the practice of infants sleeping with other children. Conducting autopsies in cases of unexpected infant death where SIDS risk factors may differ

from those typically acknowledged in populations that have been well studied, makes the prospect of identifying a true SIDS case even more problematic. For example, colder months and prone sleeping are considered to be risk factors for SIDS (Douglas 1996), but in Lithuania 60% of SIDS deaths during 1997-2000 were in the warmer months and there was no association with prone sleeping (Bubnaitiene and colleagues 2005). This suggests that the risk factors of most consequence may differ for each population because of differing infant care practices and sleep environments. SIDS is often considered to be a disease of higher income countries, but the difficulties in identifying a SIDS death in non-Western countries, as illustrated by the above example, suggests that it is not possible to conclude that SIDS is not a cause of infant death in other populations.

### **3.2.4 SIDS in the United Kingdom**

Within higher income countries, there is wide variation in SIDS rates between ethnic groups (Fleising 1992; Gantley 1993). For example, Bangladeshi infants in the United Kingdom have a much lower SIDS rate than the white British population (Gantley 1994; Moore 2005). This is remarkable considering that Petersen and Wailoo (1994) found that South Asian infants have, on average, shorter gestations and lower birth weights than other ethnic groups, and that they were more likely than white British infants to sleep in slightly warmer rooms, all of which are associated with SIDS risk. Their study also found that these infants took much longer than white infants to develop adult-like night-time body temperature patterns, which would further render them more medically fragile than white British infants. The researchers note that “in as far as the sample represents the Asian population, therefore, it supports the contention that, if anything their pattern of physiological development should render them more, not less, vulnerable to SIDS” (Petersen and Wailoo 1994: 186).

In Bradford, the SIDS rate of 0.5 per 1000 live births (equating to approximately five SIDS deaths per year) is higher than the national average for the same time period of 1996-2003 (0.4/1000), but the rate among South Asian infants in Bradford, at 0.2 per 1000 infants, is actually 2.5 times *less* than the average for Bradford (Westman 2010). Research carried out amongst Bangladeshi families in



the U.K. found that the constant care and stimulation they provide for their infants may be one explanation for their lower incidence of SIDS (Gantley 1994). Gantley (1994) suggests that the Bangladeshi infants are more likely to experience alternating periods of high and low sensory input, whereas white British infants experience long periods of lone, quiet sleep. This could explain the lower SIDS rates among South Asian infants because these infants potentially receive more support during the night if challenged by the types of respiratory or circulatory stress which can lead to SIDS.

However, because the underlying causes of SIDS are not fully understood, it is not appropriate to assume SIDS is not a concern for all infants, even in low incidence groups. A lower rate of maternal smoking seems to be a recurrent theme in research into explanations for the lower incidence of SIDS in South Asian communities compared to the majority white population (Hilder 1994; Gantley 1993). Other factors considered have included lower rates of binge drinking during pregnancy in South Asian communities, a behaviour which has been implicated in the higher SIDS rates seen among American Indians (Iyasu and colleagues 2002). Also, the sleeping position (Tirosh 2002) and differing incidence of respiratory infections among Black American infants (Spiers and Guntheroth 2001) could explain the higher SIDS rate in this group. Therefore we cannot assume risk factors for SIDS are uniform across all populations, nor are they necessarily identical even among different ethnic groups within a single country. Differing SIDS rates cannot be explained through genetic factors alone, but instead point to a need for more information about the different care practices these infants are exposed to and the different sensory and physical environments they encounter during the sleep period.

During the past 15 years, infants from backgrounds characterised by high socio-economic deprivation have had the highest rates of SIDS. This can partly be explained by the higher rates of maternal smoking, a significant risk factor for SIDS, common among deprived groups (Blair and colleagues 2006).

### ***3.3 Thermoregulation***

Because of the complexity of interaction between intrinsic and extrinsic risk factors, infant thermoregulation has to be explored in detail to understand the mechanism by which thermal stress constitutes a risk factor for SIDS. This section examines the development of thermoregulation in infants, thermal stress, thermal comfort, sleep, and the impact of clothing and bedding on infants.

#### **3.3.1 Thermoregulation**

There are six fundamental environmental variables involved in thermoregulation: air temperature, radiant temperature, humidity, air movement, metabolic heat, and clothing/bedding (Parsons 2003). Body heat is lost through radiation, convection, conduction and evaporation (Lyon 2006). Evaporative heat loss is greater with low humidity levels, low air temperatures, and high rates of airflow. Heat is also lost through evaporation which occurs in the process of breathing. Heat is lost through conduction through body surfaces and by becoming wet. Heat is lost through radiation if the environmental temperature is low. An infant's ability to lose heat through radiation is compromised by being covered by clothing and bedding.

Because of the different exogenous and endogenous factors, individuals in the same external thermal environment may experience differing levels of thermal stress. Parsons (2003) provides an example of this "Collins (1983) considers a skier with a child on his back. At the bottom of the slope the adult was hot and sweating. The child suffered hypothermia. Metabolic heat production in the skiing adult had compensated for heat loss driven by high relative air velocity across the body and low temperatures. The child had been inactive. The adult and the child experienced very different human thermal environments, and hence had very different responses" (Parsons:2003:1).

As mentioned above, the changes in convective, radiant and conductive heat affected by an infant's environment are complex. However, when intrinsic body

changes are also considered, the situation becomes even more complex. The body is not held at a static temperature, but instead functions as a dynamic system.<sup>10</sup> Heat exchange occurs between the surface of the skin and the lungs, and this heat transfer is regulated by the body's thermoregulatory processes. Blood perfusion and rate of blood flow also greatly influence the rate of heat transfer across the surface of the skin. The average insulation of tissue over temperature gradient from core to skin measured at 0.15 clo<sup>11</sup> (approximately the equivalent of the insulation provided by a cotton t-shirt) for vasodilated skin and 0.9 clo (approximately the equivalent of a thin knitted sweater) for vasoconstricted (Burton and Bazett 1936 in Parsons 2003) and 0.16/0.64 (Monteith and Unsworth 1990 in Parsons 2003). But in reality, it is even more complicated.

Both physiological and behavioural systems are involved in thermoregulation, and all operate synchronistically to achieve thermal homeostasis within constantly changing internal and external thermal environments. There are number of proposed system models of human thermoregulation, all of which recognise that if the body gets too hot it causes vasodilatation and if too cold, vasoconstriction and possibly a shivering response. It is also generally believed the control centre for thermoregulation is the hypothalamus. It is important to remember that thermoregulation does not take place in isolation and that thermoregulatory responses may conflict with other needs. For example, while engaging in exercise there is a competition between blood required at the skin surface to enable the body to cool down and blood required by the muscles for supply of oxygen and glucose (Parsons 2003).

When measuring body temperature, both core temperature and shell (peripheral) temperature are considered. Brain and vital organs are generally considered as core, and these tissues are maintained within a narrow range of

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<sup>10</sup> Complex heat transfer between the cells will depend on the thermo physical and physiological properties of the cells. e.g. thermal conductivity; density and specific heat of cells.

<sup>11</sup> A clo is a unit to indicate the thermal insulation of material.

temperature by thermoregulation. Shell temperature is often used to refer to skin temperature, although shell temperature in different parts of the body will vary (Parsons 2003). Measurement of peripheral temperature are not always a good indication of core temperature, so the most accurate way of measuring core temperature is by using a rectal thermometer.

### **3.3.2 Newborn thermoregulation**

Newborn thermoregulation is very different than older children and adults, and even different than infants a few weeks after birth. Neonatal hypothermia is a very real risk in newborns, especially those who are preterm or LBW (Ellis 1996; Ellis 2005; Galligan 2006). A study in India found that fatality was 39.3% in mildly hypothermic babies, 51.6% in moderately hypothermic babies, and 80% in severely hypothermic babies (Mathur and colleagues 2005). The environmental temperature at birth is usually much colder than the uterine environment and thermal stress, alongside other stresses during birth, help stimulate the catecholamine surge necessary for the immediate change from foetal to infant circulation and respiration.<sup>12</sup> All neonates are susceptible to cold, especially on the first postnatal day, and are affected by cold to a much greater extent than older children and adults (Hawdon 2006).

Infants can lose heat rapidly because of their high surface area to body mass ratio, higher skin permeability, and proportionally larger head surface area (Hawdon 2006). The neonate's heat loss is so significant that it may be impossible to create a thermo-neutral environment, and even their white and brown adipose tissue cannot keep them warm enough even when placed skin to skin with the mother. Most full term babies, however, will not become hypothermic if dressed

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<sup>12</sup> A foetus in utero has little need to regulate its body temperature because it is in a fairly stable thermal environment when the mother is well (Hawdon 2006). There has been some research to document the impact of maternal fever on the foetus. Although the results are inconclusive, Hawdon (2006) suggests the potential for adverse outcomes when pregnant women are overheated, including neural tube defects, limb disruptions and ancephaly. These findings have been used to inform the advice for pregnant women to avoid hot baths and saunas (Hawdon 2006).

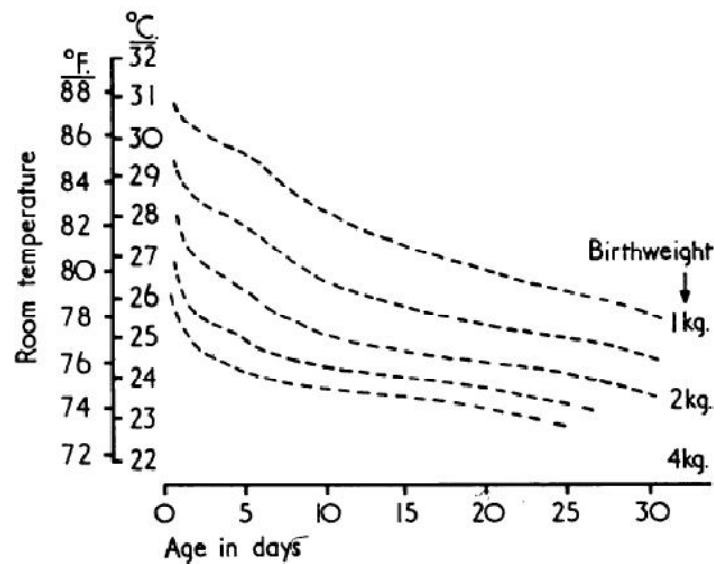
and kept in a warm room (Lyon 2006). If a neonate, even those born in hot countries (World Health Organisation 1997), are unable to generate heat by itself fairly quickly he/she will need external help to keep them warm through clothing, or heating and close body contact, such as that provided when breastfeeding (Charpak et al 2005). Infants with LBW, who are premature or who have conditions such as metabolic problems, postnatal complications (for example neonatal sepsis, hypoglycaemia and respiratory distress) and congenital abnormalities are at greater risk of hypothermia (Hawdon 2006).

Thermal stress in an infant is often defined by a rectal temperature reading that is outside the norm of 37°C (Blatteis 2002). Hey and O'Connell (1970) found, in their study comparing clothed infants in normal cots to those in incubators, that an abnormal body temperature is the result of the infant's thermoregulation being overpowered, and that infants can suffer from thermal stress whilst still maintaining an adequate core body temperature. Hey and Katz (1970) examined infants' temperatures in a metabolic heat chamber, and found that even though infants maintained a core body temperature within the normal range a drop in environmental temperature of 2°C resulted in an increased metabolic rate of more than 25%. They also discovered that infants were more restless in lower temperatures. Although the experimental conditions used in the above studies do not provide evidence on infant thermoregulation in a home setting, such as in a cot or a bed.

The studies nevertheless provide useful information regarding infants' physiological responses to cold stress. This is relevant to infant sleep and competing demands on calories between heat production and growth and the increased respiratory rate may put increased stress on more vulnerable infants. In this context, the efforts undertaken by mothers whose care-giving practices are influenced by humoral beliefs, as described in the previous chapter, may be compatible with clinical evidence on thermal stress. Their strategies to prevent infants from being exposed to even small amounts of thermal stress are congruent with findings on the potential harm thermal stress causes in infants, especially newborns and other vulnerable infants.

Edmund Hey, who conducted much of the research regarding optimum incubator conditions for newborns, studied the environmental temperature providing optimum warmth for infants depending on their weight and age over the first month. The graph below, produced by Hey and Connell (1970) illustrates their conclusion on how age and weight of clothed and wrapped infants relates to the higher the environmental temperature required for the infant to maintain an optimum temperature, albeit under experimental conditions:

**Figure 6 Room temperature required for an infant to achieve optimum warmth according to age and weight**



(Hey and O'Connell:1970:341).

Hey and O'Connell (1970) comment that "it is clear therefore that a room that is intolerably warm for an adult may be unduly cold for a small baby wearing an equivalent amount of clothing, and it is not surprising that many babies become cold when they are picked up out of their cots to be fed" (Hey and O'Connell:1970:341). Judging the adequate environmental temperature for infants based on how the caregiver feels is therefore a highly unreliable method, and the different thermal needs of infants and adults may be more appropriately reconciled by dressing infants in additional layers rather than changing the room temperature.

### 3.3.3 Neonatal hypothermia in global context

Despite assumptions that infants born in warmer countries will not have a problem with cold stress, newborn hypothermia is a major issue in developing countries and it affects neonatal mortality (Ellis 1996; Ellis 2005; Galligan 2006). In Zambia for example, 44% of newborns taken to hospital were hypothermic on admission, and 31% of these infants died. Although not all infants who are admitted with hypothermia and who subsequently die do so as a direct result of the hypothermia, it is nevertheless significant that the mortality risk for hypothermic infants is significantly higher (Mathur et al 2005). Mathur and colleagues (2005) looked at the positive correlation of neonatal mortality rates with increasing severity of hypothermia. They recommended that newborn hypothermia, especially when other conditions exist, should have a much higher category of severity in the WHO classifications.

Neonatal mortality linked to hypothermia is a concern for health campaigns in developing countries. The charity Save the Children have been running a neonatal hypothermia campaign for a number of years in an attempt to save newborn lives by motivating people in the U.S.A. to knit tens of thousands of hats to send to newborns in Malawi. However, people in donor countries have sometimes found it hard to understand why warm hats need to be sent for newborns in 'hot' countries such as Malawi and Bangladesh, when mothers in 'cold' countries are warned against allowing their infants to get too warm (H. Ball 2007, Pers. Comm., 12.4). The WHO (1997) has attempted to address neonatal hypothermia by publishing neonatal hypothermia prevention guidelines, and recommends simple recovery practices such as 'kangaroo care' for pre-term and LBW infants in particular (WHO 2003). Fransson and colleagues (2005) found that healthy newborn infants who were apart from their mothers at an environmental temperature of 23°C had a heat loss close to the maximum they could compensate for through their own heat production, whereas newborns who were kept in physical contact with their mothers did not.

Kumar and Aggarwal (1998), however, stressed that we cannot be over simplistic with prevention recommendations as they cannot necessarily be applied

in all climates at all times of year. In Northern India, they found that 11% of home-delivered newborns in the study hypothermic, but also found that another 22% were *hyperthermic* (body temperatures above the normal range). The infants born in winter were mostly hypothermic, and infants born in summer were more likely to be hyperthermic. The authors stress that “guidelines for thermal control in homebirth should be tailored to the specific environmental situation” (Kumar and Aggarwal 1998:134).

Whilst there is an important emphasis on the dangers of neonatal hypothermia, it cannot be assumed that infants who have a core temperature within the normal range but are subject to thermal stress, even if they are able to maintain adequate core temperatures by clinical standards, are not at risk. As Hey and O’Connell (1970) point out, an abnormal temperature only tells us when the infant’s thermoregulation has been overpowered. Sub-clinical levels of thermal stress can be damaging in several ways, and whilst most healthy infants can cope with the stress, others, such as infants who are vulnerable to SIDS, may be physiologically overwhelmed by thermal stress even before their thermoregulatory systems become overwhelmed. Appendix 3 lists the effect of varying degrees of heat and cold stress, hypothermia and hyperthermia on the human body.

### **3.3.4 Preterm infants and thermal care in hospitals**

Infants born prematurely at 33-37 weeks are even more vulnerable to thermal stress than term newborns (Darnall and colleagues 2006). Premature babies in incubators appear to be less able to cope with increases in temperature than decreases. Simbruner and colleagues (2005) observed more changes in rectal and nasopharyngeal temperatures when the environmental temperature was increased. Infants in the U.K. are also at risk of neonatal hypothermia. The emphasis on preventing overheating possibly leads health professionals to overlook the need to keep infants warm at birth. Temperatures in infant special care units were found on average to be too low, putting premature infants at risk. In 2003, the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) study investigated the quality of care and its effect on the survival of babies born at 27–28 weeks (CESDI 2003). The study documented a general lack of awareness and/or importance placed on the very specific thermal care needs of newborns and premature



infants. Newborns and premature infants are especially vulnerable to thermal stress for several reasons, including their reduced fat reserves, and their higher surface area to body mass ratio. Given a cultural context in which infant thermal care norms emphasise the dangers of overheating, and more fear is associated with the negative effects of heat than cold, this lack of attention to and awareness of neonatal hypothermia is perhaps not surprising.

### **3.3.5 Infant thermoregulation after the first week**

In the first few weeks and months of life, infants need external support to help them cope with temperature challenges as its surface area to body mass ratio drops and until its thermoregulatory response becomes more efficient (Fleming and colleagues 2006).

As an infant develops, its circadian rhythms become more stable, including the regulation of its temperature rhythm, all of which are regulated by an endogenous 'clock' (Holzclaw 2001). Wailoo and colleagues (2003) found that infants from an economically deprived background had a slower postnatal physiological maturation of nighttime temperature rhythms. These differences remained after controlling for the effects of room temperature, clothing, smoking, birthweight and gestational age, but not feeding substance. It is possible that breastfed infants could have benefited from the warmth provided by close physical proximity to the mother, especially if fed regularly through the night.

### **3.3.6 Thermal comfort**

Thermal sensation and thermal comfort are often ignored when considering the impact of heat and cold on the body. Yet these sensory experiences can cause distress in some infants even if they are not suffering significant thermal stress. The same environmental conditions may feel very different to each individual, not just because of different metabolic rates and physiological responses but because of how that thermal experience is perceived by the individual. Thermoreception is derived from a sensory experience and therefore cannot be based solely on physics or physiology. Physical or physiological methods cannot therefore predict perceived thermal comfort (Parsons 2003).

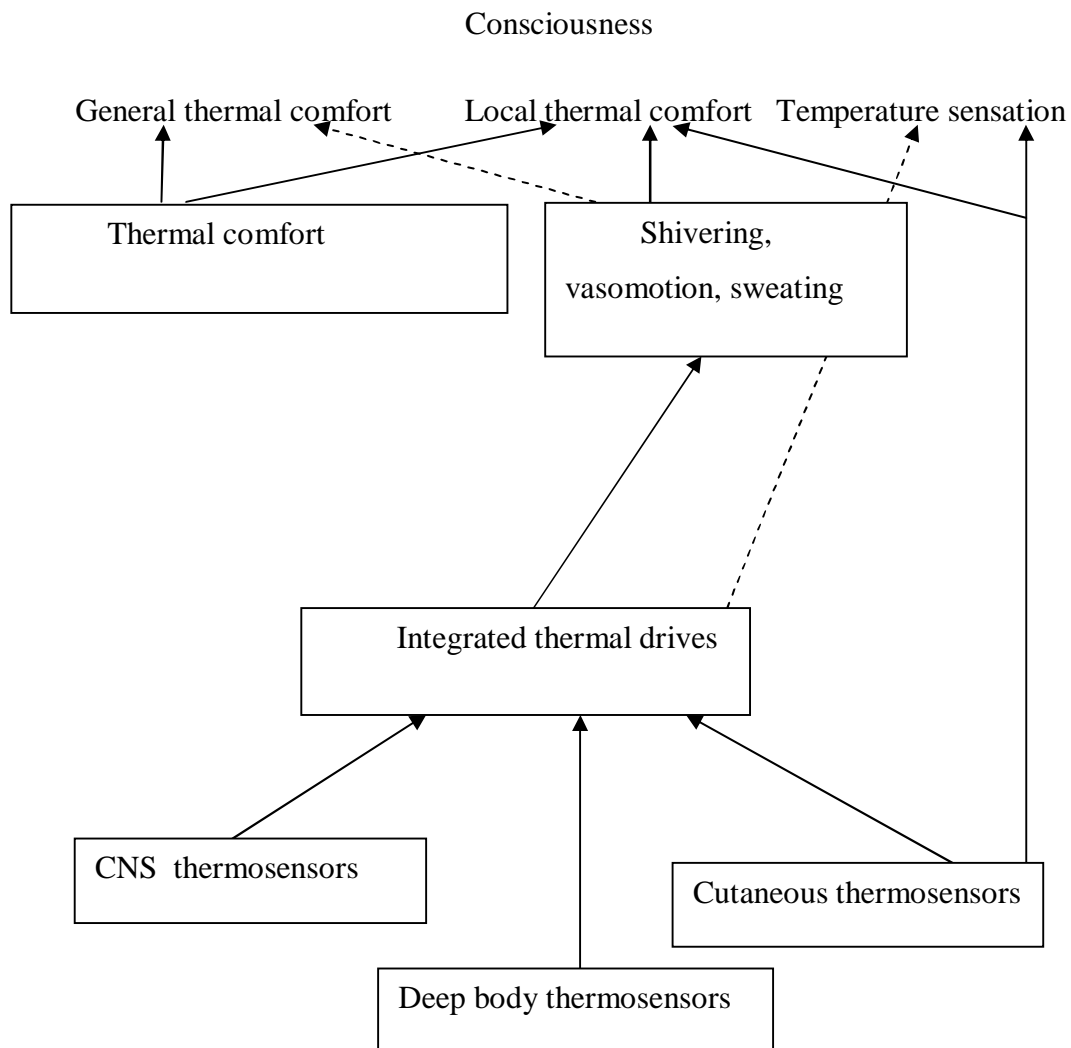
Thermoreception, in humans of any age, is influenced by both physiological and psychological factors. It is generally accepted that there are no specialised thermoreceptors in the skin, but there are nerve endings that respond to hot and cold. There are generally more cold receptors than there are warm receptors. The rate of firing of the receptors depends on the 'static' temperature and rate of change (Parsons 2003). Hensel (1981, in Parsons 2003) suggests the following continuum of sensation conditions: painful (cold); icy; cold; cool; neutral or indifferent; lukewarm; warm; hot; painful (hot). In addition, different areas of the skin have different amounts of cold or warm spots. The lips, dorsal finger, nose, face, chest, abdomen, and back of the hand have numerous cold areas, whereas the face and fingers have relatively more hot sensitive areas than other parts of the body but still less than all cold sensitive areas.

However, there is no simple relationship between temperature, rate of firing, and possible sensation of a thermoreceptor. The body 'feels' the state of the thermoreceptors rather than the actual physical environment. It is now generally accepted that cold sensation depends on mean skin temperature, and warm sensation initially depends on mean skin temperature and then on deep body temperature. Warmth discomfort is also influenced by the level of wetness of the skin (Parsons 2003). These findings only hold under 'typical' conditions however, and may not accurately capture sensations experienced in the full range of environmental conditions in which infants may find themselves.

Thermal pleasure occurs when we are too cold and then warm up, or when we are too hot and then cool down. Hence, a cool infant picked up and held near its mother in the parental bed may feel thermal pleasure. Cabanac (1981, in Parsons 2003) suggests thermal pleasure functions as the motivation for certain behaviours, such as an infant crying to be held, which has the result of restoring thermal neutrality. Different types of heat transfer may provide different sensations, such as radiant heat versus convective heat. Radiant heat from another human body, a log fire, or the sun on a cool day may feel more comforting than heat from a convection radiator. Thermal stress or perceived levels of thermal comfort undoubtedly affect infant behaviour. If infants are not experiencing thermal

comfort they will express their discomfort through crying, not sleeping, and not settling. However, as these behaviours could be interpreted as other forms of discomfort such as hunger, pain, or feeling alone, it is possible that thermal discomfort is often not identified. The figure below demonstrates the complex relationship between temperature sensation, thermal comfort and temperature regulation.

**Figure 7 Physiological conditions for temperature sensation, thermal comfort and temperature regulation**



From Parsons 2003: 69

The above diagram shows how thermal comfort felt by an individual is determined by several sensory experiences that interact with physiological processes. The interaction ultimately affects the level of thermal comfort felt by each individual.

Thermal conditions will directly affect thermal sensation and comfort, and can also influence a person's mood and behaviour. There has been much debate about how climate and thermal conditions affect behaviour. Lynn (1991, in Parsons 2003) suggests that climatic factors influence anxiety, which in turn affects rates of suicide, psychosis, alcoholism and calorie intake. Parsons (2003) lists the psychological changes associated with thermal stress. Someone who is too cold may be affected in terms of arousal and perception, and may experience a mood change. Therefore, thermal conditions must be taken into account when understanding infant behaviour also.

### **3.3.7 Thermoregulation and comfort applied to sleep**

As most SIDS deaths occur during the nighttime (Mehanni, 2000), it is important to understand the interaction between thermoregulation, thermal comfort and infant sleep. Research into infant thermoregulation has focused on body temperatures rather than infant thermal comfort. This represents a meaningful gap in the existing literature, as an infant's expression of thermal discomfort might be equally relevant to understanding thermal regulation and/or the aetiology of SIDS. Since infant behaviour affects how caregivers respond to infants, by making the infant cooler or warmer to soothe and calm the infant for instance, especially at night when caregivers are motivated to appease infants in order to preserve their own sleep could be a more important driver of how much bedding and clothing is used than the actual body temperature of the infant.

Given the paucity of research on infant thermal comfort, existing research on thermal comfort in adults can provide some points for consideration. Sleepiness in adults can be induced by the thermoregulatory system by increasing the core/shell temperature ratio. In other words, the thermoregulatory system acts to increase peripheral temperature and lower blood pressure in order to aid sleep (Kräuchi

2007). Infants develop adult-like thermoregulation at different rates. We should therefore treat the thermal care needs of infants and young children as different to older children and adults, and we should consider them at greater risk to cold stress than heat stress, although both can potentially render an infant at risk. It is again important to note that the maintenance of adequate core and peripheral body temperatures do not mean that infants are not experiencing internal thermal challenges.

It is difficult to determine what insulation and heating is required during the night because when a person first goes to sleep, his/her metabolic rate may be higher than when he/she actually falls asleep. Thus, upon retiring to bed an individual still has heat not yet lost from activities engaged in prior to sleep. During the night, environmental temperatures in most climates show marked changes, and the minimum environmental temperature typically occurs between 3:00 and 4:00 a.m. (Goldman and Kampman 2007). This coincides with the lowest drop in body temperature for adults Fleming and colleagues (2006) found that the lowest rectal temperature for infants occurred three to four hours after falling asleep. However, the ambient temperature after three to four hours will vary greatly for the infant depending on if the infant was put down to sleep in the early evening or closer to midnight, which largely depends on cultural beliefs and normative practices regarding the timing of infant sleep. During the wintertime, late sleeping infants in the UK might be at greater risk of getting cold at night if their minimum body temperature coincides with the lowest air temperature during the night. Therefore, infants with a late bedtime may have different clothing and bedding requirements than early sleeping infants.

One of the things that can trigger night-time waking is a part of the skin being suddenly exposed to cold as result of body movement during sleep. Goldman and Kampman (2007) demonstrated how different levels of thermal discomfort woke people up at different rates during the night, and found that the temperature necessary to induce an arousal from sleep was lower than the temperature that prevented people from initially falling asleep (see Appendix 4). Therefore, more bedding or clothing is needed to help a cold infant go back to sleep than is needed

to keep an infant asleep. A caregiver who has noticed their sleeping infant is cold and needs extra bedding or clothing to keep them from waking up may therefore need to invest less time, and provide less insulation, than if the infant wakes up and needs more bedding and clothing to help them return to sleep.

### **3.3.8 The thermal environment for the sleeping infant**

SIDS prevention advice in the UK often warns against infants wearing hats in bed (Foundation for the Study of Infant Deaths 2009b). Goldman and Kampman (2007) documented the mechanism whereby heat loss from the head differs from the rest of the body. There is a high blood flow to the scalp and brain, which is independent of thermal state. A hot head might not trigger the normal physiological responses to lower the body temperature. Heat loss from the head also varies according to the environmental temperature. Goldman and Kampman (2007) found that the heat loss from an adult head represents about 25% of total body non-evaporative heat losses at 20°C, 40% at 10°C; 50% at 0°C, and 80% at -20°C. Infants have proportionally larger heads than adults or an older child, which means that in a room with a temperature less than 10°C, an infant without a hat would lose a substantial amount of heat from the head. Therefore, contrary to SIDS prevention advice, wearing a hat, especially in cold temperatures, may not as be harmful as feared. It may actually be necessary in cold conditions to prevent the infant from getting too cold. Cold is discussed in sections 3.3.13.3 and 3.4.9 as a potential risk factor for SIDS, along with risk of hypothermia, poor sleep and infections. It is paradoxical that hats are thought to endanger infants lives in the UK yet save infant lives in Malawi and Bangladesh. This discrepancy is an indication of the degree of focus on overheating as a risk factor for SIDS in the UK, which is emphasised to the exclusion of harmful effects of cold on infants.

When we apply all the above information to the thermal care of infants we can see that not only are there multiple variables affecting thermoregulation including changes in environmental conditions, differences in individual vulnerability to thermal stress, and changing responses of each individual

depending on factors such as activity, sleep state, and illness, but also that consideration must be given to differences in thermal sensation and comfort. One infant with freezing cold hands may feel extreme thermal discomfort and another no discomfort at all. 'One-size-fits-all' for thermal care of infants is inappropriate, since individual needs and responses are more important than measuring body temperatures alone. This partly explains some of the conflicting advice given by health professionals relating to thermal care and individual practice. Infants may express thermal comfort or discomfort not only through physiological signs, such as skin temperature or colour, but also through behavioural cues. Thermal discomfort is expressed through lack of sleep, irritability, crying, attempting to remove clothing/bedding, or objecting to clothing/bedding being added.

As Goldman and Kampman (2007) considers, infants are often observed to display positional changes in reaction to heat stress. An infant might lie flat on its back with its arms outstretched in order to lose heat, and might curl up into the foetal position to reduce its body surface area and conserve heat. As infants have such high mass to body surface area ratios, the strategy of reducing body surface area by curling up may be a very important one particularly for infants. This behaviour is inhibited for swaddled infants. It is not clear whether this is ever a consideration when attempting to prevent or treat hypothermia in newborns, despite its apparent importance. These two reflexes may be helped or hindered by parents in infants who are too young to roll over by themselves. By placing an infant in a prone position, it would presumably have difficulty putting its arms out wide, especially if sleeping on all or part of its arms. This restricted ability to change body position or alter body posture is rarely considered as one of the reasons that prone sleeping infants are more at risk of overheating. However, an infant placed in a prone or supine position who cannot roll over independently will have trouble getting into the foetal position to conserve heat, and may be at risk of getting too cold in cold environments. Some mothers insist their babies prefer the non-recommended sleep position of sleeping on the side. The ability to change body posture in order to lose or conserve heat may be one reason for this preference, especially where the infant is too cold to fall asleep.

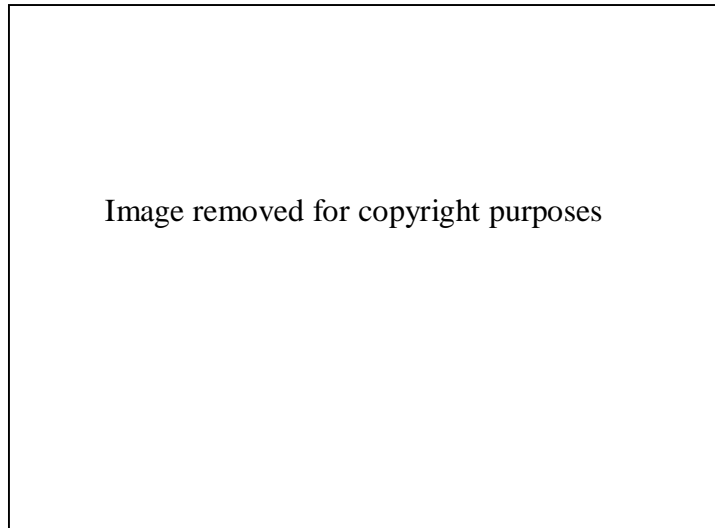
Although considering ways to create appropriate thermal conditions for an infant's microenvironment is necessary, considering the complexity of judging the thermal needs of each infant we cannot rely solely on creating a single, standardized 'appropriate' thermal environment for all infants. Mothers also need to respond to the behavioural cues given by their infants in expressing thermal comfort or discomfort. Where there is a heavy reliance on official recommendations for clothing/bedding/room temperature (Foundation for the Study of Infant Deaths 2009b), these cues may be missed or misinterpreted because there is an assumption that the one-size-fits-all approach will automatically ensure thermal comfort in all contexts and automatically will removal thermal risk.

The emphasis in the UK on overheating as a risk factor for SIDS over the past two decades may have contributed to an underappreciate of the negative effects of cold stress among mothers. Missing cues of cold stress can be detrimental to the infant in many ways, in addition to potentially increasing SIDS risk. For example, a baby that consistently refuses to settle at night may be judged to be a difficult sleeper when in fact he or she might simply be too cold to sleep and may be expressing a need for warmth. However, if there is too great a reliance on the 'prescribed' thermal care practices, the issue of thermal discomfort may not be recognised and other reasons for irritability may be explored instead, such as the baby being ill, hungry or just 'fussy.' In terms of preventing SIDS, thermal stress, from either excessive heat or cold, may increase SIDS risk among some vulnerable infants. Therefore, the ability to recognise and respond to individual cues regarding thermal discomfort is clinically significant.

The illustration below is taken from Foundation for the Study of Infant Deaths SIDS prevention literature designed for parents. Foundation for the Study of Infant Deaths is the leading SIDS prevention charity in the UK and is relied on by parents and health professionals to provide evidence-based advice on the prevention of SIDS. Their literature and advice occasionally advises parents not to let infants get cold, but the overriding theme is a focus on the dangers of overheating. The above illustration demonstrates their emphasis on the dangers excessive heat for infants



**Figure 8 Illustration from Foundation for the Study of Infant Deaths  
SIDS prevention literature emphasizing the dangers of an infant getting  
too hot**



(Foundation for the Study of Infant Deaths 2009a)

### **3.3.9 Our understanding of the impact of clothing and bedding on the infant**

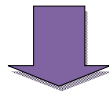
To understand what thermal effect various materials may have on the human body, and to compare the use of insulative materials between groups, it is first necessary to know the thermal insulation value of different items of clothing and bedding. Thermal insulation ( $I$ ) of a material is defined as the “resistance to dry heat loss between two surfaces, expressed in square metres Kelvin per watt ( $\text{m}^2\text{KW}^{-1}$ )” (British Standards Institute:2007). Insulation is usually expressed as clo or tog (British Standards Institute: 2007) where 1 clo or 1 tog =  $0.155 \text{ m}^2\text{KW}^{-1}$ . Widely used though this measure is, it is not a true indication of the thermal effect of the material on the body. Although the tog value is widely used because of its simplicity, it is important to remember the complexities that may make these values much less reliable than they appear. We also have to consider the outer area factor, air layer insulation factors, vapour pressure resistance, influence of body and air

movement, and the other factors mentioned in appendix 5. On the other hand, it is often not practical to include all these variables and at some point we have to choose the best method within the means of the study and declare potential inadequacies.

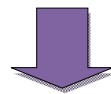
Fan (2006) and Parsons (2003) explain the different levels of thermal modelling and when each method is the most appropriate to use.

### **Figure 9 Five levels of thermal modeling**

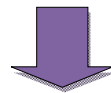
**Level 1** A physical analysis of the material, such as using a hot plate. This is the method used to give insulation values (togs) for materials, such as infant sleeping bags.



**Level 2** Biophysical analysis, taking into account different temperatures of different parts of the skin, sweating etc. Thermal manikins can be used at this level.



**Level 3** Human physiological analysis, where human subjects are studied under controlled conditions. Fan (2006) argues that this kind of analysis is not likely to be useful unless level 2 modeling has been done to select appropriate exposure duration, environmental conditions, work rate, etc.



**Level 4** Controlled field trials in real conditions, and if any surprises come of this modelling it should go back to level 3 for further study.



**Level 5** User trials on a large scale. These are time consuming and expensive and may need levels 3 and 4 to precede them.

The above model demonstrates the complexity involved in calculating the thermal effects of clothing. Most studies fall into level 1, where insulation values of materials using hot plates are the only values used. My research, for example, can only practically work at level one, which only considers the insulation values of materials used. So how can we make the use of a level 1 method the most accurate or useful possible?

### **3.3.10 Summation of individual insulation values of garments vs. ensemble values**

Although tog values appear to be relatively simple to obtain and apply, even having obtained data on number and kind of bedding and clothing, there are still different ways of deriving the results and the values calculated may turn out to be vastly different. The effect of air insulation between layers is something that can have a significant impact on differences in total insulation values of an ensemble of clothing (British Standards Institute 2007). Research using thermal manikins attempt to make the most realistic thermal reconstruction of the human body available, and has shown that the differences in results using summation of insulation values of individual garments is vastly different to measuring the insulation values of ensembles of different clothing variations (British Standards Institute 2007), and that the huge differences are probably due to the air insulation values not accounted for when simply summing the values of each clothing item. In appendix 6 I have illustrated the different results obtained by the different methods using two examples, one adding up individual insulation values for garments and the other measuring the insulation value of all the garments together, the ensemble method. It can be seen that by measuring the latter, the insulation value is higher due to the trapped air between the layers, and this value is likely closer to the real life effect of the materials on the infant.

The significant insulating properties of trapped air has been widely accepted for many years, and is what insulation design of materials is based upon. This factor is actually considered to be more significant in assessing the insulation value than the material itself, although the material can have properties that allow for air to be trapped (Fan 2006). In fact we should not be tempted to focus on the visible

and obvious – the clothing and bedding items, but on the invisible pockets of air.<sup>13</sup> The British Standard document on infant sleeping bag also recognises the significance of air for insulation: “The thermal resistance of a quilt or duvet will depend upon many inter-related factors but is essentially related to the amount of still air which can be trapped within a quilted product’ (British Standards Institute:2009:25)”. Therefore the summation method cannot be used for an accurate estimation of the thermal effect of the material on the infant, although it might still be useful for comparison purposes.

### **3.3.11 Calculating the body surface area of infants**

To use insulation values, we still have the problem of knowing how much of the body is covered by the material in question. Therefore, we need to know something about the infant’s body surface area. By knowing the tog value of that material, another value can be derived: the *contributed tog value*. For example, where a material has an insulation value of 1.0 and it covers 75% of the body, the contributed tog value would be 0.75 (Fleming and colleagues 2006). This allows us to understand the thermal contribution of a particular garment, for example.

Contributed tog value is a popular method used in infant clothing and bedding research. Unfortunately, estimating the surface area of infants is no more straight-forward than measuring insulation values. I began to attempt my own estimates for body surface areas of different parts of the body for infants of different months of age, using data from the British Standard on body measurements for infants aged 0 years; 0.25 years; 0.5 years; 0.75 years; and 1 year (British Standards Institute 1990). What is quite noticeable on the diagram is that the trunk stays almost the same in proportion to other body parts over the first year, but the

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<sup>13</sup> It is important to account for the insulation value of trapped air in materials. Indeed, “studies on the heated guarded flat plate apparatus in heavy use to measure the insulation properties of new materials has shown that clothing insulation was a linear function of the increasing circumference of the layers of clothing, and the air trapped between them, with practically negligible factors from any aspect of the materials or their fibres except their thickness” (Fan 2006:11).

head gets relatively smaller and the legs relatively longer over the year. Changing body proportions in the first year makes calculating infant body surface even more complicated and difficult to apply to a sample with an age ranging from newborn to a year old.

An accurate calculation of body surface area based on these data was beyond the scope of the present study. Ahn and Gamito (2008) describe several methods used to make this calculation, however, such as geometric, water displacement, 3-D scanning, and air displacement plethysmography. Most of these methods are not practical for most instances in which a calculation of body surface areas is required, such as on burn units. Ahn and Gamito (2008) found that none of the several formulas used to calculate body surface area are totally reliable, and are often produced from adult subjects so a reliable formula for calculating infant body surface area is greatly needed. For example, a ‘rule of nines’ is commonly used to calculate an adults’ body surface area. This holds that the arm equates to 9% of total body surface area, the leg equals 18%, the anterior trunk equals 18%, the posterior trunk equals 18%, the head equals 9%, and the perineal area equals 1%. Because a child’s head occupies a much greater proportion of the total body surface area, they recommend a ‘rule of eights’ for children. However the methods advocated by Ahn and Gamito (2008) may not be accurate. There have been several studies on infant body surface area which have produced discrepant figures and which resulted in the classification of the body into different sections making the studies impossible to compare. Appendix 7 documents the different calculations for body surface area. Studies are limited, and few have calculated similar proportions which makes it difficult to know which data are reliable.

One problem of comparing the studies involves the names of the body sections. None of the documents give illustrations to clarify the names of the various body parts used by showing exactly how much of the body was included in each section. For example, in some sources the term ‘legs’ seem to refer only to the lower leg, and not the whole leg as in some sources. The second problem is that the parts of the body chosen are different from one study to the next. Only feet, hands, legs, and thighs have values reported in all of the studies. There was one source I

did not include in the above table because percentage of the body covered by items of clothing, which are even less comparable with the body parts data (P Blair 2007, pers. comm., 26.11). The third problem is that the ages are all different, again making the data difficult to compare. We know that body proportions change between the newborn period and adulthood, but even accounting for this change the variation in values appears to be excessive. For example, various sources report widely differing figures for the proportion of body surface area accounted for by the head.

Lund and Browder (in Boniol et al:2007) state that the head accounts for 19% of body surface area in newborns, Bonoil and colleagues (2007) argue that the head accounts for 8.4% of a body surface in a two year-old, and Livingston and Lee (1999) say the head accounts for 2.7% of the body surface area of an adult. These values are too variable to all be accurate, so we may have to exclude all or some of the studies from our comparison, leaving little or no reliable data. If finding the body surface area is fraught with difficulties, so too are attempts to calculate the surface area of clothing, since each layer of clothing has a different surface area which is further affected the thickness and looseness of each layer. Knowing the surface area of the outer layer is considered important because it is an indication of contact with external conditions in the micro-environment (Parsons 2003). However even if we obtained accurate values for the contributed tog values this does not take into account the different degrees of heat loss from different parts of the body. It is used to express a uniform insulation across the whole body (British Standards Institute 2007) and therefore cannot give us the full picture of the thermal impact of the material on the infant's body.

### **3.3.12 Methods used in thermal care studies of infants**

The most important lesson that emerges from looking at the methods involved in measuring insulation values of infant clothing and bedding is that its complexity cannot be underestimated. Whatever method is used to determine an insulation value must be made explicit, along with an acknowledgment of the associated methodological limitations. Previous studies (Fleming and colleagues 2006; Ponsonby and colleagues 1992b; Williams and colleagues 1996) on infant

insulation have used values uncritically and whilst no method will be perfect, neither should we rely too heavily on values obtained through these imperfect methods. Unfortunately, however, this seems to be the case in regard to infant sleeping bags where values have been produced and relied upon uncritically. The British Standard for infant sleeping bags requires manufacturers to display which tog sleeping bag is appropriate for which room temperature and requires this information to be displayed on the packaging. Some manufacturers have supplemented this information by suggesting what clothing would also be appropriate to use with their bags at given temperatures. However, the mere existence of a British standard (British Standards Institute 2009) governing how to calculate and display tog values for such an item gives consumers a false sense of security. It glosses over the many flaws that could have occurred in calculating the recommended tog rating, and fails to account for the errors that manufacturers routinely make when testing the insulation values of their own materials. It also glosses over the numerous physiological and environmental factors that can affect infant temperature, resulting in a consumer product that could have considerably variable effects on individual infants.

Unfortunately, the few studies that provide insulation values for infant clothing have used the summation method, and ensemble values for infant clothing are extremely rare. To my knowledge, no ensemble values exist for infants or adults that includes combinations of bedding as well as clothing. As all existing studies used the simple summation method, it is therefore necessary to assume that the true values will be much higher because of the missing air insulation values. This fact calls for a reinterpretation of the results of these studies, especially where the studies are trying to ascertain if infants have the appropriate amount of insulation on them and dictate how much insulation is and is not safe.

For example, Fleming and colleagues (2006) have reproduced recommended tog values for infants at night and then superimposed their own results of tog values of bedding and clothing used at night by parents in their own sample. They concluded that 95% of the mothers kept within the recommended values for different environmental temperatures. However, given that a summation of clothing

and bedding insulation values were used, it is certainly possible that the true tog values used by the parents were all higher than assumed because the insulation of trapped air was not accounted for. If the trapped air insulation values were added, many of the infants would actually have been dressed in much greater amounts of clothing and bedding than recommended by researchers such as Wigfield and colleagues (1993). However, even if they were in more togs than recommended, the infants in Fleming's study were still able to thermoregulate effectively. This could mean that the current recommended safe tog values for infants at night, which factor into the numerous warnings about the dangers of adult duvets and/or the appropriate tog values of infant sleeping bags, may be lower than necessary. If so, it is also possible that, as a result, some infants are not being adequately insulated at night.

Fleming and colleagues (2006) show that the requirement of togs for 3 month olds at 15°C-25°C, with maximum tog for 20°C being 4 (for the coldest babies). A vest and babygro they say is 1.2 togs and a thin baby duvet being 2-4 togs. A younger baby, in the winter in a room alone with no heating, dressed in just a vest and babygro, would then be underdressed and probably have to resort to burning adipose tissue to produce heat, and vasoconstrict<sup>14</sup> to conserve heat. The baby might not actually have an inadequate core or peripheral temperature because it may produce and conserve its own heat. Yet what are the effects of the cold stress on the infant's metabolism, breathing etc. if he/she already has a delayed maturation of thermoregulation? Would there be a higher level of vulnerability because of some prenatal insult or it had an underlying condition that produced subtle complications in its metabolism? Are there some infants who, once they have warmed themselves up, are too slow in stopping burning their adipose tissue? Is that why some SIDS babies still feel hot when they are found some time after their death? Below are some examples of insulation values cited for different items

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<sup>14</sup> Vasoconstriction is when the blood vessels near the skin contract to restrict blood flow to that area of the body. This results in less heat being lost from the blood to the environment and so conserves body heat.



of infant clothing. The last column shows values for the same item for adults just as a comparison.

**Table 2 Comparison of tog values for a selection of clothing items from three sources (fabric insulation values only, not the contributed tog value).**

Clothing item	Source: British Standards Institute:2007 (adult clothing) (tog)	SWISS study (P Blair 2007, pers. comm., 26.11) (tog)	Watson et al (1997) (tog)
Babygro - cotton		1.0	0.7
Babygro – fleece [sleeping suit SWISS]	1.12	4.0	
Cardigan – light	0.4	1.0	
Dressing gown	0.64	2.0	
Socks	0.03	0.2	
T-shirt	0.12	0.8	

Note: The International standards source was for adult clothing, so values for the most similar clothing were used where possible. For example, an adult ‘sleepsuit’ was the most similar to a babygro.

More values for clothing from these sources are in Appendix 8

As illustrated by the above comparison, few studies report the air insulation values, and the values given for individual items of clothing either vary significantly or are missing. Thus, none of the studies are directly comparable to one another. The lack of comparability also occurs because a wide variety of materials are used for testing. This makes it extremely difficult to compare the insulation values for items of clothing from one study to the next. When it comes to actually using the garment, how loosely or tightly fitting it is on the infant will also

affect the thermal effect of the garment because of differing amounts of insulating, trapped air. The measurement of insulation values of clothing and bedding for humans is a field in its own right, a sub-field of ergonomics. The problem has possibly been that the researchers interested in the effects of infant clothing, particularly on SIDS, have perhaps underestimated the complexity of this field, and a field that is still developing more accurate methods of measuring the insulative effects of materials on the human body.

We can see from the five levels of calculating thermal properties, developed by Fan (2006) and Parsons (2007) and described above, that most infant clothing insulation studies which have used the summation method have only involved the first level. This falls far short of the Level 5 user trials that would better represent what actually occurs under real conditions on a large scale, a standard we would expect for clinical research of a topic surrounding the survival of vulnerable infants. If we use the results of limited work done on adult insulation values for ensembles, we still are limited in assessing the true impact of insulation on an infant's body. Due to the above mentioned limitations there is yet no reliable method worthy of replication, and questions what the best method is to use to calculate the insulation values for this study.

### **3.3.13 Fever, warmth and infection**

Fever affects human thermoregulatory systems, and thus thermal care needs may be different for infants because of their immature thermoregulation, different circadian rhythms, response to fever and body surface to volume ratios. Beliefs regarding the harm and benefit caused by fever, among both health professionals and among different cultural groups, have been discussed in the previous chapter. This section explores the evidence regarding benefits or harm from fever.

#### **3.3.13.1 Fever phobia**

In 2007 the National Institute for Health and Clinical Excellence (NICE) assessed evidence for the costs and benefits of anti-pyretics. They recommended that all infants 0-3 months with a temperature of more than 38°C should receive urgent medical attention. Given that normal body temperature is considered to be

37°C (Blatteis 2002), a reading of 38°C could easily be a result of instrument error and not a true indication of fever. One of the perceived risks of fever is seizures. Mukherjee and Mukherjee (2002) point out that not all young children are at risk of fever-induced seizures. They note that the young children most at risk are those with a family member with a history of infant febrile convulsions, those who have been in a neonatal nursery for more than 30 days, those with developmental delays, or those who are placed in day care. They also claim that there is a significant genetic component which determines susceptibility, and argue that not all infants will experience fits or seizures with high fever. In addition there are also risks involved with the use of anti-pyretic drugs such as paracetamol and aspirin. There is some evidence that use of paracetamol after first vaccinations for haemophilus influenza, diphtheria, tetanus, and pertussis weakens the immune response to these vaccinations by causing a significantly weaker antibody response (Mackowiak 1994).

### **3.3.13.2 Benefits of fever to the infant**

Some of the arguments against the administration of anti-pyretics focus on the benefits of fever, and suggest that fever is an adaptation of vertebrates and some invertebrates that has contributed to defence against pathogens for millions of years (Kluger 1986; Soszynski 2003). Several authors have considered the adaptive value of fever and observed how fever has been associated with decreased incidence of mortality and morbidity (Blatteis 2002; Hasday 2000; Herman 1997; Kluger 1986; Kluger and colleagues 1996; Romanovsky and Szekely 1998; Soszynski 2003). Romanovsky and Szekely (1998) looked at the benefits of fever versus hypothermia, and suggested that fever may be beneficial if the body has sufficient energy resources, but noted that hypothermia is an alternative strategy to conserve energy and protect vital organs.

The most common explanation for the benefit of fever is that the increased body temperature itself may kill the pathogen. The association between increased body temperatures and healing was noted hundreds of years ago, with malaria being given as a remedy for syphilis (Blackwell 2007 pers. comm. 26.10). The value of temperature to kill certain pathogens have been established for optimum

temperature in vitro,<sup>15</sup> but such values are hard to find in real body conditions because the chemical and thermal environment in the body is never constant. It is useful to know that tuberculosis, rhinovirus, and influenza thrive just below the normal body temperature of 37°C (Blatteis 2002), lending support to the cultural belief that “getting cold gives you a cold”. However, because of the different optimum temperatures preferred by different pathogens, Blatteis (2002) has suggested that keeping warm cannot kill off all pathogens, and in some cases increased temperature might provide optimum conditions for other pathogens. The implications of different temperatures at various sites in the body when they are invaded by pathogens must also be considered. For example, the nasal passages are cooler than the core body temperature. This temperature difference helps explain why respiratory pathogens thrive at a lower temperature than the core body temperature, and also explains why tuberculosis invades the internal organs because of its preference for a higher optimum temperature ( Blackwell 2007, pers comm. 26.10).

The most significant explanation for why fever, or keeping the body warm, might be advantageous in fighting off pathogens is that increased body temperature makes the immune system more active and efficient (Blatteis 2002; Kluger 1986; Mackowiak 1994; Padopoulos and colleagues 1999; Rodriguez and colleagues 2006). Qing and colleagues (2006) explain in greater detail why the immune system might be stimulated at higher body temperatures. They found evidence that lymphocytes were transported more efficiently at higher temperatures due to a thermally sensitive alert system depending on the thermal stress experienced. Van den Brink (2002) also found, when considering the old adage “feed a cold, starve a

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<sup>15</sup> Optimum temperatures for pathogens are as follows (Blatteis:2002:6) – *Bacterial*: 31-32°C Leprosy; 33-35°C Syphilis; 36-37°C Tuberculosis; 38-39°C Meningitis and typhoid. *Fungal*: 25°C Mycelial; 31°C Dermamptophytoses; 32°C Candidiasis; 38°C Yeast, Rickettsia; 37°C Typhus; 38°C Q fever. *Viral*: 29°C plantar warts; 33-34°C Variola, rhinovirus, varicella-zoster; 36°C Influenza; 37°C hepatitis; 38°C Rabies, poliomyelitis. *Parasitic*: 33°C Leishmaniasis (mucocutaneous); 36°C Falicparum malaria; 37°C Leishmaniasis (visceral); 38-39°C Toxoplasmosis, Entamoeba.

fever,” that food intake affected the immune system by increasing levels of gamma interferon production, while food deprivation stimulated interleukin-4 release.

### **3.3.13.3 Staying warm so as not ‘To catch your death of cold?’**

Getting cold has been associated with catching a cold for hundreds of years. Rather than assuming that folk medical beliefs which caution that ‘getting cold gives you a cold’ are merely ignorant of germ theory, it is possible to consider instead that there could be truth underlying this extremely widespread belief. Medics have commonly thought that lay people who follow these beliefs may simply not understand the pathogenic source of the common cold. It may instead be the case, however, that the lay belief is informed by an understanding of the way in which cold depresses the immune system long enough for an infection to take hold. Preliminary evidence for this has been gathered, although studies are not conclusive. Johnson and Eccles (2005) found participants whose feet were chilled experienced more cold symptoms afterwards. Fleming and colleagues (2006) found that infants who slept in colder night-time conditions were more prone to infections. He noted that “infants who showed the highest incidence of respiratory infections during the course of the study were most commonly cared for in lower environmental temperatures and with less bedding and wrapping – thus seeming to support the belief ‘if you get cold, you catch a cold’” (Fleming and colleagues 2006: 9A).

Again, this may not be simply due to colder temperature in the child’s microenvironment, but may have more to do with the effect of thermal stress on the individual. For example, Anderson and Stenfors (1997) found that peak rates of infection of Otitis media seemed to be related to relatively minor seasonal shifts in temperature.<sup>16</sup> This may have something to do with thermal stress on the body as opposed to actual environmental temperatures.

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<sup>16</sup> 40% of the patients in Anderson and Stenfor’s (1997) study were under 6 years of age. The average temperature was -5°C and the range was -14°C to +6°C.

Knowledge that the immune system can be enhanced at higher body temperatures has been useful in improving the results of cancer therapy (Steiner and Luiz 2001; Van Haaren 2007), and increasing body temperature through layers of clothing has been shown to support the immune functioning of patients with HIV/AIDS (University of Texas 1998). Identifying the optimum temperatures for various bacteria and viruses has been useful for developing methods to store these pathogens, and has also informed strategies for keeping the cold-adapted flu virus from invading the lower respiratory tract (Yannarell and colleagues 2002).

A context-specific understanding of infant thermoregulation and thermal comfort is therefore essential to the prevention of SIDS (including understanding of how respiratory infections contribute to SIDS risk), as well as for the prevention of infections which kill millions of infants worldwide.

### ***3.4 Thermoregulation, SIDS and infection***

#### **3.4.1 Properties of clothing and bedding**

The SIDS literature raises the question of the extent that clothing and bedding properties affect an infant's thermoregulation and thermal comfort. Although we can develop the theoretical values of different clothing materials,<sup>17</sup> the real life effects those materials have on the body are far more complicated. Several other factors, which are often poorly understood, also need to be considered, such as air flow between the body and material and metabolic heat production. For example, when Arkell and colleagues (2007) tested a cot mattress that had a much lower insulation value than conventional cot mattresses they found that axillary temperatures of infants were actually higher using the mattress. They hypothesized that the more deformable surface of the mattress led to less effective insulation of

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<sup>17</sup> The insulative property of a material is calculated by establishing the insulation value ( $m^2KW^{-1}$  where m= meter and K= Kelvin and W = watt) of a material in a laboratory and multiplying that value by the percentage of the body covered by that material.

infant sleeping bags because the material was compressed, less air was trapped in the material, and the material therefore had a reduced capacity for insulation. Kerslake (1991) looked at how the presence of a duvet contributed to lower ventilation indices around the infant. His research revealed that tucking in bedclothes only had a significant effect when a duvet was included in the bedding combinations. Wilson and Laing (2004) have developed a model that considers the 3-D arrangement of bedding combinations. This has been used in studies on thermal insulation of infant bedding (Wilson and Chu 2005).

Whilst it is possible that ‘overwrapping’ may be one of the risk factors for SIDS, it is overly simplistic to approach the topic by calculating how much insulation an infant needs, determining how the thermal microenvironment of the infant’s bedding combinations interacts with the human body, and then developing and applying uniform recommendations for safe bedding (see appendix 9 for safe bedding advice available). Nighttime insulation appears to be a risk factor for some populations but not for others. Indeed, “lower rates of SIDS apparent in ‘Asian’ populations do not appear to be entirely attributable to use of lower levels of bedding insulations” (Wilson and Chu 2005: 695). Grover and colleagues (1994) showed that bundling (heavy wrapping) of healthy infants with extra clothing resulted in a higher skin but not rectal temperature. They concluded that elevated rectal temperatures should therefore rarely be attributed to bundling. It could be the case, as with bed-sharing, that some infants sleep better than others with well-insulated bedding in some conditions. At the moment, we do not know which infants might be more at risk from bundling since far less research has been done in this area compared to research on the risks of bedsharing.

### **3.4.2 Heat stress and SIDS**

Much of the literature on the link between thermal stress and SIDS actually focuses exclusively on the link between heat stress and SIDS, despite using the term thermal stress. Evidence regarding the link between cold stress and SIDS is sparse, and what little information exists is discussed below. It is not surprising that there is a bias in the research towards analysing the dangers of heat stress rather

than cold stress given the considerable cultural preoccupation with the dangers of heat compared to the dangers of cold, as discussed above.

The relationship between heat stress and SIDS may occur because infants do not have sufficiently mature thermoregulatory systems to cope with extremes in temperature, and can become overwhelmed by challenges of thermal stress on their metabolic, respiratory, and circulatory responses. The evidence for the link between thermal stress and SIDS in the clinical literature almost universally refers to heat stress alone, and the issue of cold stress is rarely addressed. Fleming and colleagues (1992) initially found anecdotal evidence that heat stress may be linked to SIDS, and further elaborated on this link in a subsequent study (Fleming and colleagues 2006). They found that infants in Avon, UK who succumbed to SIDS were more likely to have been heavily wrapped and have heating on at night than matched control infants. There were also more SIDS deaths with heavily wrapped infants with infections than the controls who had infections but were not heavily wrapped. Guntheroth (2001) also found that infection, excessive room heat, and insulation, as well as prone sleeping, increased the odds ratio for SIDS deaths. This study further argued that the link between overheating and SIDS was not as generally accepted in the USA as it is in other western countries.

Ponsonby and colleagues (1992b) found an independent association between thermal stress and prone sleeping. They also found that SIDS cases in their cohort in Tasmania had an excess of 2.3 togs for a given room temperature compared to the control group which had 0.6 togs ( $p=0.009$ ). The evidence is by no means conclusive, as we might expect with such a varied group of infants globally. Although the mechanisms by which thermal stress might result in SIDS are not fully understood, it does not explain why some low SIDS-risk groups such as South Asians tend to keep their infants 'inappropriately' warm, more so than the high-risk groups (Watson and colleagues 1998).

It has also been difficult to separate the effects of thermal stress from other risk factors such as prone sleeping or maternal smoking, because in the SIDS data these factors often occur contemporaneously. The link between overheating and



SIDS was a major component of the Back to Sleep campaign of the early 1990's (Blair and colleagues 2001; Esmail and colleagues 1995). This factor became inextricably linked to the more established risk of prone sleeping. The Back to Sleep campaign was successful in reducing a significant number of SIDS deaths within a matter of years. However, the risk of prone sleeping was linked to overheating, and this resulted in a widespread assumption that the risk of overheating was far greater than what had actually been established empirically. This campaign resulted in concern about overheating in infants and a reduced concern about infant's getting cold (Hiley and Morley 1994). It is now generally believed that overwrapping infants puts infants immediately at fatal risk of SIDS.

### **3.4.3 SIDS and change in climatic conditions**

The term 'thermal stress' is often used both when referring to an external factor such as extreme heat or when the body is actually under stress while coping with these external factors. Even though infant's thermoregulation may be immature, it may still be able to cope with a certain range of temperatures without being excessively stressed. To some extent, infants can become acclimatised to a range of temperatures (Parsons 2003). However, this process of becoming acclimated may take several weeks. When infants are suddenly exposed to more extreme conditions, their limited thermoregulatory responses may be unable to cope, potentially resulting in serious harm. Although this can happen in adults as well, such as in cases of hypothermia or heat stroke, it is much more likely to happen in infants given their immaturity of their thermoregulatory systems. Murphy and Campbell (1987), using a sample covering the years 1979-1983, found a significant correlation between deaths and the level and rate of change of environmental temperature four to six days prior to death, irrespective of age. This suggests that a sudden extreme thermal stress may put infants at more risk of SIDS compared to more minor forms of thermal stress. It is therefore not the thermal stress itself that will result in a SIDS death, but a combination of the infant's ability to cope with the stress, the level of stress experienced, and the presence of appropriate forms of care to help infants manage the stress.

Interestingly, a similar phenomenon occurs with older people who die from cardiovascular disease after being exposed to cold stress. These excess deaths in Europe occur in climates that are more temperate compared to those which experience extreme cold (Gascoigne and colleagues 2010). Whether this phenomenon helps illuminate the aetiology of SIDS, however, is unclear since the relationship between recent thermal stress, cardiovascular changes, and SIDS has not been investigated.

In addition to looking at the role of sudden changes in temperature, it is also interesting to compare the incidence of SIDS across seasons. Douglas and colleagues (1996) found that SIDS rates did vary seasonally, yet could provide no explanation for the causal mechanism involved. Macey and colleagues (2000) found no association between the Fohn winds in Christchurch, New Zealand and any significant effect on SIDS rates. Even in semi-tropical climates such as Hawaii with a temperature range of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , there was an increased rate of SIDS observed in winter (Mage 2004). They suggested that this increase was attributable to higher infection rates during the winter months because it coincided with term time for schools. Ponsonby and colleagues (1992a) found a strong seasonal association, with an excess of deaths among male infants and infants of older mothers occurring in the winter.

#### **3.4.4 Changes in metabolic rate, adiposity and body surface to mass ratio and SIDS**

Fleming and colleagues (1992) describe how an infant's metabolic rate rises over the first three months of life. They also note a rise of 50% in loss of heat per unit of surface area because of the change in mass to surface area ratio that occurs as infants develop. In addition, they describe how infants gradually develop a thicker layer of subcutaneous fat over the first three months, coupled with an increase in the effectiveness of their vasomotor response to cold (through vasoconstriction or vasodilation). Despite the increased capacity to lose heat through the skin surface, they contend that there is a shift towards heat conservation as infants mature. More detailed research is needed to compare changes in the body surface area to mass ratio over the first year of an infant's life.

For example, while Fleming and colleagues (1992) suggest that the head is the site of 40% of a three month-olds heat production and 85% of an infant's heat loss in bed, this may be too great a generalisation to use for all infants. Infant head and body sizes will vary considerably over a year, and therefore their individual body surface area to mass ratios and adiposity levels must be taken into account. Guntheroth and Spiers (2002) hypothesised that the largest number of SIDS deaths in the one to six month age group occurred because infants lost their neonatal protective mechanisms during this time and were therefore more susceptible to fever after one month of age.

### **3.4.5 Heat stress and bedsharing**

The rate of SIDS deaths occurring in infants reported to have co-slept (slept in the same room as the caregiver) at the last sleep has risen significantly from 12% to 50% ( $p < 0.001$ ) in the past 20 years, but the actual number of deaths occurring in the parental bed has more than halved. In the 2008 Confidential Enquiry in Maternal and Child Health (CEMACH) report 'Why Children Die' only 18% of infants suffering sudden unexpected infant death (SUDI) were found in a cot (Pearson 2008). This is partly because of a reduction in SIDS deaths in infants sleeping alone, rather than a rise in SIDS among co-sleepers.<sup>18</sup> The percentage of co-sleeping infants from deprived backgrounds has risen from 57% to 86%, and in pre-terms there has been a risk from 12% to 34% (Blair 2006). These figures have contributed to a common misinterpretation of bed-sharing risk data. For example, Mitchell (2009) concludes that "more than half of the deaths from SIDS occurred when the infant was sleeping with a parent" (Mitchell 2009:873). Such phrasing has led to a focus on bed-sharing as the main risk for SIDS. This is a surprisingly illogical conclusion of risk, if half were sleeping in a parental bed, then half were not, so why did sleeping in the parental bed pose more risk?

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<sup>18</sup> Co-sleeping is defined as an infant sleeping in the same room as the parent, either in a cot, crib, or in the parental bed. Bed-sharing is defined as the infant sharing the parental bed.

The most influential organisation recommending SIDS reduction practices to health professionals and the public in the UK, the Foundation for the Study of Infant Deaths (Foundation for the Study of Infant Deaths date nk), have regarded bed-sharing as inherently dangerous to the infant: “Consequently the Foundation for the Study of Infant Deaths and the Department of Health’s advice remains that for the first six months, the safest place for your baby to sleep is in a separate cot in a room with you, both by night and by day” (Foundation for the Study of Infant Deaths: 2010), despite evidence that bed-sharing may have some protective functions for SIDS (Ball 2002; McKenna 1996). For example, Ball (2006) suggests that co-sleeping (i.e. bedsharing and/or room sharing) can help infants to overcome respiratory challenges because the infant spends less time in rapid eye movement (REM) and deep stages of sleep. This is believed to be important because of the suspected relationship between infantile arousal deficiencies and some cases of SIDS (McKenna 1996).

These types of SIDS prevention messages that emphasise keeping infants out of the parental bed stand in stark contrast to messages espoused by organisations promoting breastfeeding, such as La Leche League, who promote bed-sharing as a strategy for facilitating successful breastfeeding (Ball 2003; LLL 2008). There is also widespread interest in bed-sharing in the UK, even with the knowledge that bed-sharing infants might be at greater risk of SIDS. The level of interest in bedsharing, and the frequency with which it is practiced globally, is unsurprising for a number of reasons. McKenna (1996) considers how crucial the dyadic relationship between mother and infant is, both day and night, to ensuring the infant’s survival, especially in high risk conditions. The human infant is born with only 25% of its adult brain weight, making humans the most neurologically immature mammals at birth and the most dependent on external regulation for the longest period of time after birth of all primates. Thus, “for infants to survive, and for human (parental) reproductive success to be maximised, natural selection likely favoured the co-evolution of highly motivated care givers on one hand and highly responsive infants on the other – infants designed to respond to and be dependent on external parental sensory signals and/or regulatory stimuli available in a

microenvironment within which mothers and infants are almost always in contact” (McKenna 1996: 207).

Physical contact between infants and caregivers is necessary to help neurologically immature infants thermoregulate, and human infants have not evolved to cope with being left without their parents for long periods of time. This contrasts with the offspring of other mammalian species, who can preserve heat by sleeping in a litter while their parents are away. The human infant needs regular and close contact with a caregiver to help it regulate its temperature (McKenna and McDade 2005). Human infants have evolved to be partly precocial sleepers, although they lack the ability to cling to their caregiver, and infant will cry if separated from its mother, the composition of human milk is that of a precocial species (Ball 2006).

In recent years, as a result of the conflicts over whether bedsharing confers either protective or risk factors for SIDS, there has been an increasing awareness of the specific risk factors that increase SIDS risk for bedsharing infants. The discrete risk factors that have been identified include sofa sleeping, younger infants bed-sharing with a parent who has consumed alcohol, drugs, or is ill or over tired, parental smoking, overcrowded housing,; an infant going under a duvet, use of a duvet of more than 10 togs, and low birth weight (Blair and colleagues 1999; McGarvey and colleagues 2006). Ball (2002) found no evidence of overheating among bed-sharing infants. Richard (1999) found that bed-sharing was associated with a significantly higher axillary temperature compared to solitary sleeping infants, but only in REM sleep. Core temperatures were the same in both groups. However, even though bed-sharing infants were found to have slightly higher temperatures than cot sleeping infants, Fleming and colleagues (2006) found that mothers were able to help support the regulation of their infant’s temperature adequately without instruction.

Where there is a fear associated with the dangers of bed-sharing, extra care is needed to distinguish where advice is based on evidence rather than unsupported assumptions. By understanding the conditions under which bed-sharing increases

risk, it is possible to reconcile the conflict between those who promote bed-sharing and those who fear fatal consequences associated with the practice of bed-sharing. This has historical roots from an era in which poor mothers, assumed to be drunk, were accused of being a danger to their infants by overlaying them. This dates back to the 18th century when the high infant mortality rate was blamed on “careless, heavy sleeping girls” killing their infants by overlaying (Hardyment 2007: 51). Similarly, some cases of overlay were thought to be a form of deliberate infanticide (Hansen 1979). The origins about the fears of overlying go back as far as the Old Testament, where the First Book of Kings states, “then one night she accidentally rolled on her baby and smothered it” (2 Kings:5:7 Good News version). The fear about overlaying persists today, with some coroners judging the cause of death to be overlaying or asphyxiation and not SIDS (Ball and Klingaman 2007), even without evidence (Blair and colleagues 2006).

The development of ‘clip on cots’<sup>19</sup> has relieved the fears some have about bed-sharing, a fear that is perhaps not necessary for mothers who do not have high risk bed-sharing behaviours such as smoking, drinking and being over-tired (Ball and colleagues 2011). Physical proximity, either through bed-sharing, co-sleeping, or use of clip on cots, allows caregivers to respond to infant cues regarding discomfort, including discomfort caused by thermal stress, even if the caregiver is not experiencing thermal stress.

### **3.4.6 Prone and supine sleeping, heat stress and SIDS**

One of the most harmful examples of medical advice given in the past century involved the recommendation that infants be placed prone (on their stomachs) to sleep (McKenna and McDade 2005). It had been noted that premature infants who slept in the prone position fared better than those sleeping in a supine position, so it was assumed that all infants would be better off sleeping prone (McKenna and McDade 2005). In the late 1980s, findings emerging from SIDS

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<sup>19</sup> Clip on cots, or sidecar cribs, are three-sided cots that attach to the parental bed to provide a separate sleeping surface but allow the parents to access the infant easily whilst still in bed.

research revealed that prone sleeping appeared to be a major risk factor for SIDS. The subsequent 'Back to Sleep' campaign of the early 1990's saved thousands of lives by successfully effecting a rapid behavioural change in the population by getting parents to put their infants to sleep in a supine position (Blair and colleagues 2006; McKenna 1996).

Despite this success, the reason why prone sleeping is so dangerous to an infant is still not clear. Several theories have been put forward, such as a higher bacterial count in the respiratory tract of prone sleeping infants leading to a higher production of toxins (Bell and colleagues 1996); pharyngeal fluids resulting in laryngeal reflexes affecting respiration (Jeffery 1999); and re-breathing causing a reduction in oxygen in the microenvironment (Guntheroth and Spiers 2001). There are also some considerations of temperature, which note that supine sleepers are more likely to uncover their arms and legs when sleeping, with the result that they overheat less (North 1995), and that the temperature in the respiratory tract is higher in prone sleepers, making it easier for some, although not all, pathogens to colonise (C Blackwell 2007, pers comm., 26.10.). Russell and Vink (2001) hypothesize that supine sleeping promotes appropriate thermal regulation via the head and face, which is a major source of heat loss. Scheers-Masters and colleagues (2004) found that it was unlikely that prone sleeping and high environmental temperature had a significant role in SIDS.

### **3.4.7 Smothering and SIDS**

In the past few decades there have been some famous cases where mothers have been wrongly jailed for murdering their infants by asphyxiation or shaken baby syndrome (Dyer 2005). It is almost impossible to distinguish in autopsy between the two in a young infant (Blair and colleagues 2006). Since the asphyxiated infant is not able to struggle (Banaschak and colleagues 2003), they are unlikely to receive tell-tale injuries indicating intentional smothering. Smothering is also indistinguishable from SIDS in autopsy, and unintentional overlaying is often assumed, even where there is no strong evidence (Emery and White 2000). A death of a bed-sharing infant could involve more subtle

mechanisms, such as re-breathing the mother's expired air if she is too close and lays for too long, or if she is not alert enough to respond in cases where a SIDS-vulnerable infant experiences distress. Parkins and colleagues (1998) found that reducing oxygen by 15% resulted in severe prolonged apnoea in some infants.

Another cause of smothering may occur if bedclothes cover the infant's face. Baddock (2007) filmed infants sleeping during the night, and found that face-covering events are more common in bed-sharing infants. However, mothers are often alert enough to respond to the infant's signs of distress and they will wake to adjust the bedding, especially if they sleep in the same room. This may explain why SIDS is more of a risk in infants whose mothers have an altered state of consciousness, such as that caused by drugs, alcohol or extreme tiredness. Franco and colleagues (2002) found that in an experiment where infants' faces were covered by a sheet, there was an increase in their auditory threshold. Blair and colleagues (1999) found that infants sleeping under duvets were at more risk of SIDS since they could become covered by the duvet, causing them to experience head covering and causing them to have more difficulties losing heat.

### **3.4.8 Thermoregulation, respiratory control and SIDS**

Another link between SIDS and body temperature involves respiratory control. Guntheroth and Spiers (2001) found a strong association between thermal regulation and respiratory control, especially for prolonged apnoea. Russell and Vink (2001) describe thermoregulatory neurons as being linked to respiratory regulation in the medulla. Blackwell and colleagues (1995) and Molony and colleagues (1999) suggest that the development of pyrotoxins from viruses in the respiratory system are encouraged by prone sleeping and excess clothing and bedding, since temperatures between 37°C and 40°C are ideal for some viruses. Nevertheless, there is a possible confusion between overheating from clothing and overheating caused by infection. Some parents wrap their babies more heavily precisely because they have detected that their infants are unwell (Helweg-Larson and colleagues 1994), with fever often being preceded by cold hands due to vasoconstriction. Another theory relating to respiration and infection is that a prone sleeping infant will not have the advantage of gravity working to clear its airways



from mucous caused by a respiratory infection (Bell and colleagues 1996). Another possible factor is that higher body temperatures lead to respiratory problems, deeper sleep and fewer arousals (Bell and colleagues 1996).

### **3.4.9 Cold stress and SIDS**

Despite the overwhelming emphasis on research into the relationship between heat stress and SIDS, there is some evidence that cold stress also affects SIDS risk. Thermal stress and SIDS in the literature almost always refers to heat stress only. Cold stress and SIDS has been hugely under-researched compared to heat stress and SIDS.

Williams and colleagues (1996) found an association between SIDS and too little insulation. Another possible relationship between cold and SIDS is that defects in the infants thermoregulation could cause hypothermia. Dunne and colleagues (1986) published a case study of a boy in the first years of his life who had frequent episodes of hypothermia and sleep-related apnoea. Various attempts to prevent him from getting cold when he slept did not work, and he suffered several near-miss episodes of SIDS. When he was 17 months old, the episodes stopped and he subsequently suffered no long-term effects.

Goldsmith and colleagues (1991) suggest that infants who become too cold in the winter months are subjected to an under-recognised cause of SIDS. Lloyd (1986) suggested that environmental cold can cause death through other mechanisms than hypothermia, and argued that some of the increase in SIDS observed during the winter may be due to undiagnosed pulmonary hypotension with apnoeic episodes. Cardiovascular changes could be a factor in cold stress and SIDS, as discussed above. Furthermore, cold depresses the immune system and leaves the body less able to fight off pathogens, so cold-stressed infants may suffer more frequent infections, which are also linked to SIDS. There have been several reports of SIDS victims having had respiratory infections in the weeks prior to their death (Bajanowski 2007; Fleming and colleagues 2006; McKenna and colleagues 1996; Moloney and colleagues 1999). Evidence for the link between the colder temperatures and SIDS is extremely scarce, however. The over-emphasis on

protecting infants from heat stress might unintentionally be putting an unknown number of infants at risk of SIDS due to cold stress. Efforts to eliminate all sources of thermal stress, including stress caused by both heat and cold, would ultimately be a more sensible approach, one which is largely congruent with the actual infant care practices of mothers in cultures influenced by humoral beliefs.

### **3.5 Conclusion**

The thermoregulation of an infant is complex. There are many intrinsic and extrinsic factors to consider in how the infant controls its temperature and responds to thermal stress. There are also many individual differences that dictate thermoregulation as well as thermal comfort. Different infants will express thermal discomfort at varying levels of thermal stress, which partly influences the types of thermal care they receive from their caregivers. How thermal stress contribute to SIDS is equally complex, and its complexity must be adequately acknowledged when designing SIDS-prevention advice for parents that relates to thermal care of infants.

The precise mechanisms that cause SIDS are not known. It appears that a SIDS death results from a combination or succession of physiological challenges to the infant's respiration and internal regulation, especially in infants with often unknown, subtle vulnerabilities. SIDS is the main cause of death in the UK for infants aged one month to one year, but the number of infants dying of SIDS in this context pales in comparison to the millions of infants who die from pneumonia alone in the rest of the world. Lack of resources needed to conduct post-mortem examinations, combined with a context in which infectious diseases are prevalent, makes it almost impossible to establish whether or not there is a significant incidence of SIDS deaths in lower-income countries. In the UK, the search to unravel the mysteries of SIDS is of great concern. Certain ethnic minorities in high-income countries, especially South Asian communities, have remarkably low rates of SIDS (Blackwell and colleagues 2006). South Asian infants' slower maturation of thermoregulation, higher rates of LBW, and reported higher bedroom temperatures would seem to put them more at risk of SIDS, but their SIDS rate is in fact exceptionally low. One of the explanations for this apparent paradox is that

cultural patterns of infant care among South Asian groups involve a higher degree of attentiveness through the night and day, which offer protection to infants as they undergo internal physiological challenges.

One area that seems particularly lacking in SIDS research on thermal stress is the contribution of cold stress to SIDS. Many papers refer to thermal stress but focus entirely on heat stress. Although there are only a handful of studies that examine the link between cold stress and SIDS, theoretically there is no reason for cold stress to be any less significant to SIDS than heat stress. I propose that this bias is due to cultural beliefs in the UK that focus on the dangers of heat for infants to the exclusion of dangers caused by cold. Another reason that South Asian infants in the UK could have such low SIDS rates could be because their mothers, informed by humoral beliefs that emphasise maintaining thermal balance avoid exposing their infants to extremes of cold or heat, so protecting them from both heat and cold stress.

SIDS prevention advice regarding thermal (heat) stress usually focuses on room temperature and use of appropriate clothing and bedding for infants at night. It has already been established that no infant will have the same thermal experience in a given environment. For example, older healthy babies may suffer heat stress in the same environmental temperatures that cause hypothermia in newborn or low birthweight infants. Estimating appropriate bedding and clothing for a given environmental temperature has proved to be especially complex, yet this complexity is vastly oversimplified when research findings are translated into public health messages regarding SIDS prevention. It is not possible to guarantee that a given amount of clothing and bedding for a given environmental temperature will protect even one infant from heat stress during the night, and it is even more inappropriate to assume that one-size-fits-all advice can be developed that applies to all infants. It may ultimately prove to be more important for individual mothers to respond to infant cues regarding thermal comfort, since infants experience extrinsic and intrinsic changes throughout the night and at different times may require assistance from his/her caregivers to maintain thermal comfort and be protected from the potential dangers of thermal stress. Human thermoregulation is

part physiological and part behavioural, and thus an infant's expression of its own unique response to heat and cold stress must be considered more important than uniform assumptions about appropriate room temperatures and amounts of clothing and bedding.

# Chapter 4 Research Questions

## *4.1 Introduction*

Chapters 2 and 3 have highlighted several aspects of thermal care of infants, and presented existing research on the effects of thermal stress on infant health. Chapter 2 presented findings from social science research, and Chapter 3 presented the findings of clinical studies. Together, the literature reviewed in these chapters informs several specific research questions for the present study, focused on aspects of thermal care which have not previously been addressed by existing discourse.

Drawing from the review of the literature and from the case study presented in chapter 2, two primary factors emerge which drive mothers' decisions regarding thermal care of infants. The first of these involves their beliefs about how heat and cold contribute to and explains disease aetiology. The second is based on what they perceive to be the major threat to infant life in their community. For example, in Guatemala a major perceived threat to infant life is pneumonia. Cold is believed to result in pneumonia, and thus protection of infants from cold is a major priority in infant care in Guatemala. It is important to note that the major threat to infant health as perceived by mothers may or may not coincide with actual epidemiological realities. Since social change usually occurs slowly, the threats to infant health prevalent in preceding generations may remain a focus of maternal concern, particularly where grandmothers have some degree of influence over infant care practices, and these concerns may continue to govern parenting practices despite epidemiological shifts.

In the UK, the thermal care practices of South Asian and white British mothers are expected to be motivated by a combination of their thermal care beliefs and the major threat to infant health and survival in their communities. SIDS is the main cause of infant mortality among white British infants. Are white British mothers expected to be predominantly influenced by beliefs about the harmful

effects of heat, thereby prioritising protection from heat over protection from cold? Judging what mothers perceive to be the major threat to infant life is particularly complicated because the South Asian community includes both first and second generation mothers, each of whom grew up in a different disease environment that involved different rates of infant mortality and different causes of infant death. Overall, however, the main threat to infant lives in the South Asian community in the UK is congenital abnormalities (Oddie n.d.), which is not believed to be prevented by thermal care of infants. Do South Asian mothers therefore aim to promote thermal balance, not prioritising either protection from heat or cold but rather prioritising the maintenance of thermal balance?

Thermal care of infants is essential to their survival. There are several external signs of thermal stress, such as changes in skin colour or having skin that is hot or cold to the touch. Furthermore, the infant has the ability to express thermal discomfort through such behavioural cues as crying, lack of sleep, and irritability. These are evolved behaviours, and therefore health advice regarding thermal care that recommends mothers use body and room thermometers to maintain correct temperatures are expected to have less influence over mothers' evaluations of infant thermal status than innate behaviours and interactions that occur within the dyadic relationship.

The evidence regarding "safe" amounts of bedding and clothing is lacking, particularly given the complex differences between infants of different ages, weights, health status, and metabolic rates. Reliance on advice informed by this currently inadequate evidence base does not necessarily promote, in practice, the intended thermal outcomes for infants.

Considering the above points, it is useful to address the research questions outlined below using an exploratory approach in order to generate detailed information than can be used to inform future large-scale studies. The research questions are outlined in detail below.

## *4.2 Research questions*

### **4.2.1 Research question 1: Does the use of clothing and bedding differ between white British and South Asian mothers?**

Because of potentially different beliefs about the nature and severity of thermal threats to their infants, it is possible that the amount of insulation provided to infants by South Asian mothers will differ from that provided by white British mothers. Based on the literature reviewed in chapter 2, it seems likely that the South Asian mothers might aim to prevent their infants from getting too hot and too cold, whereas white British mothers may tend to put less rather than more clothing and bedding on their infants as a strategy to prevent overheating. It would therefore be useful to know how much insulation from clothing and bedding is placed on infants at night. The results of this research question are presented in chapter 7, and are discussed further in chapter 11.

### **4.2.2 Research question 2: Do South Asian infants sleep in different environmental conditions than white British infants?**

The environmental conditions infants sleep in must also be considered in order to put the clothing and bedding use in context. These environmental conditions may potentially differ between households based on several factors, variability in housing, heating, ventilation, dampness, number of people sharing a room with an infant, infant sleep surface, and presence or number of sleeping companions. Even where the environmental conditions are relatively similar, there may also be differences between the two groups that may influence how the thermal environment of the infant's room is managed. Variability in the amount of control caregivers do or do not have over the modification of this environment is also expected to differ. The results of this research question are presented in chapter 8, and are discussed further in chapter 11.

### **4.2.3 Research question 3: How do mothers assess the thermal needs of their infants?**

Judging an infant's thermal needs requires the consideration of a number of environmental cues, as well as an assessment of the infant's physiological state, the infant's behaviour, and the degree of thermal stress expected, or not, for the infant. Because there are multiple factors that a mother could consider, are there differences in these judgements and the actions taken as a consequence between mothers and between ethnic groups? It would be useful to know how mothers decide whether their infant is suffering from thermal stress, and if so, whether this decision-making process varies by group. The results of this research question are presented in chapter 9, and are discussed further in chapter 11.

### **4.2.4 Research question 4: Are there differences in beliefs and priorities about the adverse effects of heat and cold on infants between white British and South Asian mothers?**

Because of the many different thermal care beliefs and differences in infant mortality experienced by different communities, as documented in chapter 2, it is expected that two groups with very different cultural origins will hold different priorities and beliefs regarding what dangers of heat and cold stress infants are vulnerable to, and how thermal care should be provided to protect infants in light of these dangers. These different beliefs have not previously been explored in detail, yet these beliefs play a vital role in structuring mothers' infant thermal care practices. Exploring these systems of belief is therefore fundamental to the understanding of infant thermal care. The results of this research question are presented in chapter 10, and are discussed further in chapter 11.

The methods used to answer these research questions, and a description of the research process, is presented in the following chapter.



## Chapter 5 Methods

In this chapter, I provide information on how methods for the present study were trialed, selected and implemented, and I discuss other methods that were considered but rejected. I also describe the various avenues I pursued for participant recruitment, and which ones ultimately proved successful. This study primarily employed a mixed methods approach, using semi-structured and structured questions in interviews to explore ethnic differences in infant thermal care practices and to understand the explanations underlying these practices. The location chosen for the study was the Bradford District, primarily involving the town of Keighley, Bradford was an area of particular interest because a large proportion of infants in Bradford are born to mothers of South Asian origin,<sup>20</sup> thus providing a substantial population with which to compare thermal care practices and beliefs of white British mothers.

The remainder of this chapter is organised as follows: Section 5.1 details the development of the study design, and section 5.2 presents the pilot phase of the study. Section 5.3 describes the methods used in the main study.

### *5.1 Development of the project*

#### **5.1.1 Consideration of research methods**

As a medical anthropologist, I am well aware of the benefits of both quantitative and qualitative methodologies, and I weighed the relative value of the two approaches in considering the design of the present study. Quantitative methods had the capacity to capture the wider picture of what a large number of people believed and practiced in terms of thermal care of infants. Qualitative methods had the capacity to capture the depth and complexity of people's beliefs

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<sup>20</sup> South Asian countries include Afghanistan, Bangladesh, India, Nepal, Pakistan and Sri Lanka.

and practices related to thermal care of infants. Participant observation, or ethnography, is regarded as an excellent method for evaluating whether people do what they say they do, although the presence of the researcher must always be acknowledged as a source of potential bias (Flick 2004; Mason 2006). The rules and norms of any culture are, in some circumstances, allowed to be broken, and understanding these rules and their exceptions is best accomplished through observation. I found a perfect example of this during the pilot (which is described in detail in section 5.2 below). I asked a Bangladeshi mother if she took her infant and young children out in cold weather if one of them was sick, and she told me she would avoid doing so in order to keep from making her daughter's illness worse. The next week I arrived in the cold, driving rain to the parents and toddler group, and she informed me that her daughter had a fever. I said I was surprised that she had taken her daughter out of the house on a cold day if the baby was sick, and the mother told me that, since she was the coordinator of the toddler group and since she had no one to leave her daughter with at home, she reluctantly had to take her daughter out in the cold. Thus, even this brief period of participant observation revealed a difference between what she said she did and what she actually did, and allowed me to gain some insight into her reasons for breaking rules related to thermal care practices.

When language barriers are present, direct observation is also useful since in-depth conversations, even when aided by an interpreter, are likely to be limited. I considered recruiting a small group of 30 Bangladeshi mothers by offering English conversation classes in their own home, which would have been focused on the topics of health and infant care that would be most beneficial to them when taking their children to a local doctor perhaps. However, although these classes would have allowed me to conduct in-depth discussions about thermal care practices with these women, the intensive nature of such data collection measures would have meant that I would be limited to a small sample of mothers belonging to only one ethnic group. Furthermore, conducting direct observations of the way that mothers dressed their infants in their own homes at night would have been particularly intrusive for both white British and South Asian mothers. Such methods were therefore not appropriate, ethical, or feasible for the present study.

My guiding research question, combined with the lack of existing studies on the topic, ultimately informed my choice of methods for this study. Given that so little is known about infant thermal care beliefs in the UK, and given that I was interested in gathering information on these beliefs among two different ethnic groups, I chose a mixed methods approach. I decided that quantitative methods involving structured questions would be used to obtain information on the background of the mother and infant, the thermal environment of the infant's room, and the items of clothing and bedding that were used at night for the infant. Qualitative methods, involving unstructured questions, were used to explore the mothers' reasoning behind the thermal care beliefs and practices. I also chose to use observational techniques where possible, although these were not as extensive as those involved in purely ethnographic studies.

This thesis is more than just a mixed-methods approach, because it uses a medical anthropological analysis of thermal care practices and beliefs that question current medical assumptions about thermal regulation in infants. Furthermore, it aims not just to document what people do, but also to explore why they do it. Likewise, it examines how the beliefs and practices of other cultures can help us better understand and evaluate our own thermal care beliefs and practices. It provides a unique synthesis of clinical and anthropological research to address the interaction of cultural beliefs and behavior on the physiology and health of infants. This represents the unique contribution of medical anthropology. Inhorn (1995) has argued that an anthropological-epidemiological synthesis can lead to results that are greater than the findings generated by either discipline alone. Inhorn (1995) argues that the use of opposing approaches to study the same medical topics can lead to a greater understanding of health-related behaviour.

There is much to be gained by integrating clinical and epidemiological models of disease with anthropological perspectives and data. To my knowledge, this combined approach has not been used in the study of thermal care of any age group, and has been used to only a very limited extent in SIDS research. How I finalized the details of the methods is discussed below. In summary I used a questionnaire of 56 questions, which included both structured and unstructured

questions. I showed mothers my Durham University identity card and obtained consent before commencing each interview. Before asking for a signature for consent, I reviewed a participant information sheet that gave details of the study and gave mothers a copy to take home. I also provided them with my contact details in case they decided to withdraw consent afterwards. I did not write names on the questionnaires and kept the questionnaires and consent forms in separate, secure locations accessible only to members of the research team. I allowed discussion of any topic throughout the interview, and offered a small gift at the end of the interview.

### **5.1.2 Recruitment avenues/opportunities**

Various avenues for participant recruitment were explored. I found that accessing participants through Sure Start programmes attached to the NHS in the area was restrictive because their managers were wary of letting me access their clients if I had ethics approval from the University of Durham but not from the NHS. In addition, the Sure Start Centres had been approached by several organisations wanting to access their clients, so the staff were also wary of burdening their clients with numerous research requests.

Bradford was selected as the research site for the present study because it has a large South Asian community, and 40% of newborns in Bradford are South Asian. At the time of my study, a large number of newborn infants in Bradford were enrolled in the Born in Bradford (BiB) birth cohort study, one of the largest infant health research projects in the world. The BiB cohort study recruitment closed in December 2010, with a sample of 13,750 infants that was recruited between 2007 and 2011 (Born in Bradford 2011). Although no collaborative endeavours with the BiB project were planned, I elected to recruit mothers from the same area so that my results could be reviewed in conjunction with the findings of the numerous infant research projects linked to BiB. Most of the BiB collaborators were conducting clinical and quantitative studies, and few measures were designed to capture the infant care practices of South Asian mothers, even though these mothers represented such a significant portion of the population in Bradford.

### 5.1.3 Ethical considerations

Ethical considerations limited my recruitment options since I was not able to access mothers through NHS staff or organizations.<sup>21</sup> I therefore had to use community and education organizations to access mothers. This route was potentially advantageous, however, since I was not identified with health professionals and was therefore ‘safer’ to talk to about what were considered by health professionals to be unsafe infant sleeping practices, including heavy dressing or bed-sharing. Although South Asian mothers’ experiences with health visitors and midwives were generally positive, a few of the South Asian mothers told me they had difficult experiences with health visitors involving conflicting cultural beliefs about appropriate forms of thermal care for young infants. For example, some South Asian mothers were criticized by the health visitors for putting “too much” clothing on their infants, and one mother reported that the health visitor had taken off her infant’s sweater without asking the mother.

Although consent was obtained in writing (see appendix 10) before the interview, and was obtained after reviewing the participant information leaflet given to each mother (see appendix 11), I did anticipate circumstances where a participant might choose to withdraw her consent during the interview for a variety of reasons, such as if she had changed her mind, run out of time, was needed by her children, or had not fully understood what the interview entailed. I assured participants that they could refuse to answer any question, and informed them that they could withdraw from the study at any point without having to provide a reason for their withdrawal. I also was sensitive to any signs of discomfort, and in cases in which I felt their desire to continue the interview was in question or they needed to pat attention to their children. I took steps to ask whether they were comfortable with continuing their participation and I offered additional explanations and reassurances about the study if necessary. No participants withdrew from the study during the interviews, although the level of detail given in response to the questions

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<sup>21</sup> These included midwives, health visitors, mother and baby clinics, and Sure Starts and parent and toddler groups that were run by NHS organisations.

occasionally became limited towards the end of the interview, usually because of children needing attention. I was also patient with interruptions from children, family and friends during the interview. Where the mothers seemed to have doubts about the study, this was usually resolved by continuing to explain the purpose of the study and the use of the information. If a mother seemed worried they should be appearing to say the “right thing” I would reassure them that I was just interested in finding out what people do and I was not telling anybody any right or wrong ways to care for their infants.

In consideration of my own wellbeing, I took preventive measures to ensure my personal safety. I never worked entirely alone, as the interviews were either carried out in a public place or in the company of a facilitator or interpreter when conducting interviews in people’s homes. I also followed Durham University’s Lone Working Policy (Durham University 2004).

#### **5.1.4 Provision of gratuity**

At the end of the interview, I offered participants a choice of baby toys, hats, or a pair of socks as a gesture of thanks. Many researchers offer ‘rewards’ such as gift vouchers, to compensate participants for their time in interviews. I was not able to offer this because I did not have the resources for a £10-£20 gift voucher for all mothers. In retrospect offering a voucher could have been a disadvantage if the mothers felt any pressure to give answers they thought I would want to hear in return for their ‘payment’.

The gift provided a way to compensate people for their time, and to show appreciation for the contribution of their time and answers. It was also helpful when participants had young children with them, who were often appeased by the toys. The gift provided a way to end the interview on good social terms even if we left sooner than the mother would have preferred.

## ***5.2 Pilot Study***

I conducted the pilot study in the Barker End area of Bradford in June and July 2007. The pilot had several purposes. From the literature I had concluded that South Asian mothers employed different infant thermal care practices from white British mothers. The pilot aimed to obtain empirical evidence that there were potential differences in infant thermal care and that these differences could be captured by the proposed research methods. The pilot study also allowed me to establish which South Asian group would be most appropriate for my fieldwork, and allowed me to finalise the questions to be covered in interviews.

For the pilot, I interviewed fourteen mothers of children under five years of age who were attending two toddler groups in the Barker End area of Bradford. The interviews involved semi-structured questions. I spoke to six mothers of Bangladeshi origin, six of Pakistani origin, one of Indian origin, and one white British mother. One Bangladeshi mother translated at the toddler group for the Bangladeshi mothers who could not speak English, and in the other toddler group all the mothers spoke English. Because I only spoke to one white British mother in the pilot it was difficult to make comparisons, but there was an indication that the South Asian mothers were less concerned about heat than the white British mothers interviewed.

### **5.2.1 Location**

Because of the concentration of South Asians in Barker End, I only found one white British mother to talk to during the pilot, and I concluded that if I wanted to include white British mothers in my study I would have to look for them in a separate neighbourhood. I realized it would be necessary to access South Asian and white British mothers in two distinct neighbourhoods in different parts of the city, where quite possibly there was little social mixing between the two groups. This led me to consider Keighley as a better contained area for study. Keighley is a small town in the Bradford District with a large South Asian population (16%) (Office for National Statistics 2004a,b). Some areas of Keighley have a higher concentration of South Asian residents, but as these areas were smaller than the

vast areas in Bradford, I anticipated that there would be more social contact between the two groups in Keighley and therefore greater awareness of each other's beliefs and practices related to thermal care of infants.

Interviewing mothers in public settings or, in the case of some of the South Asian participants, in the home usually meant that I was not able to guarantee a completely private interview with unaccompanied mothers. Some of the mothers were distracted by children, friends, or family members. However, some of these mothers would have been completely inaccessible otherwise, and by excluding them I would have obtained data on a far less diverse population, with fewer mothers from hard-to-reach backgrounds represented, including teenage mothers, low-income mothers, mothers with little or no education, and first generation South Asian mothers who are often under-represented in research.

### **5.2.2 Accessing mothers with young infants**

I also discovered during the pilot that although it was fairly easy to find mothers to talk to in parent and toddler groups since other group members were willing to help keep their toddlers busy while I conducted the interview, the mothers of toddlers did not have a good enough recollection of the thermal care they had provided to their children when they were young infants. I therefore decided that it would be best to ask mothers how they looked after young babies whilst they were still in infancy, and concluded that parent and toddler groups were therefore not an effective means of reaching my target participants. I also decided to focus solely on mothers and not fathers in order to simplify the research design.

I identified several community organisations in Keighley that I thought might be able to help me gain access to participants, and planned to use snowballing methods to find a sufficient number of mothers after initial introduction through the organisations. It seemed that South Asian mothers, and quite possibly white British mothers too, with young infants have great difficulty in leaving the house because of the constant care requirements of the infant, and also because the South Asian mothers in particular had concerns about taking a young infant out in the elements. The sleeping, eating and changing requirements of



young infants can be hugely restrictive to a mother, often leaving her with little time to do anything besides care for her baby. Therefore, it became apparent that I had to be prepared to go to either the houses of the mothers, or places they were able to visit with their babies, in order to facilitate the interviews given the time and lifestyle constraints of the participants..

### **5.2.3 Which ethnic groups?**

Although Bradford has one of the largest Bangladeshi communities in the UK outside of London, finding sufficient mothers with infants under a year old was very difficult. By far the largest group of South Asian mothers in Bradford were of Pakistani origin, so it would have been easier to concentrate solely on them. However, I did not want to exclude mothers of other South Asian countries because they are often left out of research, and I anticipated that they would possibly have similar thermal care beliefs because of the strong influence of humoral beliefs in all South Asian cultures. I decided to obtain full details of ethnicity of the participating mothers in order to identify any potential ethnic differences within the South Asian mothers, although I acknowledge that substantial cultural variation exists within and between South Asian countries. The details I collected included country and region of birth, number of years in the UK, and birth place of parents and in-laws. I also chose to exclude any mothers who were white, but not white British, because of the different thermal care beliefs held by Southern and Eastern Europeans. Ultimately, I only excluded one mother who was of Italian origin.

### **5.2.4 Visual data methods**

To ameliorate some of the difficulties involved in interviewing non-native English-speakers, I developed a language-free tool to facilitate the process of demonstrating which items of bedding and clothing mothers used for dressing their infants at night. A reconstruction of bedding and clothing, as well as the baby's sleep environment, was developed and trialed. Visual tools such as those used in photo-interviewing or photographic elicitation have been used for many decades, but have become more common in recent years. Diagrams or photos can be useful

instruments to convey thoughts to others, act as a motivation in an interview, and complement conventional research methods (Crilly 2006; Salmon 2001).

I first considered a computer programme that would permit participants to drag and drop items of clothing on the baby. Given the sheer variety of clothing and bedding items that could be involved, using a computer would have been useful because it would have been able to handle a large amount of items. On further consideration, however, I decided that some mothers might not be adept at using computers, and therefore too much explanation might be necessary. Furthermore, carrying a laptop with me in the course of collecting these data might have posed an undue danger. I therefore decided to employ a simple visual tool. Magnetic stickers were produced as images using a graphics tablet printed on magnetic sheets. These allowed participants to chose bedding and clothing to demonstrate how their infant slept at night.

Picture one - Bedroom and sleeping positions as arranged by a South Asian mother to show how she and her infant slept at night during the winter. The mother demonstrated how she slept alone with her infant in a double bed, with a pillow to the left side of her infant to stop him/her falling out of bed.

**Figure 10 Bedroom/sleeping positions**



**Figure 11 Illustration of clothing stickers mother could chose to demonstrate how their infant is dressed**



The advantages offered by this tool included its ease of implementation for mothers who spoke little or no English, its capacity to produce a physical rendering of the manner in which infants were clothed and covered, and its reflection of specific details such as the order and combination of clothing and bedding items and the sleeping position in which infants were placed. However, it also involved a considerable disadvantage, since the large board and pictures needed to be laid out for the mothers. After piloting it with a few mothers, I reluctantly had to give up using it because it was too cumbersome given the flexibility required for interviewing mothers in numerous locations.

### **5.2.5 Interpreting**

It was also confirmed in the pilot that many of the South Asian mothers had only recently come to the UK, often had limited English, and therefore required an interpreter in order to participate in the study. Using an interpreter places some limitations on the research because of the potential for the interpreter to influence the participant, answer for the participant, or inaccurately translate conversations. It is also difficult to develop adequate rapport with participants when conversations are done through an interpreter. Therefore, I worked closely with all volunteer interpreters to review the research aims and research questions in order to ensure that they would not influence the results of the study. A more detailed account of the use of interpreters is given below in section 5.3.3.

### **5.2.6 Recording interviews**

Tape-recording of conversations with South Asian women, particularly when conducting in-home interviews, was not appropriate for the participants involved in the study. Some of them expressed concern about their husbands not liking the use of tape recorders, and the recordings had the potential to record background conversations that were not part of the study design. Consequently, I decided not to record the interviews but to write down the answers using shorthand and transcribe them fully immediately following the interview.

### **5.2.7 Choosing methods and determining sample size**

As discussed in section 5.1.1 above, I decided to use a mixed methods approach. Therefore, for the quantitative questions I needed a power calculation for the sample size required for a statistical significance of 0.05. This calculation showed an effect size which came to 300-600 mothers. This sample size was beyond the capacity of the present study, given the time and resource limitations. Likewise, I planned to collect qualitative data as well as quantitative data, so I ultimately concluded that it would be better to conduct an exploratory study. I needed a sample that would be as large as possible while still allowing for the more in-depth qualitative research. I therefore decided to recruit 50 white British mothers and 50 South Asian mothers, focusing on the Keighley area for participant

recruitment. This study design was intended to gather information on several aspects of infant thermal care and provide the groundwork for future larger scale and/or more in-depth studies using qualitative and quantitative methods.

One advantage of a mixed methods approach was that specific questions were more appropriate to either quantitative or qualitative methods. For instance, demographic information and information on the amount of insulation used for infants at night were best suited to quantitative measures. More involved responses, such as those related to mothers' beliefs about the dangers of cold and heat, were best achieved through qualitative methods. Since this particular topic has not previously been explored, qualitative methods were particularly relevant for the present study since the mothers' answers could not be anticipated enough to provide them with a choice of pre-selected responses. I used my experiences gained while conducting fieldwork in Guatemala, coupled with the results of the pilot study, to inform the questions used in the larger study. I decided what information I hoped to collect from the participants, and then determined which questions were best suited to structured quantitative methods and which to unstructured or loosely structured questions using qualitative methods. I also planned to use participant observation as far as I could whilst talking to the mothers and arranging access to participants. I decided to explore mothers' reports related to the following topics: clothing and bedding choices in winter and summer; environmental conditions in the room the infant slept in; how mothers judged that their infants were not too hot or too cold; and how mothers believed heat or cold could harm their infants. I did not expect South Asian mothers to talk explicitly about humoral beliefs. Rather, I predicted that both groups would express preferences about thermal care practices and that they would give reasons for these preferences. The interview questions are given in appendix 12.

### ***5.3 Data collection methods for main study***

#### **5.3.1 Recruitment**

When I approached organisations in Keighley to help me find mothers, they were overwhelmingly helpful. They commented on people rarely bothering to come out as far as Keighley to do research. This was in contrast to the over-researched Sure Starts in inner-city Bradford. Most understood the significance of the research and were very keen to be involved. One Sure Start did assist with publicity and outreach in order to recruit their clients for this study. For ethical reasons, all of the organisations I worked with elected to contact their clients directly, rather than allowing me to access them on my own. Because of this indirect communication, it was almost impossible to get permission to go to mothers' houses directly. However, one Sure Start arranged for a handful of mothers to come to their centre where they provided a room for the interviews. I found another handful of mothers at a toddler group, but the subsequent recruitment process resulted in a total of only seven mothers. This caused me to question my capacity to recruit an additional 93 mothers, and led me to conclude that the snowball method of recruitment was not practical for research involving mothers of young infants.

##### **5.3.1.1 Recruitment in the shopping centre**

As I examined other possible avenues for participant recruitment, I considered other possible locations where mothers of young infants might congregate, such as at toddler groups, at houses of friends or family members, or at baby clinics. I considered approaching schools, but excluded this option since it was likely to produce a sample that had few first-born infants. Fortuitously, while spending a day in Keighley I went to the local shopping centre to buy a sandwich and was struck by the sheer number of pushchairs and prams in sight. I walked around for 30 minutes counting babies in pushchairs, and calculated that there were at least three infants an hour in the centre. It appeared that I had found a substantial concentration of potential participants in a community location where I could access mothers directly without encountering problems with data protection.

This small shopping centre was popular mainly with white British mothers. It provided a dry, warm environment to walk round to shop, to bump into friends and acquaintances, and to gain a connection with the outside world in contrast to the social isolation of looking after an infant at home. I requested permission from the Airedale Shopping Centre management in Keighley to interview mothers on their premises, and found that they were very cooperative. They could not offer a fixed place for a table or stand, so I had to carry all my paperwork and gifts on me. However, this degree of mobility had its advantages since I could choose where to stand at any given time, selecting quieter spots for interviewing, or entrances to shops popular with mothers which were good places for recruiting.

### **5.3.1.2 Recruitment in South Asian homes**

Although I did recruit seven South Asian mothers in the shopping centre, they were rarely present at that location. I occasionally saw South Asian mothers with pushchairs, but almost all the time the passengers were toddlers. On the few occasions where I did see a South Asian mother with an infant and I approached the family, they often declined to enter into any conversation and would pass by quickly, smiling and shaking their head before I had even opened my mouth.

By the time I had interviewed 51 white British mothers, I had only interviewed 15 South Asian mothers recruited through the shopping centre, Sure Start, toddler groups, and through community workers arranging home visits to their relatives who had infants. Therefore, I had to change my tactics in order to recruit another 35 South Asian mothers. A mother and community worker at one of the organisations I had contacted explained why I was not finding South Asian mothers in the shopping centre. She said that South Asian mothers with babies usually look after babies and do housework in the morning, and then go out in the afternoon if they want leaving the babies at home sleeping under the care of a relative. She recounted that when her own children were small, she never had to take her babies with her because she had been able to leave them at home with her mother-in-law during their afternoon naps. For South Asian babies where the often family gets up later in the morning, the afternoon nap may be the first nap of the day. Also, South Asian mothers are more reluctant to take their infants out in the

cold and disrupt their sleeping and feeding routines, especially if they are ill or could become ill by being taken outside.

Despite the stereotype that South Asian mothers have access to constant help with childcare because of other female family members living in the same house or nearby, the South Asian mothers in my sample found it hard to get someone else to look after their infant if they were not napping, making it very difficult to arrange a time and place to meet the mothers outside their homes. The difficulty in interviewing mothers outside their homes is illustrated by the following example. I had arranged (with an interpreter) to meet a mother at her in-laws' material shop at midday. We were told repeatedly for two hours while we waited that she was "just on her way," only to be told eventually that the woman was a "lazy person." The mother did not want us to go to her house, and kept insisting she was just leaving. She eventually arrived, apologising for the delay, saying that she had been trying all that time to get her baby to sleep so that her mother-in-law could look after her while she went out. This illustrates not only that South Asian mothers needed me to go to their homes, but also that I needed a facilitator, not just an interpreter, to help me access South Asian mothers in their homes.

I considered several methods of accessing South Asian mothers in their own homes. Accompanied by the interpreter, we tried knocking on the doors of houses with infant clothing hung out to dry in the yard. Despite windows being open and TV's and radios on, nobody would open the door. On the one occasion someone did answer, we were asked to call back another time and were given an incorrect mobile number to call. I eventually found that a facilitator or intermediary, especially ones who spoke one or more South Asian languages, who used his or her own personal contacts, was the only way I could recruit South Asian mothers in their homes. A more in depth discussion of the issues involved in interpreting is given below in section 5.3.3. For a participant to agree to an interview, there therefore had to be a person known mutually to the participant and me. Cold calling never worked. Even with interpreters who were members of the South Asian community, there still needed to be a direct connection between the interpreter and the participant, such as an older lady who introduced us to her neighbours. It was



not a question of not trusting a member of the white British community, such as myself, but a question of not trusting anyone they did not know either directly or indirectly. The success of my research with the South Asian community was dependent on the people who were willing to help me find South Asian mothers and to build trust with the mothers to facilitate the research. This commitment was largely outside my control, but luckily I did find it. The facilitators from the South Asian community who assisted with this study included a male community worker, female community workers, the mothers that were interviewed, the interpreter's mother, and a friend of the interpreter's mother. The facilitators that introduced me to mothers and helped me gain their trust are listed in appendix 13.

### **5.3.2 Interviewing**

#### **5.3.2.1 Interviewing in shopping centre**

Once I had established that I would recruit mothers in the shopping centre mostly on weekday mornings, I developed a routine where I let the centre's management office know I had arrived each day, and then went down to the mall. I judged who to approach by looking at the age of the infant in a pushchair/pram and the mother. Spotting a very young baby was easy, as they were usually lying down or in a pushchair with the smaller 0-6 month size car seat attached to it. The behaviour of young infants was also noticeably different from older babies. They were less mobile, sleepier, cried differently, played differently, were small, and made no word-like noises. Distinguishing between a baby approaching a year and those over a year was much more difficult.

I avoided approaching women who were in deep conversation with friends or family, were on the phone, or were having difficulties dealing with the infant or older siblings. Some mothers were obviously avoiding my path by cutting quickly across to the other side of the mall and avoiding eye contact, and some I could not approach because of other shoppers who were obstructing the path. I also chose not to pursue mothers in situations that would have required running after them, since I did not want to make potential participants feel like I was hounding them.

Once I had approached mothers, I explained briefly what I was doing. Approximately one in three mothers I spoke to agreed to participate. I apologised to mothers who I could not include, usually because their infant was over a year or they were not white British or South Asian. Mornings were the most productive times for interviews in the shopping centre. This was when mothers were more willing to stop and talk and were not in a hurry. Mothers in the afternoon tended to be rushing through the shopping centre to pick up school-aged children. Some mothers did find their time restricted towards the end of the interview, especially if the baby or other children were in need of attention. I tried to be as sympathetic as I could to their needs, asking them if they were willing to continue, and reminding them that they were free to discontinue participation at any time.

Providing privacy for the interviews in the shopping centre was difficult. Wherever possible, I attempted to stand out of earshot of stall sellers, other shoppers who were passing by or sitting on benches, and the shopping centre's security guards. If being out of earshot was unavoidable, I asked participants were comfortable with continuing where we were or if they wanted to move. For example, a male security guard came and stood nearby during one interview, and the mother said she would prefer to move to a bench, which she did, and she did not mind that she was then within earshot of an older lady and her grandchildren.

### **5.3.2.2 Interviewing in South Asian homes**

Acquiring the trust and commitment of facilitators is not necessarily compatible with research plans or deadlines, but the quality of the research achieved by gaining access to appropriate participants depended on these facilitators. Trust had to be earned, which required a level of care and commitment beyond the limited purpose of simply collecting data. An understanding had to be reached between research staff and participants in order to allay any fears that participants would be stereotyped negatively or criticised for certain infant care practices, such as overwrapping. Trust is rarely gained where there is a suspicion of being judged or where inauthentic motives are perceived, so I had to be genuine in my willingness to put the needs of participants first. Help from the facilitators was

essential to gaining participants' trust necessary for them to allow me into their homes and to feel comfortable with the questions I was asking.

Purdah (the social rules regarding separation of men and women) was obviously a consideration when visiting South Asian households. Men usually opened the door to us but quickly disappeared once showing us to where the women were. On a few occasions, husbands of the participants stayed in the room to listen to some of the questions I asked, leaving when they seemed reassured the research was genuine and I was not asking questions that were too revealing about their family.

The interviews were usually carried out in the company of other family members for several reasons, including the fact that the room we were using was the only warm room in the house, or because of curiosity, distrust, or a desire to make us feel welcome. On a few occasions, either a sister-in-law or mother-in-law or even a daughter appeared to be interfering with the answers, but only on one occasion was a mother unable to answer without the reassurance of her sister-in-law for each answer. A list of others present in some of the interviews is given in appendix 14.

### **5.3.3 Use of interpreters**

After a limited amount of voluntary ad hoc interpreters ran out, I only had funding for interpreting for a maximum of 35 mothers. Some of the mothers' English was proficient enough for the interview, but being accompanied by an interpreter was useful in many instances. Interpreters allowed me to arrange a visit with a mother through other family members using a South Asian language, to give the mother a choice of language throughout the interview, to help out if the mother could not express everything in English or did not understand the subject, and to generally provide continual reassurance that I could be trusted and the research was worthwhile. The interpreter was an unmarried, childless young lady of Pakistani origin. Therefore, in Pakistani culture she had a lower status in terms of knowledge of caring for infants and thus posed less threat to any mothers worried about their answers being judged by the interpreter.

### **5.3.3.1 Advantages of an interpreter**

Interpreting was also not only about language translation, it was about cultural appropriateness and cultural interpreting. Perhaps that was one of the reasons why one nervous participant mentioned above got reassurance from her sister-in-law for everything she said. In other words, she wanted to know she was saying the right thing to make the right impression on me, a stranger from another culture. Whilst maintaining sensitivity to the mother's situation, we both tried to persuade the sister-in-law that we were happy to provide all the translation, but she still would not leave the doorway or lose eye contact with the mother. Some South Asian mothers were quite keen to answer in English as much as possible, and need the assistance of the translator for only a few words they could not express in English. For example, when talking about the first conditional in English language (e.g. "what would you do if . . . ?"), some of the mothers needed an explanation in their own language for some of the questions.

### **5.3.3.2 Disadvantages of having an interpreter**

There are difficulties posed by having interviews interpreted. There was one conversation in Urdu that included the odd word in English, making me wonder if the baby was 14 months and they were telling me he was 12 months just so he would fit in with the study. I did not want to accuse them of lying so I tried to verify the information myself. The baby in question had an older brother under two years of age, so it seemed that the baby was indeed 12 months old. Nevertheless, the problem of verifying the interpreter's account of the mother's answers is always present, less so if the interpreter understands the importance of relaying an accurate account of what was said.

### **5.3.3.3 Difference between having a volunteer and paid interpreter**

A female Pakistani community worker offered to arrange visits, accompany me, and interpret where necessary in Keighley. Although she was being paid in her role as a community worker, she was not a formally recruited interpreter. This meant that I was unable to spend as much time briefing her on the research and I had less control over her interpreting methods. For example, at times she had a very long conversation with the participant but summarised the conversation for me.

With a formal interpreter, I was able to insist on a detailed reply. However, she was very committed and interested in the research due to recent personal experience of an infant death in her family and another infant relative in a serious, unstable condition in hospital at the time she was assisting me with my research. She was able to communicate this enthusiasm and interest in infant health research to her relatives and neighbours who she persuaded to allow me in their homes to conduct interviews.

#### ***5.4 Methodological limitations***

The data I collected included both quantitative and qualitative data. The quantitative data covered demographics and individual family data, data about the thermal environment in the infant's home, and data on the clothing and bedding used for the infant at night. The qualitative data covered beliefs about the harm caused by heat and cold, whether heat or cold was of most concern, and the mothers' interaction with others regarding thermal care advice.

Whilst I tried to choose the most appropriate methods possible for the research questions being investigated, there were several limitations to my data which I would like to make explicit before presenting the results. The limitations of different research methods have already been discussed above. Additional limitations are posed when trying to apply the same interview technique to two separate cultures in different settings. Therefore, there may be more that needs to be considered when comparing the data acquired from the different groups.

It would have been impossible to have identical conditions for the two groups, including the influence of others and the environment in which they were interviewed, both of which could potentially influence the data collected. How comfortable each group would have felt either at home or in the shopping centre would have differed to some extent, and my methods of contacting them would have maybe been an advantage for some and a disadvantage for others. For example, the white British mothers may have been more comfortable with me, a stranger approaching them in the neutral area of the shopping centre and asking them for personal details, than some of the South Asian mothers who had less idea

of how to judge if they could trust me with their personal details with strangers in earshot. Gaining access to people at home through friends and family may have worked well with South Asian mothers but may have been more intrusive for white British mothers. A white British mother might have felt under pressure in their own home with a stranger of unknown socioeconomic background potentially judging their home in terms of tidiness, cleanliness, and apparent resources. A South Asian mother may have equally feared judgment, but given that these mothers were often already under daily peer pressure to keep their homes ready for visitors to drop in unannounced they may have felt more confident in the conditions of their homes.

Undoubtedly, the same issues affected both groups to some extent, but in the end there was no way of having an identical environment that could have controlled for these conditions and the affects they might have had on the data collected. The two groups were different, and there were thus inherent limitations in the ability to construct identical conditions for the different groups. The differences in the two groups in the same geographical location of the Bradford District are still significant, although less obvious at first glance. The aim is to compare the two groups, whilst appreciating the caution needed in interpreting the results where there are differences in all stages of the research. Similarly, there may have been slight variations in the wording of the questions I was asking, even to participants for whom English was their first language. There were a few questions that posed different problems or differing understanding in the two groups, enough for me to change the wording specifically for that group. Details about the problems regarding specific words are given in appendix 15.

### 5.4.1 Quantitative data analyses

The quantitative data were entered into Microsoft Excel 2007, and resulted in over 7000 data points<sup>22</sup>, for the 102 mothers recruited for the study. The relevant statistics were extracted and analysed using Microsoft Excel 2007 and the results are presented in Chapters 6-10 below. SPSS 17 was used for significance tests on certain data sets.

Analysis of the demographics and characteristics of the mothers and their infants and families was fairly straightforward. The process of estimating the insulation values for the infant clothing and bedding, however, required a great deal of careful consideration of different methods used, and the reliability of the methods is explained in Chapter 3. I needed not only to estimate the insulation values of the different materials, but also the surface area of the infant and how much of the body was covered by the material. I also had to consider other possible factors, such the outer area, air layer insulation, and the influence of body and air movement. I describe below the rationale for selecting the methods to produce this calculation, the drawbacks involved in using other possible methods, and the limitations involved in the calculations I produced.

Despite the significant limitations and potential flaws in estimating the thermal effect of clothing and bedding on an infant, it is worthwhile to attempt, albeit with caution. Perhaps the ideal method would be to obtain data produced by testing ensembles of infant clothing on an infant-sized thermal manikin. Kang and Tamura (2005) have developed insulation values using an infant-sized thermal manikin for 30 infant garments and 10 ensembles. However, these do not include bedding. Therefore, a summation method would still be necessary for the clothing and bedding because of the lack of values available for ensembles of clothing plus bedding.

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<sup>22</sup> There were 54 questions asked, resulting in over 7000 individual pieces of information for the 102 mothers included in the study.

It is possible to use the data obtained to compare the two groups, by coming up with values for comparison purposes only. Furthermore, by calculating insulation used on the infants' torsos only it is possible to avoid the problem of the differing values for different shapes and kinds of clothing, how much of the body is covered by the clothing, and potential relevance in vasoconstriction of the extremities. The torso temperature is less variable among infants than the extremities (Singh and colleagues 1992). The torso is also the most important area of the body for thermoregulation because it contains most of the body's vital organs, and thus the body prioritises thermoregulation in this area as well as the head. Therefore, there are fewer variables to account for since the values do not depend on whether the air insulation is missing, or the design of one particular garment has a different thermal effect than another since it would have approximately the same effect on both groups. By simply adding the insulation values of the clothing and bedding, it is possible to assess whether one group, or a sub-group, uses more or less insulation than another. Because much of this study focuses on the qualitative aspects of thermal care, it is not essential to know exact insulation values, since the primary purpose of the research is to address differences between the groups. Therefore, this simple method is sufficient for the purpose of the present study. The insulation values used for different types of materials are presented in appendix 16.

Insulation values for the cot or bed mattresses, or for nappies were ignored as this was considered similar for all infants. Therefore, the results obtained do not claim to give a true estimate of insulation used for each infant, but a measure of comparison between the South Asian and white British groups of relative insulation used on infant torsos only.

## **5.4.2 Qualitative data analyses**

### **5.4.2.1 Thematic coding of interviews**

For the analysis of the qualitative data I first considered using a software packages for managing and analysing the qualitative data such as NVivo or EPPI-Reviewer which would have allowed for assigning themes to sections of data which



could then be searched using the keywords assigned. However, I decided that a partly manual method would be more advantageous in providing me with an extensive knowledge of my data achieved through a laborious yet informative process involving repeated combing through data to identify themes and subthemes. This allowed me to revisit the data several times to ensure that I had assigned all the relevant themes to sections, each time allowing me to gain additional perspectives and insights. The time dedicated to manual thematic analysis also allowed me to have a higher degree of recall of my data, and this facilitated a higher quality of data analysis and allowed me to find relevant quotes when needed. Once a list of all themes was produced I used the software *Inspiration*, a mind mapping software to organise out themes and add a visual plan of the emerging themes and subthemes on different levels. The result was several mind maps on the major themes containing every topic mentioned by the mothers, linked in to the main and subthemes. Mind maps of the quantitative data were also produced which enabled me to see how the data from different methods could be integrated and linked together. This was useful in discussions with supervisors and others regarding my results, and was extremely useful in the writing-up stage.

The second stage of the analysis was to determine how much data I had available for all of the themes and therefore which ones I should focus on for the analysis. I took many of the themes and extracted all the references mothers made to these themes collating them into separate documents which I could then focus on when interpreting and writing up each theme. Where I found I had little data available I made sure the topics were mentioned in the writing up but were not a major focus. The mind maps and data collated by themes were then used as the basis for the chapters written up in the below results.

## ***5.5 Conclusion***

The research questions, ethical considerations, and logistical issues related to gaining access to mothers all influenced my choice of methods. I chose a mixed-method design with a medical anthropological approach to combine and analyse quantitative and qualitative data. The medical anthropology synthesis and integration of these data is unique to the field of research into infant thermal care, and the research questions posed have not been attempted before. This particular research project did not have the capacity to include a large number of participants, or go into great depth of the beliefs of any one culture. However, the methods chosen have generated innovative findings on thermal care of infants that can be used as a basis for future studies employing a variety of research methods, and can help inform additional investigations of the many lines of inquiry related to this topic.

## Chapter 6 Results demographic data

This chapter presents the background data collected from the mothers about themselves, their families, their infants, and their housing. The data relevant to the research questions are presented in chapters 7-10. The information below describes the characteristics of the mothers interviewed.

### *6.1 Characteristics of mothers*

The 51 white British and 51 South Asian mothers in my sample were of similar age, and most white British mothers lived in the Keighley area while the South Asian mothers lived in the town of Keighley and the city of Bradford. In both groups the number of mothers educated to degree level or higher was similar, but there were more South Asians who had either no qualifications or a lower secondary school education. Three quarters of white British and one quarter of South Asian mothers worked, but only two of the 13 South Asian mothers who worked were first generation<sup>23</sup> South Asian.

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<sup>23</sup> I defined first generation as a mother who grew up in South Asia and second generation as those who lived in the U.K. after the age of four.

**Table 3 Characteristics of mothers in sample**

<b>Characteristic</b>	<b>White British mothers (n=51)</b>	<b>South Asian mothers (n=51 unless specified)</b>
Number of mothers	51	51
Location of interview	(n=51)	(n=51)
Shopping centre	49 (94%)	7 (14%)
Sure Start and toddler groups	2 (6%)	10 (20%)
In home	0 (0%)	32 (63%)
Other	0 (0%)	2 (4%)
Mean age	28 years	27 years
Age range	17-46 years	19-40 years
Education		
Degree or higher	9 (18%)	9 (18%)
A level/NVQ 4-5/HND/ diploma	7 (14%)	10 (20%)
NVQ 1-3 or GCSE (or equivalent)	28 (55%)	20 (39%)
No qualifications or Pakistan school year 9 or below (lower secondary)	7 (14%)	12 (23 %)
Employment status	38 (75%)	13 (25%)
Employed / maternity leave		
Unemployed	13 (25%)	38 (75%)
Married or partnered	(n=51) 40 (77%)	(n=50) 48 (96%)
Generational status		1 <sup>st</sup> generation: 26 (49%) 2 <sup>nd</sup> generation: 25 (51%)

### ***6.2 Characteristics of first generation compared to second generation of South Asian Mothers***

The South Asian community is diverse in culture, religion, and socio-economic factors. Below I focus on one major difference, the difference between first and second generation mothers. Mothers were categorised as first generation if they came to the UK after the age of 16 and second generation mothers were

defined as those who spent their childhood in the UK. There were no third generation mothers in my sample.

**Table 4 Differences between first and second generation mothers**

<b>Characteristic</b>	<b>First generation</b>	<b>Second generation</b>
Number of South Asian mothers	26 (51%)	25 (49%)
Age mother came to live in UK	17-30y (mean 20y)	
Languages spoken	Urdu, Punjabi, Pushtu, Hindko, Miripuri, English	English, Urdu, Punjabi, Bengali
<b>Education</b>		
<b>Degree or higher</b>	4 (15%)	5 (20%)
<b>A level, NVQ 4-5, HND or diploma</b>	4 (15%)	4 (16%)
<b>NVQ 1-3 or GCSE (or equivalent)</b>	10 (39%)	13 (52%)
<b>No qualifications or Pakistan school year 9 or below (lower secondary)</b>	8 (30%)	3 (12%)
Employment	3 (12%)	10 (40%)
Nuclear family	9 (35%)	20 (80%)
Multi-generational family	17 (65%)	5 (20%)
Interview interpreted	14 (55%) Urdu 4 (14%) Punjabi	None

There were a similar number of first generation and second generation South Asian mothers in this sample, which allows for a useful comparison of the two sub-groups. This sample is therefore unique in that I was able to include first generation South Asian mothers, who are typically difficult to access for research

purposes due to a variety of cultural and language barriers. For this study, 69% of first generation mothers required interpretation in the interview, demonstrating how important it is to use an interpreter when working with first generation South Asian mothers. Although these mothers spoke four different South Asian languages, they could all understand Urdu and Punjabi.

Unfortunately, first generation South Asian mothers are not often included in research studies, and yet they represent 50% of all South Asian mothers in Bradford (Bradford and District Partnership 2010) and have the highest infant mortality rate of all groups in Bradford. The infant mortality rate for South Asian infants born to first generation South Asian mothers is around 14 deaths per 1000 live births. Babies born to first generation Pakistani mothers are three times more likely to die than those born to white mothers. Babies born to second generation Pakistani babies are almost twice as likely to die as babies of white mothers (Brown 2005).

There were equal numbers of first and second generation South Asian mothers educated to degree level or above, but there was a much larger group of first generation South Asian mothers who had no qualifications or who were educated to lower secondary level. There were more first generation mothers living in multigenerational families compared to second generation mothers. However, 20% of the husbands who married second generation mothers went to live with their wife's family. Some of these would have been first generation South Asian.

### ***6.3 Characteristics of family and home***

It is difficult to compare the incomes of white British and South Asian mothers because many of the South Asian mothers did not want to answer this question, did not know the answer, or were instructed by their husbands not to answer. Many of the South Asian mothers also reported that their husbands dealt with financial issues. Furthermore, living in a multi-generational household makes family income more complex and harder to measure because some of the living costs are shared and this collective income is not comparable to the income earned by nuclear family units. Among those South Asian and white British mothers who

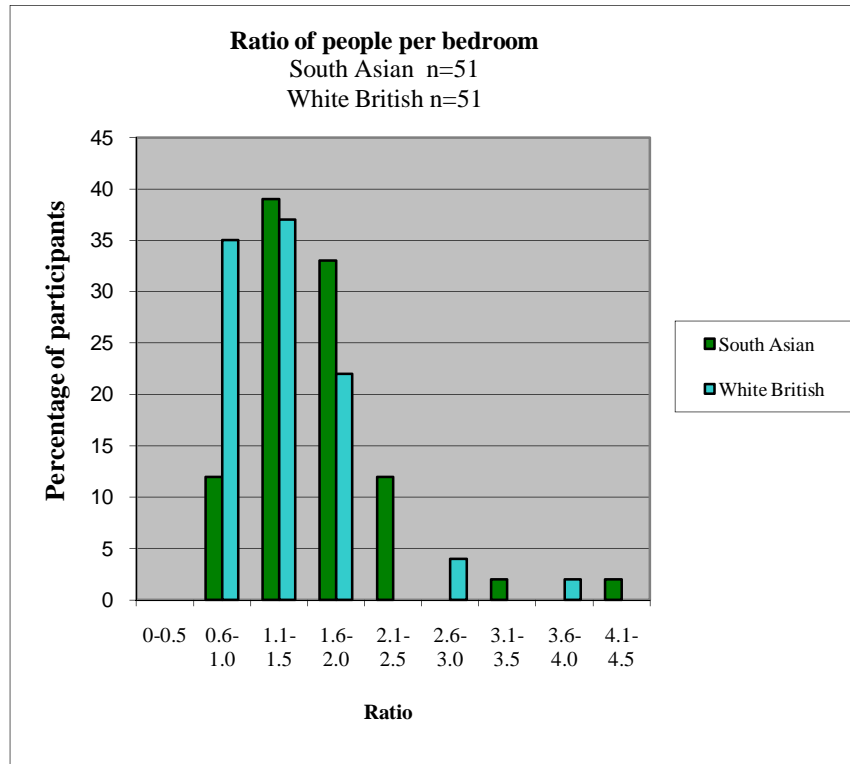
did talk freely about their family income, many complained about the complexity of different sources of income coming in and changing all the time, especially over the maternity period. The data demonstrate, however, that there was a fairly even distribution of income brackets among the white British mothers and that most of the South Asian mothers had low family incomes.

**Table 5 Characteristics of family and home**

<b>Characteristic</b>	<b>White British (% of those who answered)</b>	<b>South Asian (% of those who answered)</b>
Family income		
<£13,499	12 (27%)	18 (71%)
<£19,999	9 (20%)	2 (8%)
<£29,999	12 (27%)	1 (4%)
<£39,999	4 (9%)	3 (13%)
>£40,000	7 (16%)	1 (%)
Didn't answer	11 (22%)	26 (51%)
Infant living with nuclear or multi-generational family	48 (94%) nuclear, 3 (6%) multi-generational	29 (56 %) nuclear, 22 (44%) multi-generational

56% of South Asian mothers were living in nuclear families. The small number of white British infants living with grandparents were all born to teenage mothers. There were similar numbers of professional/highly skilled occupations of husbands/partners in both groups.

**Figure 12 Are white British and South Asian houses overcrowded?**



Most families from both groups had ratios between 0.6 people per bedroom and 2.0 people per bedroom, as shown in this figure above. Where there were many people living in a South Asian household, this usually involved several bedrooms or two terraced houses that had been combined.

#### **6.4 Characteristics of infants**

One of the explanations given for South Asian infants having such low SIDS rates is that South Asian women rarely smoke (Blackwell 2004). This is reflected in this data set, but 22% of South Asian infants were exposed to second hand smoke from other smokers in their household, compared to only 14% of white British infants. This also means that 22% of South Asian mothers were exposed to second hand smoke during pregnancy. 41.2% of South Asian infants were receiving at least some breastmilk, whilst only 29.6% of white British infants were.



Breastfeeding was more common among first generation South Asian mothers, with 46% of their infants receiving some breastmilk at the time of interview, even though South Asian infants were on average one month older than white British infants.

**Table 6 Characteristics of infants in sample**

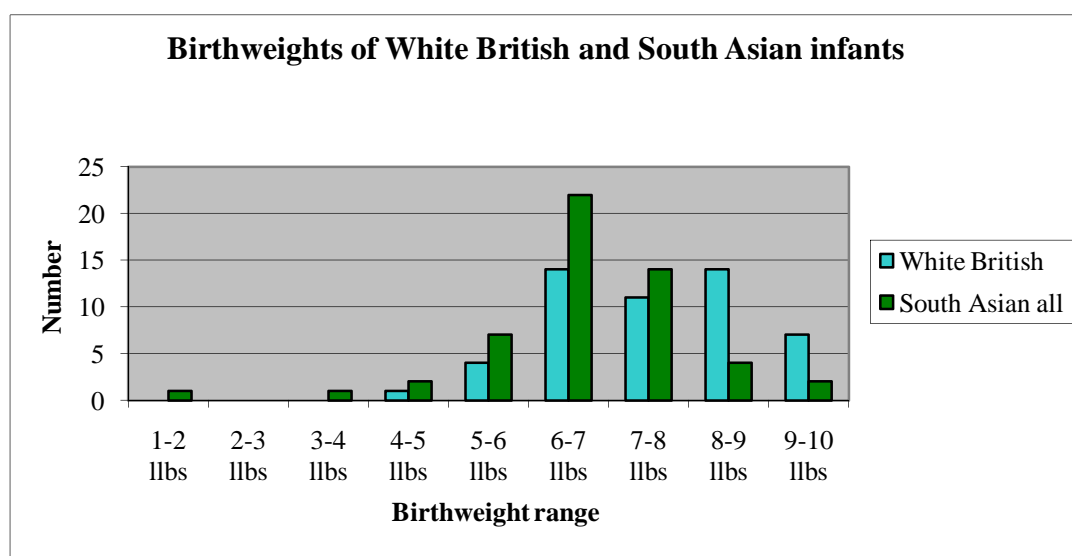
<b>Characteristic of infant</b>	<b>White British (n=51)</b>	<b>South Asian (n=51)</b>
Mother smoked during pregnancy		
Never	41 (82%)	47 (98%)
Often	5 (8%)	1 (2%)
Occasionally	5 (8%)	
Exposed to cigarette smoke in house		
Never	44 (87%)	40 (78%) 3 (6%)
Often	2 (4%)	7 (14%)
Outside	3 (6%)	0 (0%)
In kitchen only	2 (4%)	1 (2%)
Back room only	0 (0%)	
Age of infant	Range 4 days -13 months	Range 3 weeks – 12 months
Mean	4.5 months	5.7 months
Weeks gestation when born	Range 38-43 weeks	Range 25-42 weeks
Mean	39.7 ( Only 1 born before 38 weeks)	38.9 weeks (5 born before 38 weeks)

Birthweight	Range 1.81kg – 4.08kg	Range 0.45kg – 4.08kg
Mean	3.17kg	2.72kg6lb
Low Birthweight	4 (7.8%)	9 (17.6%)
Premature	2 (3.9%)	5 (9.8%)
Current health	All good	4% not good
Breastfeeding		
Breastfed	10 (19.8%)	13 (25.5%)
Bottlefed	35 (68.3%)	30 (58.8%)
Mixed	5 (9.8%)	8 (15.7%)
Receiving some amount of breast milk (breastfed or mixed)	15 (29.6%)	21 (41.2%)
Gender of infant	30 (58%) female 21 (42%) male	23 (45%) female 28 (55%) male
Room infant sleeps in		
With mother	30 (59%)	49 (96%)
Alone	20 (39%)	2 (4%)
With siblings	1 (2%)	0 (0%)
Sleeps in bed with mother		11 (21%)
Always	0 (0%)	12 (24%)
Sometimes	13(26%)	28 (55%)
Never	38 (74%)	

## 6.5 Weight of infant

Birthweights of white British infants were generally higher than South Asian infants, as shown in figure 12 below.

**Figure 13 Birthweights of white British and South Asian infants**



Nine of the South Asian infants were low birth weight (LBW) compared to only three of the white British infants. Five of the LBW South Asian infants had first generation mothers and four had second generation mothers.

## 6.6 Conclusion

Overall, these demographic indicators describe how, for this sample, there were more South Asian mothers with no qualifications, many more South Asian mothers who did not work, and that nearly all South Asian mothers were married compared to three quarters of white British mothers who were married or living with their partner. Half of the South Asian mothers were first generation South Asians, and half were second generation, which allowed for some comparison between generations. Another major difference between the two groups was that there were more South Asian than white British mothers with a household income of less than £13,499, although income was difficult to discern in the South Asian

group because of the factors outlined above. Nearly all white British mothers and just over half of South Asian mothers lived in a nuclear family household. The multi-generational households in which the South Asian mothers were living, despite a larger number of residents, were not overcrowded because their properties had more rooms per household.

With regards to differences between infants in the two groups, 2% of South Asian and 16% of white British mothers reported smoking during their pregnancy but 14% of white British and 22% of South Asian infants were exposed to cigarette smoke inside the house during pregnancy and after birth. A higher number of South Asian infants lived in a house where it was reported that residents or visitors smoked immediately outside the house, possibly exposing the infant to smoke entering through doors or windows. A larger study would be able to confirm if less exposure to cigarette smoke could be one reason for the lower rate of SIDS among South Asian infants. This refers only to maternal smoking during pregnancy and does not depict the full range of factors affecting infants' exposure to cigarette smoke. The mean birth weight for South Asian infants was only 85% of the mean of the white British infants, and over twice as many South Asian infants were born low birthweight and/or premature compared to the white British infants. Almost half of South Asian infants slept in bed with their mothers, either all the time or occasionally, whereas only a quarter of white British infants slept occasionally in their mother's bed. Although caution should be exercised in interpreting the data on sleep location because mothers may be aware of health professionals' warnings not to bed share, these data indicate that more South Asian than white British infants sleep in bed with their mothers, and thus receive maternal warmth as well as the insulation they are provided with from clothing, bedding, and household heating at night. The above data serve to demonstrate the differences between South Asian and white British mothers and infants in my sample, and this description provides relevant contextual information for interpreting the results of this study.

# Chapter 7 Results: Infant clothing and bedding

## 7.1 Introduction

This chapter focuses on mothers' use of insulation for infants at night and their beliefs about the kind and number of clothing and bedding items required. The first section below estimates insulation values of infant clothing and bedding during winter and summer. The complexity of calculating thermal insulation of clothing and bedding was discussed in detail in chapter 3,<sup>24</sup> where it was concluded that insulation values from data acquired outside laboratory conditions can only be considered imperfect approximations, although these data do allow for comparison between groups. The insulation values presented in this chapter are calculated for the torso only.<sup>25</sup> Section two of this chapter compares the number of layers used for night-time infant covering. This is important because the standard calculation of insulation values does not include the insulation value of air trapped between layers; it is recognised that the insulation provided by this air is significant, but it is not possible to quantify the value of this insulation for the purpose of the present study. Since the primary objective here is to understand behavioural differences in

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<sup>24</sup> Chapter 3 discusses the difficulty in judging the optimal amount of clothing and bedding since there are too many variables to calculate exact variables, such as the infant's intrinsic and extrinsic environment (including the infant's metabolic rate), the percentage of body covered by a thickness of material, environmental air temperature, air velocity, and factors related to how the infant adapts to thermal stress. Therefore, comparisons of high and low insulation values or number of layers does not indicate whether an infant is unsafely covered with clothing and bedding.

<sup>25</sup> This is because the extremities are more subject to vasoconstriction, so insulation has a different effect on these areas. Calculating insulation on the torso only also avoids some of the problems of calculating the surface area covered by the material. Estimating body surface area of infants of different sizes and ages is extremely complex, and there is a paucity of anthropometric evidence to aid such estimation.

thermal care practices between groups, it is not essential to calculate the exact insulation values for air or materials in this case.

In the third and fourth sections of this chapter, differences in infant clothing and bedding use are examined in detail for mothers who were high and low insulators. A substantial proportion of South Asian mothers reported weights for their infants at the time of the interview that could be classified as underweight. Analysis of the potential link between insulation and number of layers used and infant weight is considered. The fifth section provides a qualitative analysis of maternal motivations for certain clothing and bedding choices, particularly where decisions were not solely based on maternal thermal care intentions. In the final section of this chapter, indications that the infant exercises a degree of agency in influencing his or her own thermal care are provided.

## ***7.2 Insulation values of clothing and bedding used***

This section describes infant insulation used by South Asian and white British mothers at night and examines seasonal differences.<sup>26</sup> The insulation values for each bedding and clothing item were calculated using values for different material types given in the British Standards Document BS EN ISO 9920 (2007).<sup>27</sup> The summation of insulation value for each bedding and clothing item was calculated, as discussed in chapter 3. Only insulation on the torso is calculated to

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<sup>26</sup> Seasonal differences were divided into winter and summer to represent extremes of cold and heat. The average temperature in Northern England during 2008 according to the Met Office was 8° C, (Met Office 2008a) and in summer 18.6° C (Met Office 2008b). Despite the variation in temperature during seasons, the seasonal differences serve as an approximation for cold nights and warmer nights.

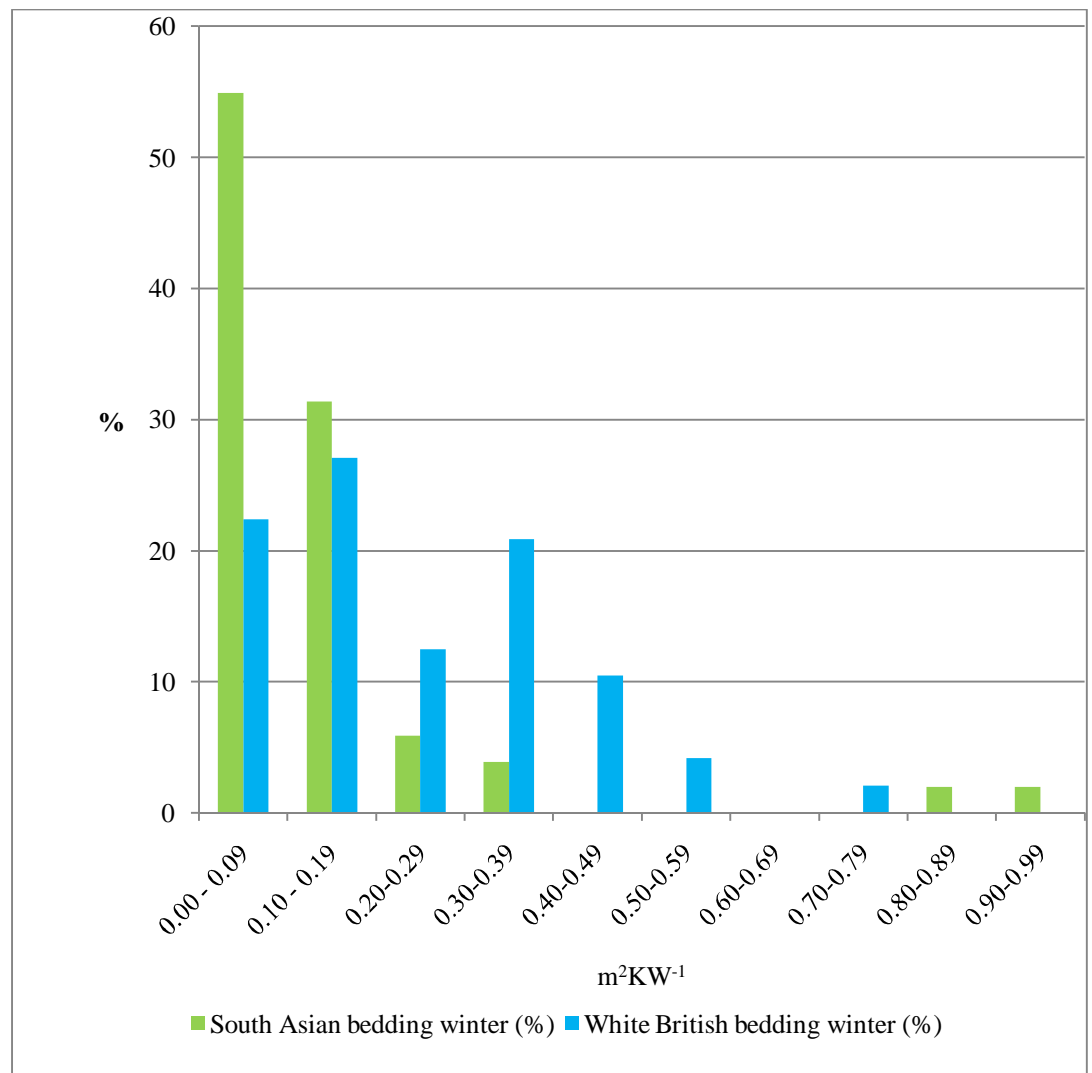
<sup>27</sup> The units are in  $m^2KW^{-1}$  which are the units used in the BSI (2007) document (where m= meter and k = kilowatts). A better known unit for insulation values is the tog. 1 tog = 0.1  $m^2KW^{-1}$ . Where necessary for discussion and comparison of other studies using tog values rather than  $m^2KW^{-1}$ , the values are converted accordingly.

avoid errors in calculating percentage of body surface covered by a material and the variation in heat exchange at the extremities.

## 7.2.1 Winter insulation

### 7.2.1.1 Winter bedding

**Figure 14 Comparison between South Asian and white British infant bedding insulation in winter** (South Asian n= 51, white British n = 49)



Note: The lowest insulation value in the  $0.00-0.09m^2KW^{-1}$  range was  $0.04m^2KW^{-1}$

The majority (72.6%) of South Asian mothers used infant bedding within a narrow range of insulation values (0.05-0.19m<sup>2</sup>KW<sup>-1</sup>), and as a group their infant bedding practices were quite uniform. The white British mothers, however, exhibited values spread across a much wider range, with 77.2% using bedding in a range of 0.05-0.39m<sup>2</sup>KW<sup>-1</sup>, excluding outliers. Using a Mann Whitney U test, there was a highly significant result (p=<0.001, MWU statistic = 710.0) for white British mothers using more infant bedding than South Asian mothers. Some of this difference can be explained by the differential use of infant sleeping bags, which is discussed in section 4 of this chapter below.

### 7.2.1.2 Winter clothing

**Table 7 Winter infant clothing**

Insulation value (m <sup>2</sup> KW <sup>-1</sup> )	South Asian infant clothing	White British infant clothing
	winter (%) (n= 51)	winter (%) (n=47 )
0.00-0.04	4 (7.8%)	5 (10.4%)
0.05-0.09	44 (86.3%)	34 (72.9%)
0.10-0.14	2 (3.9%)	4 (8.3%)
0.15-0.19	1 (2%)	3 (6.3%)

Note: One outlying statistic was excluded from the table above to make the table more practical but the outlying statistic was included in statistical tests. This was insulation of value 0.47 m<sup>2</sup>KW<sup>-1</sup> used on one white British infant.

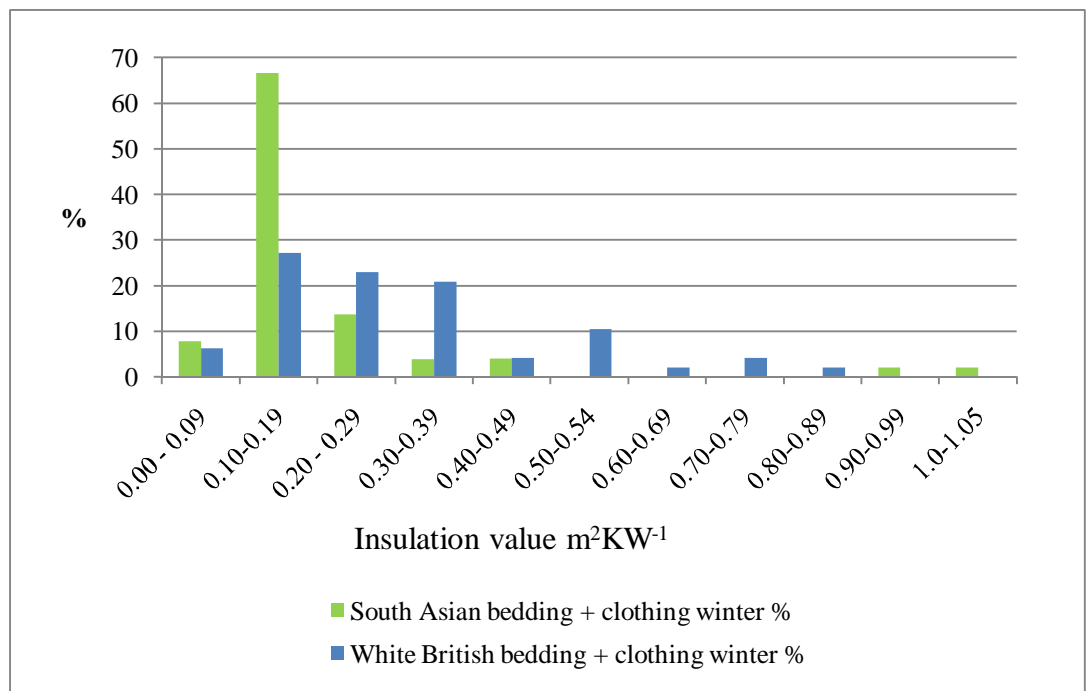
No statistically significant difference (Mann Whitney U test p=0.639, MWU statistic =1201.5) was found between winter night-time infant clothing insulation used by the South Asian and white British mothers. Table 7 above shows that 86.3% of South Asian mothers and 72.9% of white British mothers used clothing with insulation values between 0.05-0.09m<sup>2</sup>KW<sup>-1</sup>. This typically involved the use



of a cotton romper vest combined with a babygro (see appendix 17). Unlike the wider variations seen in bedding use, clothing practices were similar for the two groups.

### 7.2.1.3 Total insulation in winter

**Figure 15 Comparison between South Asian and white British infant total (bedding plus clothing) insulation in winter (South Asian n= 51 white British n=47)**



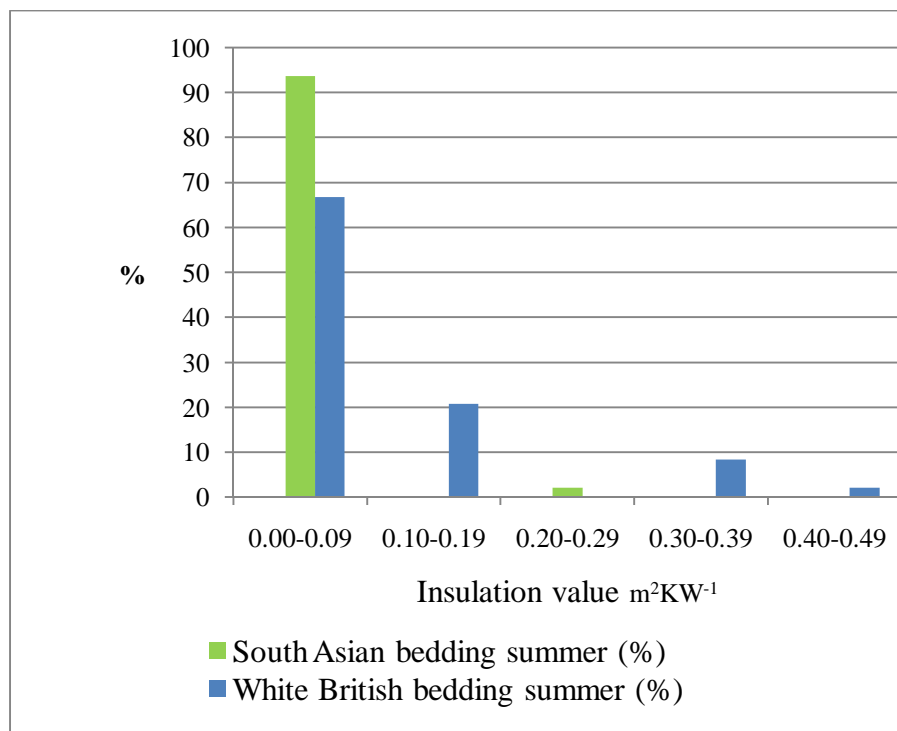
The total insulation used by South Asian mothers at night during the winter fell mostly within a limited range (0.10-0.29 m<sup>2</sup>kw-1). However, the values collected for the white British mothers were more variable. 84.2% of the South Asian mothers had bedding and clothing insulation values below 2.0m<sup>2</sup>kw<sup>-1</sup>, compared with only 33.4% of white British mothers. The mean value for winter bedding and clothing insulation values for South Asian mothers was 0.21 m<sup>2</sup>KW<sup>-1</sup> and for white British mothers 0.32 m<sup>2</sup>KW<sup>-1</sup>. Applying the Mann Whitney test to the data, a p value of <0.001 (MWU statistic = 682.5) was obtained, revealing a highly significant difference between the two groups and demonstrating that the South Asian mothers use less insulation than the white British mothers in the winter.

The higher value for the white British group could be partly explained by the popularity of infant sleeping bags. Both groups have a couple of values in the extremes.

## 7.2.2 Summer insulation

### 7.2.2.1 Summer bedding

**Figure 16 Comparison between South Asian and white British infant bedding insulation in summer** (South Asian n= 48 white British n=49)



As with the winter insulation, the South Asian infant bedding insulation range in summer was narrow. Applying the Mann Whitney U test, there was no significant group difference found ( $p=0.192, 961.0$ ). The white British bedding use was more variable, although most values are still in the lower range. The higher range of bedding insulation with the white British mothers was again mostly due to the use of infant sleeping bags. The two very high values for South Asian infant bedding reflects the use of adult duvets; although 11 (22%) mothers said they usually shared a bed with their infant, 9 of them did not report using infant duvets.

None of the South Asian mothers used infant sleeping bags in the summer and only one mother reported using one in the winter.

### 7.2.2.2 Summer clothing

**Table 8 Comparison between South Asian and white British infant clothing insulation in summer**

Value range (m <sup>2</sup> KW <sup>-1</sup> )	South Asian clothing summer (%) n=48	White British clothing summer (%) n=51
0.00 - 0.04	27 (55.3)	31 (60.4)
0.05 - 0.09	21 (44.7)	20 (39.6)

Again there was little variation between the white British mothers and South Asian mothers in infant clothing practices, and the clothing used in summer all fell in a lower range of insulation values. The Mann Whitney U test did not show a significant difference (p=0.378, MWU statistic = 1003.5) between the insulation values of clothing used by South Asian and white British mothers in the summer. In the summer, mothers were more likely to use just a romper vest and no babygro on their infant, as opposed to a romper vest plus a babygro in the winter. A greater proportion of the infants were therefore clothed in material that fell in the insulation range 0.00 – 0.04m<sup>2</sup>KW<sup>-1</sup> in the summer.

### 7.2.2.3 Total insulation in summer

**Figure 17 Comparison between South Asian and white British infant total (bedding plus clothing) insulation in summer (South Asian n= 48 white British n=49)**

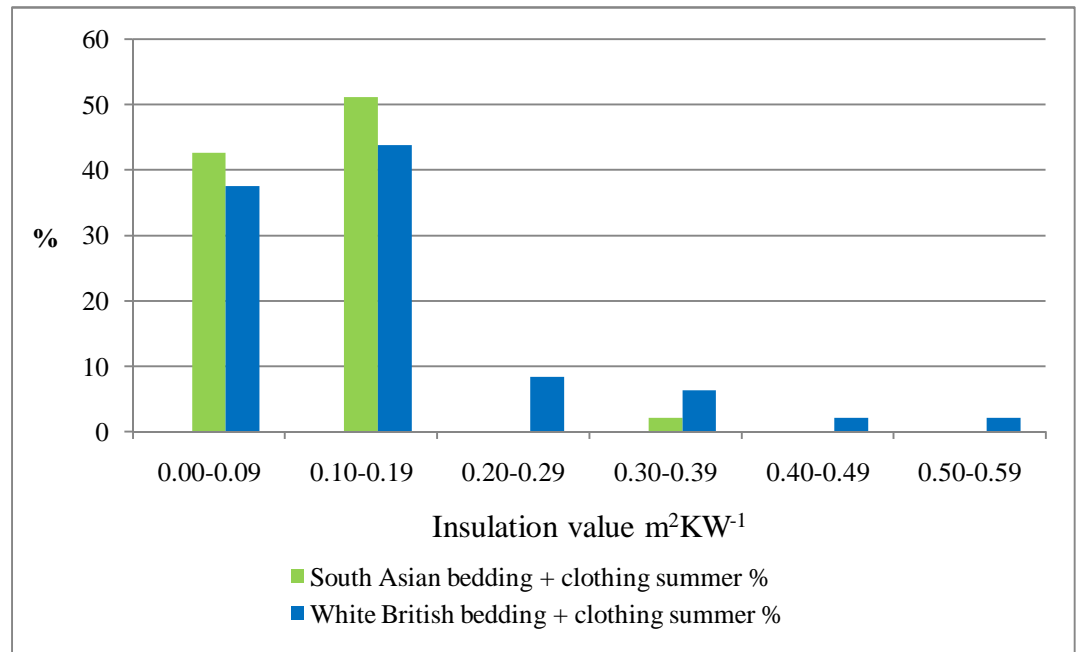


Figure 16 demonstrates that both the white British and South Asian mothers' total insulation values were almost entirely in the range 0.05-0.19m<sup>2</sup>KW<sup>-1</sup> in the summer, but the white British mothers displayed more variability. There are more white British values in the higher range of 0.20-0.39 m<sup>2</sup>KW<sup>-1</sup> and two mothers who put relatively high amounts of insulation on their infants during summer nights (0.43 m<sup>2</sup>KW<sup>-1</sup> and 0.52 m<sup>2</sup>KW<sup>-1</sup>). This can again be attributed to the use of sleeping bags. There was no statistical significance found by applying the Mann Whitney U test (p=0.181, MWU statistic = 950.5). A very conservative insulation value was given for the sleeping bags, but the mothers who used sleeping bags for their infants still had relatively high insulation values compared to other kinds of infant bedding.

The mean summer total insulation for white British infants was 0.15 m<sup>2</sup>KW<sup>-1</sup>, and for South Asian infants the insulation value was 0.13 m<sup>2</sup>KW<sup>-1</sup>. The difference in mean summer insulation value for white British and South Asian infants was

2 m<sup>2</sup>KW<sup>-1</sup>, whereas in the winter the white British total insulation was 11m<sup>2</sup>KW<sup>-1</sup> higher. South Asian mothers used 0.8 m<sup>2</sup>KW<sup>-1</sup> more insulation in winter than summer, and white British mothers used 0.17 m<sup>2</sup>KW<sup>-1</sup> more insulation during winter than summer. Therefore, white British mothers used more insulation during winter than summer for their infants.

### 7.3 Number of layers

It has been demonstrated that the layering of clothing and bedding is an important source of warmth (Fan 2006), and while insulation values for the air between layers cannot be easily estimated,<sup>28</sup> in this analysis a comparison of number of layers used can be made as an approximate comparison of insulation. The number of layers of infant bedding was summed, counting an item of bedding that only covered one side of the infant as a half layer, and swaddling blankets and sleeping bags as one layer. I have focused here on winter layers only due to the lack of variation in the summer data.

**Table 9 Comparison of the number of layers of clothing and bedding used by South Asian and White British mothers in winter**

Number of layers	South Asian % (n=51)	White British % (n=48)
2-2.5	5 (9.7%)	6 (12.4%)
3-3.5	35 (68.6%)	21 (43.8%)
4-4.5	10 (19.6%)	20 (40.8%)
5-5.5	1 (1.9%)	0 (0%)
6-6.5	0 (0%)	1 (2.1%)

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<sup>28</sup> Air trapped between layers can actually provide more insulation than the material itself. The insulative property of any material comes mainly from its ability to trap air. Layering of clothing is often considered to keep the body warmer than few, yet thicker layers (BSI: 2007; Fan 2006; Goldman & Kampmann 2007).

The mean number of layers of bedding and clothing reported during winter was 3.7 layers for white British mothers and 3.4 for South Asian mothers.

Most of the South Asian mothers (68.6%) used between 3 and 3.5 layers of bedding and clothing, whereas there was a much higher percentage of white British mothers in the 4 to 4.5 layer category. Given that the number of layers used indicates how much trapped air provided additional insulation, it is possible to conclude that white British infants experience a higher level of total insulation at night. Employing two methods of measuring thermal insulation of bedding and clothing (estimated insulation value of materials used and number of layers), the sleeping bag users emerged as the highest insulators compared to other white British mothers, partly because the sleeping bag counts as two layers while duvets, blankets and sheets count as only one. The use of sleeping bags, including whether mothers considered sleeping bags as enclosing rather than covering infants, is discussed in further detail in the following section.

#### ***7.4 Users of higher insulation – use of infant sleeping bags***

##### **7.4.1 Comparing insulation of infants sleeping with infant sleeping bags to those sleeping with sheets, blankets, and duvets.**

The variation in insulation values of infant bedding used by white British mothers could be explained by the use of infant sleeping bags, which are commonly referred to as “infant sleep bags” in the UK or “sleep sacks” in Holland (L’Hoir and colleagues 1998). See appendix 18 for an example of an infant sleeping bag. 48% of the white British mothers used sleeping bags for their infants. This section looks at the characteristics of the white British mothers who chose to use infant sleeping bags and those who did not during winter months. None of the South Asian mothers used infant sleeping bags in the winter, so this sample is made up of White British mothers only.

**Table 10 Insulation types provided by sleeping bags compared to blankets, duvets, and sheets.**

Bedding insulation value ( $m^2KW^{-1}$ )	White British infants with infant sleeping bags (%) (n=20)	White British infants without infant sleeping bag (%) (n=27)	South Asian infants without infant sleeping bag (%) (n=50)
0.00-0.09	0 (0%)	27 (100%)	49 (98%)
0.10-0.19	12 (58%)		1 (2%)
0.20-0.29	1 (6%)		
0.30-0.39	5 (24%)		
0.40-0.49	1 (6%)		
0.50-0.59	0 (0%)		
0.60-0.69	1 (6%)		

In winter the white British mothers who did not use sleeping bags used infant insulation materials similar to the South Asian mothers (between  $0.00m^2KW^{-1}$  and  $0.09m^2KW^{-1}$ ); there was no statistically significant difference between the two ( $p=0.492$ , MWU statistic = 623.5). Those who did use sleeping bags had much higher insulation values ( $0.46m^2KW^{-1}$ ). There was a highly significant difference between winter bedding insulation used by White British mothers who used infant sleeping bags and all bedding insulation used by South Asian applying the Mann Whitney U test ( $p<0.001$ , MWU statistic = 86.5). The South Asian winter insulation values are provided above to demonstrate how similar insulation from blankets, sheets, and infant duvets were in both groups compared to insulation in the group of mothers who used sleeping bags for their infants. Despite infant duvets being of similar thickness and therefore providing similar insulation values, the sleeping bags covered both sides of the infant and therefore provided twice the insulating value of the infant duvets.

#### 7.4.2 Characteristics of mothers who used infant sleep bags

Mothers who used sleeping bags for their infants were more likely to be older than those using blankets. The mean age of non sleeping bag users was 26.6 years, and of the mean age of sleeping bag users was 30.4 years.

**Table 11 Comparison of education between white British mothers who used an infant sleeping bag and those who did not**

Highest level of education	Mothers who used infant sleeping bags (%) (n=20)	Mothers who did not use infant sleeping bags (%) (n=27)
Higher education	5 (25%)	0 (0%)
Further education	11 (55%)	11 (44%)
Compulsory secondary education	1 (5%)	12 (36%)
No qualifications	15 (15%)	6 (20%)

The highest qualifications obtained by the sleeping bag users were higher than those of the non-sleeping bag users. Therefore, a higher level of education was a factor related to sleeping bag use.

**Table 12 Comparison of household income between white British mothers who used an infant sleeping bag and those who did not**

Income of mother's household (per annum) (where known)	Mothers who used infant sleeping bags (%) (n=18)	Mothers who did not use infant sleeping bags (%) (n=21)
£40,000+	4 (22%)	1 (5%)
£30,000-£39,999	1 (5%)	1 (5%)
£20,000-£29,999	6 (33%)	5 (24%)
£13,500-£19,999	3 (17%)	6 (29%)
<£13,499	4 (22%)	8 (38%)



The sleeping bag users had higher incomes. 86.9% of the sleeping bag users had jobs, while only 64% of those who did not use sleeping bags had jobs. The data in this section show that white British mothers who used infant sleeping bags were older, more educated, more likely to be working, and had higher incomes than the white British mothers who did not use sleeping bags for their infants. Therefore, sleeping bag users have a higher socioeconomic status than the white British mothers who did not use infant sleeping bags for their infants. It remains to be determined whether use of infant sleeping bags depends on affordability, preferred choice of bedding type, or influence from family or peers.

### **7.4.3 Explanations for using or not using infant sleeping bags**

Mothers' explanations for preferring infant sleeping bags involved prevention of bedding covering the baby's head, for warmth, and to stop the covers being kicked off by the infant. Although the manufacturers claim the bags help prevent SIDS by keeping the infants in a low insulation environment, they were more popular with mothers who were reassured their baby would stay covered:

“She has a bottom sheet on the Moses basket, then one of those sleeping bag things, 2 .5 togs. Winter and summer. She used to kick the sheets off” (Participant 12WB)<sup>29</sup>.

In some cases, mothers reported that health visitors had recommended that the mothers purchase the sleeping bags:

“In winter and summer she has a bottom sheet, and nothing else except her sleeping bag. The health visitor told me to get one so she wouldn't get overheated, so I did” (Participant 10WB).

In other cases the sleeping bags were received as a gift:

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<sup>29</sup> When I have quoted mothers I have also cited their participant number and whether they were white British (WB) or South Asian (SA).

“I used to have one of those sleeping bag things but she grew out of it. Someone gave it to me. I need to get another one” (Participant 26WB).

Reasons for not using infant sleeping bags were that the cost was prohibitive to buy a larger size once the infant’s feet reached the bottom of a bag that was given as a gift, or that the mother had not used one for the first child so didn’t see the need for one:

“I don’t use those sleeping bag things, they didn’t have them with my other two so I never got used to them. I think if they use them now they won’t want to sleep in a normal bed when they get older” (Participant 61WB).

Other mothers did not like them because the baby got twisted and frustrated in the bag, which the mothers perceived as being uncomfortable.

## ***7.5 Users of relatively low insulation from bedding and clothing***

### **7.5.1 Users of relatively low insulation**

Given that cold stress is a possible risk factor for SIDS (Dunne and colleagues 1986; Goldsmith and colleagues 1991; Lloyd 1986; Williams and colleagues 1996), it is useful to examine the data here relevant to the risk of cold. This section examines relatively poorly insulated infants on winter nights as a potential group of infants exposed to cold stress, such as those infants covered with insulation values of  $0.2 \text{ m}^2\text{KW}^{-1}$  (2 tog) or less. Although the true insulation value is likely higher than  $0.2\text{m}^2\text{KW}^{-1}$  because of the added insulation provided by trapped air, we can still treat this group as the lighter insulators, regardless of whether or not there is evidence this level of insulation is safe or unsafe. The insulation value of  $0.2\text{m}^2\text{KW}^{-1}$  is far less than the minimum safe insulation levels found by Fleming and colleagues (2006)<sup>30</sup>. It is also significantly less than the

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<sup>30</sup> Fleming et al. (2006) used different insulation for the infant bedding and clothing used by mothers in their study. They used togs, which can be converted to  $\text{m}^2\text{KW}^{-1}$ , but also produced a value for clothing based on percentage of the body covered and counted bedding as covering both sides of the infants. They also had different insulation values for the materials.

insulation provided by the 10+ tog ( $1\text{m}^2\text{KW}^{-1}$ ) duvets adults commonly use and find comfortable on cold nights. These relatively poorly insulated infants could well be too lightly dressed for the environmental temperatures in which they found themselves sleeping.

The above data appear to indicate that low insulation is used by mothers of lower socioeconomic status. In winter, 33% of white British infants were insulated with less than  $0.2\text{m}^2\text{kw}^{-1}$ . SIDS in Bradford is almost entirely limited to infants of deprived white mothers (Westman 2010). More white British mothers with lower socioeconomic status put less insulation and layers on their infants than the white British mothers of higher socioeconomic status. There was no significant group difference in insulation values between white British mothers who did not use infant sleeping bags and South Asian mothers in winter ( $p=0.492$ , MWU statistic =623.5) or summer ( $p=0.244$ , MWU statistic =497.5). There was a small statistically significant difference (where significance is less than  $p= 0.05$ ) in insulation use between white British mothers who did use infant sleeping bags and all South Asian mothers ( $p=0.02$ , MWU statistic =266.5) in summer, but for winter insulation there was a significant difference ( $p<0.001$ , MWU statistic =497.5). Lower insulation use for infants was a characteristic of most South Asian mothers, and was less linked to socioeconomic status. 74% of the first generation South Asian mothers put  $0.2\text{ m}^2\text{kw}^{-1}$  or less insulation on their infants on winter nights when colder outdoor, but not necessarily indoor, temperatures may have motivated the choice to use more insulation for their infants. However, there was no statistical significance found between first and second generation South Asian mothers' use of total insulation in winter ( $p=0.711$ , MWU statistic =305.5) or summer ( $p=0.991$ , MWU statistic =275.5).

### **7.5.2 Insulation used for infants underweight at the time of interview**

In Chapter 3, I questioned if low insulation may affect infant growth because of the competition for energy between growth and metabolic heat production. I questioned if infants that have to produce a lot of their own heat to keep warm because of a lack of insulation or heating may be at risk of being underweight. 5% of five-year-old children in Bradford are underweight (Bradford Observatory

2007). Information from other sources on underweight infants in Bradford was not readily available, whereas South Asian children's risk of obesity was (Bradford Observatory 2007). This focus on obesity may conceal a possibly significant group of underweight South Asian infants, whose normative feeding practices may even relate to obesity and food behaviour in later childhood. It is not uncommon to find overweight adults living in houses with undernourished infants (World Health Organisation 2010a). In my sample,<sup>31</sup> 4.5% of white British and 35.7% of South Asian infants were underweight at the time of interview. This was a higher percentage than would be predicted using any clinical reference charts on infant growth. This could be due to poor recall of the weight of infants at the time of interview. Indeed, 47% of South Asian mothers did not know the weight of their infant, compared to 14% of white British mothers. However, a few of the South Asian mothers reported that their GP or health visitor had diagnosed their baby as underweight and in need of treatment, whereas none of the white British mothers did, indicating that that underweight was more of an issue for the South Asian infants:

“Well the health visitor says she isn't healthy, she needs to be seen by a paediatrician because she is underweight and her head is too small to scale”  
(Participant 82SA).

More (30 %) of the underweight South Asian infants were breastfed compared to 22% of the normal weight infants. However, when adding together infants fed by both breast and bottle, the differences were less (50% underweight received some breast milk vs. 59.7% of South Asian infants not underweight. 60% of the underweight South Asian infants had first generation mothers compared to 33% of the normal weight infants. 40% of the underweight infants were born either

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<sup>31</sup> My data included the birth weight of the infant, weight at time of interview, weeks gestation when born, and age at time of interview. The new W.H.O. (2010) growth charts were used to determine whether the infant was underweight at the time of interview. Low birth weight was defined as a birth weight less than 2500 g and prematurity was defined as being born before 37 weeks.

low birth weight and/or premature, compared to 11% of the normal weight infants.<sup>32</sup>

The relatively high proportion of underweight infants in this sample facilitates exploration of the ways in which infant weight might interact with thermal care. The mean winter material insulation value for the normal weight South Asian infants was  $0.24 \text{ m}^2\text{Kw}^{-1}$  (2.4 togs) and  $0.27 \text{ m}^2\text{Kw}^{-1}$  (2.7 togs) for the underweight infants. The mean number of layers for normal weight vs. underweight South Asian infants was 3.5 and 3.6, respectively. Thus, there appears to be little difference between the two groups indicative of a relationship between light clothing and bedding and being underweight. About half the amount of insulation was given to the underweight infants ( $0.19 \text{ m}^2\text{Kw}^{-1}$ ) at the time of interview and low birthweight South Asian infants compared to the normal birthweight but underweight at time of interview infants ( $0.33 \text{ m}^2\text{Kw}^{-1}$ ). However, the data collected here are not sufficient to draw additional conclusions; future studies can further explore this association.

Low birth weight and premature infants have different thermal care requirements than normal birth weight infants. They have less brown fat for insulation and heat production, and their body surface area to weight ratio is higher, meaning they lose heat faster (Lyon 2006). Some of the mothers talked about how they were taught in the hospital to keep their infants warm:

“When she was in hospital they told me what to do. They told me how to keep the baby warm and check her temperature to see if they are too cold or too hot.” (Participant 97SA)

Some South Asian mothers were aware that vulnerable infants needed protection from the cold even in the summer:

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<sup>32</sup> South Asian mothers in Bradford have significantly ( $p < 0.0005$ ) more infants born with low birth weight than white British mothers, even with the same level of deprivation, but preterm birth rates were similar. (Bradford and District Infant Mortality Commission 2006).

“. . . She was very tiny because she was premature. It was quite cold this July and August. I had to make her warm and wrapped up and things like that . . . She sleeps with cotton gloves because her hands get cold easily” (Participant 97SA).

However, one South Asian mother of an infant born 10 weeks premature was “told off” by a health visitor for putting too many layers on her premature baby:

“My first born was 10 weeks premature and I had to be very careful about keeping her warm, she was always getting cold. She was born in August and when the health visitor came she told me off for having so many layers on her in the middle of summer on a hot day, but I felt I had to cover her up” (Participant P4SA).

Advice from health professionals to avoid letting infants get overheated conflicts with the thermal care needs of low birth weight and premature infants who do need to be kept warmer:

“Hospital people told me that if they have too much clothing they could suffocate or get too warm” (Participant 88SA [mother of twins, one born LBW]).

Despite advice to the contrary, many of the South Asian mothers with premature or LBW infants who needed extra insulation were ignoring health professionals’ advice aimed at SIDS prevention, and were making their own decisions about the thermal care requirements of their infants.

## ***7.6 Decisions about clothing, bedding, and other items providing insulation***

Although issues regarding the provision of insulation and layers have been explored above, it is useful to employ qualitative data to illuminate why mothers used different combinations of clothing and bedding at night. There were often specific reasons and rules behind mothers’ choices of clothing and bedding for infants.

### **7.6.1 Choices of bedding and clothing based on thermal properties of items**

Clothing was sometimes used to substitute for night-time heating. Clothing was adapted based on the type of bedding involved to achieve the right level of thermal care. For example, mothers sometimes chose long sleeved garments for their infants when using a sleeveless infant sleeping bag. Mothers took advantage of using several layers to adapt to changing environmental temperature, rather than using less but thicker clothing. Some mothers concentrated on putting sufficient clothing on their infant at night because they were sure any bedding or clothing would be kicked off:

“I have to keep him covered [with clothes] because he always takes his covers off – he either kicks or pulls them off” (Participant 85SA).

Whilst the theme of smothering came up in discussions about the infant sleeping bags because a few mothers feared their infant would slip under the covers, there was also a different concept of smothering that did not involve the airways being blocked by bedding or the mother’s body. There was a concept of “whole body smothering” by clothing and bedding that did not allow the skin to breathe or perspire:

“[On hot nights she has] footless pajamas so her feet are cool and can breathe” (Participant 43SA).

This explanation of “whole body smothering” is substantively different than the idea of suffocation resulting from the mouth and nose being blocked by material:

“If in bed he has no duvet on him, he likes sleeping bags, I am worried about a duvet going over his face” (Participant 6WB).

This illustrates another difference between lay and medical definitions. Whilst the medical concept of respiration refers to exchanging gases across the surface of the lungs, lay beliefs regarding respiration include the need to exchange heat as well as respiratory gases, hence the need for the whole skin to breathe and

lose heat. The concept of the skin needing to be free to “breathe” was therefore important to some of the mothers interviewed.

### **7.6.2 Choices of bedding and clothing not based on thermal properties of items**

Clothing and bedding decisions were not based solely on thermal comfort. Indoor and outdoor clothing restrictions were discussed by some mothers in the sample. For example, a hat was not supposed to be worn indoors. Similarly, a bus counted as an indoor environment, where location rather than temperature was an indicator for dressing behaviour:

“Sometimes I see babies like on a bus with a hat on. You’re supposed to take the baby’s hat off when you get on a bus aren’t you?” (Participant 46SA).

Another example of bedding or clothing choice not based on thermal properties was the use of gloves for scratch mittens, and for day use of sun hats. Some items were for the day only, whereas others were meant to be used only at night. An older mother talked of knitting a “bed cardigan” for her baby and her soon-to-be grandchild.

Comfort was also a consideration that could override thermal properties of bedding and clothing. The texture and feel of bedding and clothing was sometimes used for comfort and softness in the belief that infants would sleep better. Items such as pillows, toys, and apnoea mats were placed in the infant’s cot for purposes other than thermal care, but nonetheless these items could provide insulation and reduce air circulation around the infant, thereby reducing heat loss through evaporation and making the infant warmer:

“She also has a sleep position pillow to stop her rolling onto her side” (Participant 6WB).

Provision of bedding and clothing was also a way of expressing affection and providing protection for infants. A lack of clothing and bedding symbolised a lack of love, regardless of thermal needs:



“My mother-in-law tells me not to put so many clothes on him, but I feel it’s safer to have him covered up and it gives me ‘peace at heart’ that he’s nice and covered and he will sleep well and cosy” (Participant 4SA).

Swaddling is practiced not just for thermal care but because mothers believe swaddling makes the infant reassured and promotes better sleep (Franco 2005; van Sleuwen and colleagues 2007). Mothers who swaddle may be unintentionally keeping their infant warmer as a result. Swaddling has an impact on the infant’s ability to adjust its temperature through changing its position, inhibiting the ability to curl up to conserve heat and to spread limbs out to cool down, but mothers elect to swaddle their infants because of the capacity of swaddling to calm and soothe infants:

“My mum goes when he was born if I don’t wrap him up [swaddle him] he’d get scared because they like to be all wrapped up tight. But he doesn’t like it now, he’s happier when he can move his hands and move about” (Participant 86SA).

The infant’s ability to adjust his or her own temperature, even if only partially, cannot be overlooked. Infants are not entirely dependent on their caregivers for thermal care and are going through a transition throughout their childhood from being almost entirely dependent at birth to managing their own thermal care later on in childhood. That the infant may attempt to influence the thermal care provided to them is often overlooked.

### ***7.7 Infant’s agency: infant’s preferences***

In thermal care and SIDS prevention advice for mothers, there is rarely a mention about the infant’s influence over its own thermal care. In my study, mothers reported that they sometimes based their clothing and bedding decisions on their infant’s perceived preferences. They believed that an infant will, to some extent, express her thermal discomfort in an attempt to acquire assistance. This expression of need is necessary, because the infant’s capacity for thermoregulation takes months to mature (Wailoo 2003). Therefore, during the early months he or she is dependent on a caregiver for assistance in maintaining thermal comfort in a constantly changing environment, along with other vital forms of support (Hrdy

1999; Lawrence and Lawrence 2005). Several instances were recorded in which mothers expressed their interpretations of infant clothing and bedding preferences. For example, some mothers believed that their infants preferred pajamas to a Babygro, that they wanted the face covered, or that they wanted to sleep with something soft. In this section, I discuss bedding and clothing preferences of infants, as interpreted and expressed by their mothers.

Some mothers reported that their infants did not like having their feet covered, or that they did not like the all-in-one babygros or other excessive clothing:

“Babygro, he likes it, he won’t sleep in pajamas, he doesn’t like his feet being cold” (Participant 77SA).

Mothers also reported that some infants preferred to have a certain kind of bedding all the time, such as not being able to sleep without a blanket. Some mothers believed their infants would not sleep without a blanket, even if it was hot:

“Some babies like taking a blanket even if it is cold or warm” (Participant 100SA).

Others believed that infants preferred to be wrapped or swaddled in a certain way:

“She still likes to be wrapped, she likes that cosy feeling still” (Participant 29WB).

Infants demonstrated individual preferences for kinds of clothing by expressing irritability or by attempts to remove the clothing. For example, mothers talked about their baby not liking the tightness of clothing:

“Yes, I ask my sister why she puts so many layers on her baby. She’ll put tights on, and loads of clothes underneath, the little girl looks uncomfortable so I tell her not to put so many layers on her daughter” (Participant 11SA).

This mother was aware of her infant’s agency to express preferences and indicated that even though these preferences could be hard to change if not discouraged early on, she still gave in to her son’s preferences:

“I like to take his trousers off, he likes to be in just a vest and t-shirt. The girls say to me I’m giving him bad habits for when he is older, but he’s happy like that” (Participant 86SA).

It is not necessarily the mother’s imagination that leads her to believe an infant might want a cuddle blanket. Indeed, there may be a physiological and psychological basis for such preferences, as sensory stimuli such as smells on blankets have previously been shown to reassure newborns (Nishitani and colleagues 2009). Some mothers believed their infants were attached to a “cuddle blanket” and they allowed the infants to sleep with one irrespective of the thermal function of the blanket. During an interview in one mother’s home, there was an infant in a car seat on the floor in the lounge, holding onto a blanket. The mother talked about how attached she thought her infant was to that particular blanket:

“My mum says I should wash it, I do, she just doesn’t know that it looks like that because we’ve had it for so long. He likes to cuddle it and won’t go to sleep without it. I’ve tried putting something different on him but he won’t sleep” (Participant 76SA).

Four mothers believed a blanket (although not a particular blanket) helped the infants sleep, and all four of them reported that the infant would only sleep with a blanket they could pull over their eyes:

“I’ll check him and he’ll throw them off as he needs to. He holds onto one of them and kicks the covers off and holds the blanket over his face to sleep but it doesn’t cover his body” (Participant 21WB).

Other mothers placed a blanket on the infant’s face, believing he or she would not sleep otherwise:

“She won’t sleep if she doesn’t have the shawl on or something. She likes to have it on her face” (Participant 99SA).

The mothers also defended their infant’s preferences from family members who objected to the infant’s face being covered:

“So he’s used to being wrapped up, he won’t sleep unless his eyes are covered. I fight with them [family] about it and stuff and they take it off once he’s asleep” (Participant 86SA).

All of these mothers were aware that having the infant’s face covered was not ideal, but found their infants would not sleep any other way. This is a good example of how the infant’s agency is an important factor in thermal care decisions, and depicts the ways in which mothers consciously tolerate behaviour that they are fully aware could pose a risk to their infant’s life or health if they feel they cannot persuade their infant to accept a safer behaviour. Whilst it is hard to estimate the thermal impact of these objects on the infants, this is an illustration of the deterministic value of an infant’s agency, and how it can conflict with the decisions a mother might otherwise make.

## ***7.8 Discussion and conclusion***

Determining how much bedding and clothing infants are provided with at night is complex, given the variety of garments and materials used and how they interact with the infant’s intrinsic environment and the environmental conditions where the infant is sleeping. The complexity has been managed through focusing on a comparison between South Asian and white British mothers, and on insulation on the infant’s torso only. By comparing insulation values and layers of bedding, thermal care behaviour in the different groups can be observed. Winter and summer bedding values varied little for South Asian infants and more so for the white British infants. Winter bedding insulation was significantly higher among white British than South Asian mothers ( $p < 0.001$ ) which was also reflected in the significantly higher clothing plus bedding insulation values for white British mothers in winter ( $p < 0.001$ ) but not in summer ( $p = 0.181$ ). There was no statistical significance between clothing insulation values between the two groups in winter or summer. Clothing showed very little variation either between seasons or between groups, meaning there was more to be ascertained by focusing on bedding differences between seasons and between groups. The major differences in bedding are the result of the use of infant sleeping bags. Only one South Asian mother used a sleeping bag for her infant, and only in winter, so use of sleeping bags was nearly

exclusive to the white British mothers. White British mothers who used sleeping bags for their infants were using significantly more insulation in winter ( $p < 0.001$ ). The more educated, and potentially more SIDS-aware mothers, were higher insulators because of the sleeping bags. Lower income white British mothers tended to use lower levels of insulation for their infants and were less likely to use sleeping bags. South Asian mothers used relatively less insulation for their infants compared to white British mothers.

It is important to remember that lower or higher values for insulation used do not indicate whether an unsafe amount of insulation was used. There is insufficient evidence to predict what precisely is a safe or unsafe amount, as intrinsic and extrinsic factors unique to individuals make it impossible to prescribe a one-size-fits-all amount of insulation. Because of changes in environmental conditions and metabolic rate, it is unlikely that even on an individual level a particular amount of insulation can be prescribed. It is more likely that parents need to be responsive to these intrinsic and extrinsic changes, through judging signs of their infants' thermal comfort or discomfort through the night to assist their infants in maintaining thermoneutrality. Other factors must be taken into account. For example, mothers clothing their babies in less insulation may be compensated by leaving the heating on at night or having the infant in closer proximity to the mother as a heat source. This may be especially true for the South Asians, among whom bed-sharing is more common. If it seems that the white British infants have too much insulation on, we must consider that they are also more likely to be sleeping in their own room and the mothers may find they do not settle as easily unless they have slightly more insulation.<sup>33</sup> The results for the thermal environment in the home are provided and discussed in the next chapter. Greater variability was observed in the use of bedding than the use of clothing in winter and summer. Therefore, future research should focus specifically on differences in the use of bedding.

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<sup>33</sup> 39% of White British infants and 0% of South Asian infants slept alone in a room at night.

The number of layers used could be as significant as the clothing and bedding, because of the insulating properties of trapped air within the layers. The mean number of layers used was higher among white British mothers than South Asian mothers, which is explained by the popularity of the infant sleeping bags among white British mothers. This again contradicts the notion which was expressed by some of the white British mothers that South Asian mothers overwrap their infants. Mothers are rarely warned about the dangers of cold stress and SIDS, partly because there is a paucity of research on this risk and partly because of white British cultural beliefs about heat posing more risk than cold, as discussed in chapter 2.

Infant sleeping bags are becoming increasingly popular in the UK, a trend that came partly from Holland where up to 75% of infants slept in sleeping bags in the 1990's (L'Hoir and colleagues 1998). Some of the infant sleeping bag manufacturers claim their bags prevent SIDS by preventing overheating, making them a compelling item to buy for those who fear their infant could die from SIDS. One of the biggest manufacturers of infant sleeping bags in the UK, Grobag, has its products heavily endorsed by the charity Foundation for the Study of Infant Deaths (Grobag 2008),<sup>34</sup> giving parents the impression it is somehow a device that can protect their infant from SIDS (see appendix 19). There is currently no sufficiently sound evidence available to support or refute such a claim.

One of the requirements of the British Standard for infant sleeping bags is that the packaging displays information regarding the room temperature required

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<sup>34</sup> “grobag® is Foundation for the Study of Infant Deaths's recommended baby sleeping bag specialist, and grobag is proud to be Foundation for the Study of Infant Deaths's official partner. ... Joyce Epstein, Director, Foundation for the Study of Infant Deaths, said, ‘We are delighted to be working with the grobag® team in what is our fifth year of collaboration. Rob and Ouvrielle came to us for safety advice 6 months before they launched and we were pleased to help them - it was obvious that safety was one of their main concerns from the start’” (Grobag 2008).

for different tog bags (British Standards Institute 2009).<sup>35</sup> None of the advice in the British Standard included sleeping bag use when the temperature is less than 10°C despite the possibility of infants sleeping at night in the U.K. in an environmental temperature of less than 10°C. In a study of indoor temperatures at night in England, the homes studied had a 5<sup>th</sup> to 95<sup>th</sup> percentile range of 12.1-21.8°C when the outdoor temperature was +5°C (Oreszczyń and colleagues 2006). Some of the households in my study had no heating in the infant's bedroom, and when outdoor temperatures are lower than 5°C it is likely that some infants sleep in rooms that have temperatures much less than 12°C and less than 10°C, which is the minimum temperature for which there is advice available for appropriate clothing and bedding. Most research papers on indoor temperatures in the U.K. report mean indoor temperatures while outdoor temperatures are above 5°C. Data on the indoor temperatures for infant sleep environments are not readily available. This is partly because much of the relevant research is conducted in the field of fuel poverty, where overall figures are of more interest than extremes. However, because of the varying thermal needs of individual infants, in particular those who are newborn, LBW, or born prematurely, even indoor temperatures of 12°C could put these infants at risk of experiencing cold stress and subsequently SIDS, or respiratory infections which in turn can increase an infant's risk of SIDS (Moloney and colleagues 1999). Advice for safe bedding at temperatures below 10°C is needed, in addition to more research on exposure of children to room temperatures below 10°C.

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<sup>35</sup> The information that must be provided at point of sale includes the following: "The tog value of the product with the applicable room temperatures: NOTE The following measured tog values for children's sleep bags may be used as a guide: Less than 1.0 tog – room temperature 24°C to 27°C; 1 to 2 tog – room temperature 21°C to 23°C; 2 to 3.5 tog – room temperature 10°C to 20°C" (BSI 2009). There is no guidance for tog values above 3.5 or in room temperatures less than 10°C.

The data on safe tog ratings for different ambient temperatures in the British Standard for infant sleeping bags (2009) appears to be based on research conducted by Fleming and colleagues (2006) in Bristol. There are few research papers that stipulate such figures. As this paper suggests, 3-4 tog ( $0.3-0.4 \text{ m}^2\text{kw}^{-1}$ ) is the optimum insulation for an infant to maintain thermoneutrality at room temperature ( $23^\circ\text{C}$ ). Most of the South Asian and white British mothers (who did not use infant sleeping bags) used insulation that was lower than recommended in their study. These differences could have been due to the way the insulation and body surface area were calculated, so it is difficult to make a direct comparison. The British Standard advice implies that, with the help of these sleeping bags specially designed for infants, it is possible to use a precise sleeping bag and clothing combination for a particular room temperature and therefore ensure the infant is not exposed to thermal stress. British Standards are often a revered source of reliable recommendations for safe products, and in the case of infant sleeping bags it is a requirement that the materials and design conform to the standard BS 8510 (British Standards Institute 2009). More details about the thermal care recommendations and infant sleeping bags are provided in appendix 20.

Correspondence with the Knowledge Centre, which produces the British Standards, about the evidence base for their recommendations regarding safe insulation levels for infant sleeping bags revealed that they were unable to justify their recommendations with any further information than that stated in the British Standards document (British Standards Institute 2009). This was explained as being because the recommendations are the product of a consensus of an expert panel.<sup>36</sup> It seems that “this process gives them the strength and authority in establishing a set

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<sup>36</sup> “Standards are created by committees, the members of which are not employed by BSI. We do not have experts available to answer questions or interpret the standard on an ad hoc basis or even explain why a certain decision about content was made. As with all British Standards the text of BS 8510:2009 was arrived at by consensus through an extensive process in which the views of the experts on the technical committee are informed by consultation, research and public comment. This process gives them the strength and authority in establishing a set of common and reliable benchmarks on which all users can depend” (Gohil 2009, Pers. Comm. 10.11).



of common and reliable benchmarks on which all users can depend” (Gohil 2009, Pers. Comm., 10.11). Transparency and availability of evidence would allow a greater confidence in the standards. Without this transparency, the standards are being adopted blindly. Furthermore, no account is taken for the many possible variations of intrinsic and extrinsic factors for different infants and environmental conditions that would make this advice highly subjective.

Even without feedback from the Knowledge Centre regarding the evidence base for their standards, it is apparent that there is a limit to how much the British Standards can be relied upon because they articulate the insulation property of the material used for the garment but not other thermal factors, such as the closed design which is more efficient at retaining air warmed by the infant’s body. Fan (2006) and Parsons (2003) levels of thermal modelling measuring the tog of the garment material is the most basic level (level 1) for testing the thermal property of a garment, as opposed to the ideal of level 5 thermal modelling which would be a large scale study of infants in a real life setting. To provide greater evidence of the thermal effect of sleeping bags on infants, it would be ideal to achieve a level 5 type study involving a large-scale user trial. This is especially important if it is claimed that these garments are protective against SIDS if produced according to certain standards with the implication that they are life-threatening if not.<sup>37</sup>

Mothers who fear SIDS may be vulnerable to relying too much on recommendations, trusting that they are based on reliable, scientific evidence, and they may place less importance on their own judgements or observations regarding their infant’s thermal needs. Infant sleeping bags are part of a multi-million pound industry of “technical” or “functional” clothing. Technical clothing is claimed by

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<sup>37</sup> “Grobag is leading the way in safety for Baby Sleep Bags by meeting BSI’s new specification, BS 8510:2009, which details the safety criteria for all Baby Sleep Bags . . . The Gro Company has been involved in the development of this British Standard from the start . . . We firmly believe that Baby Sleep Bags are a far safer form of bedding for babies than traditional blankets and sheets, and that we have not only been instrumental in introducing them properly to the UK, but also making sure that those sold in the UK are safe and are used safely too” (Grobag 2010).

manufacturers to be technologically superior to other clothing, performing functions such as improved heat loss, wicking, maintenance of body temperature, etc. These “performance materials” claim to take over or enhance the body’s thermoregulatory capacities, yet the claims are not based on sound evidence. The infant sleeping bag is part of this movement to persuade consumers to buy products that promise to, in some way, take over the body’s own abilities to thermoregulate.

It is ironic, however, that the manufacturers of the infant sleeping bags promote their products on the basis that they are recommended by SIDS-prevention charities to guarantee a certain tog rating that is safe with regards to risk of SIDS. The sleeping bags in this study are providing more insulation than the blanket/sheet/infant duvet combinations, which contradicts the purpose of preventing SIDS through overheating. If cold stress is a contributory factor for SIDS (Dunne and colleagues 1986; Goldsmith and colleagues 1991; Lloyd 1986; Williams and colleagues 1996), then the white British middle class mothers may be unwittingly protecting their infants from cold stress through the use of infant sleeping bags, even though these mothers are actually concerned about protecting their infants from heat stress and SIDS. As almost all South Asian mothers used lower amounts of insulation on their infants, it is curious that white British mothers had the perception that South Asian mothers put too much insulation on their infants. This perception may have come from the white British mothers observing South Asian infants out in their communities:

“I don’t want to be you know . . . But I see a lot of Asian babies, all bundled up a lot. I see that a lot. I have picked up on that. I don’t know why they do it but I think the babies have too much clothing on” (Participant P61WB).

Outdoor, daytime dressing practices cannot be assumed to be the same as indoor, night-time dressing practices. The chances of white British mothers actually observing South Asian night-time bedding and clothing practices are slim, and hence the overdressing stereotype is likely to go unchallenged.

In chapter 3, it was hypothesised that cold stress could affect infant growth because of the competition between energy required for metabolic heat production

and growth. The results, although extremely limited for statistical purposes, presented in this chapter have shown that a larger proportion of South Asian infants appeared to be underweight, and almost all South Asian infants had lower amounts of insulation at night. Not all underweight infants had been born LBW or preterm, and thermal care behaviour was different among the mothers of LBW infants and the mothers of underweight infants who were born at a normal weight. The LBW underweight infants were given little clothing and bedding on winter nights, raising questions about competition between metabolic heat production and energy needed for growth. Health professionals discouraged mothers of LBW infants from putting too many layers on their infants, despite the fact that these infants need to be kept slightly warmer than normal birthweight infants. The mothers of normal birthweight, underweight infants put a lot of bedding and clothing on their infants at night. Reasons for this could include that they were confusing their infant's cry for feeding with a cry due to cold, and that they were providing more bedding at night instead of providing a night-time feeding. However, whether these infants were underweight because of their thermal care cannot be established with the small number in this sample. Further research is required to test this hypothesis.

The above question about potentially cold stressed South Asian infants is an excellent example of how more than just clothing and room temperature must be considered when estimating how warm or cold an infant might be at night. The lower insulation used by most South Asian mothers may have been compensated for by warmth acquired through close proximity of parents or siblings sharing the infant's bed. Whilst bed-sharing was more common among the first generation (25%) than second generation South Asian mothers (17%), heat provided by bed-sharing does not explain why more first generation mothers used a lower level of insulation. The difference between the two generational groups could be because of cultural adaptation of infant care practices to different environments, with the acquired infant care beliefs of the first generation mothers adapted for a much warmer environment. This may have occurred because the consequences of putting too much clothing and bedding on their infants was outside their known norms for bedding and clothing use, and they may have been wary of putting too much insulation on their infants. This would only be the case if the mothers were not also

looking for cues from the infant to help them judge if their infants were too hot or cold with the mother's chosen clothing and bedding.

Could exposure to cold stress be putting the deprived white British infants at greater risk of SIDS? From these data, a link between cold stress and SIDS is suggested but cannot be firmly established. There is no logical link between the choice to use fewer layers and a lower level of income. However, because SIDS cases in Bradford occur almost exclusively among infants whose mothers are white British and of lower socioeconomic status, this link is worth exploring further in future research.

Decisions about clothing were not always related to environmental temperature. The location of infants affected the decisions about clothing use. Other factors which affected mothers' decisions about infant clothing included the need for comfort, the fear of smothering, the ability of clothing to provide affection and comfort to infants, the time of day, and the choice to use clothing for non-thermal purposes, such as using socks for scratch mitts.

The fact that infants acts as negotiators of their own thermal care is almost always overlooked. Mothers reported that their infants displayed specific preferences, and they believed these preferences were strong enough to persuade mothers to alter the thermal care practices they would have otherwise chosen. Some of these preferences, such as sleeping with a blanket over the face, were known to pose risks, but the mothers felt they had no choice because the infant would not sleep otherwise.

This chapter has demonstrated that infant clothing and bedding use varies between white British and South Asian mothers, and has explored maternal reasoning behind clothing and bedding decisions. This contributes to an understanding of variations in the thermal care of infants, and illustrates how difficult it is to predict the night-time thermal environment in which infants sleep.

# Chapter 8 Results: Environmental conditions

## *8.1 Introduction*

This chapter assesses the extrinsic thermal conditions of the infant's home environment. The evidence presented in chapter 3 revealed that, in addition to bedding and clothing, there were several other factors relevant to the infant's thermal environment, such as air temperature, air velocity, insulation, metabolic rate of the infant, and humidity (British Standards Institute:2007:2-4). As discussed in the methods chapter, this study has neither the scope nor aim to gain precise measurements of such factors, such as those obtained by studies of the micro-environment of infants in incubators (Knobel 2006; Yon 2006; Simbruner and colleagues 2005; Telliez and colleagues 2004). However, it is essential to consider the extent that environmental factors play in the thermal care of the infant alongside the use of clothing and bedding explored in chapter 7. Below are the results related to extrinsic factors including air temperatures, heating, humidity, and ventilation. The differences in the extrinsic environment are useful to take into account when considering how much bedding and clothing is appropriate for different infants or different groups.

## *8.2 Heating*

### **8.2.1 Type of heating**

Although most homes had central heating (94% of South Asian and 92% of white British mothers), one household did not have any heating of any kind. 8% of South Asian and 14% of white British participants said they did not have central heating in the room the baby slept in and were using convection heaters, storage heaters, or nothing. Increasing fuel prices were affecting decisions over use of heaters. A typical comment was: "I used to put an electric heater on in the baby's room to keep him warm, but then we got an electricity bill for £600 so I've stopped doing that now" (Participant 11SA).

Three South Asian infants slept in rooms with no heating at all, however all but three slept in the same room as their parent so nearly all would have had some supervision if they became too cold at night. One of these infants slept in the same bed as the mother and would have received warmth from her body. Two had more winter insulation (0.29 and 0.21 m<sup>2</sup>kw<sup>-1</sup>) than usual (0.10-0.19 m<sup>2</sup>kw<sup>-1</sup>) for South Asian infants. This suggests mothers increased the clothing and bedding to compensate for the lack of heating in these infants' rooms.

### **8.2.2 Could they keep the house warm enough?**

Another indication of infants' potential exposure to cold stress, or mothers' need to keep the infant warmer, was how difficult mothers felt it was to keep their houses warm during the winter. 82 % of white British mothers felt they could keep their house sufficiently warm during winter compared with 55% of South Asian mothers. 60% of the South Asian mothers who felt they could not keep their house warm enough were first generation. It is therefore possible that they might be having trouble getting used to a colder climate, having recently arrived from Pakistan. The mean insulation values for winter clothing and bedding for first generation South Asian mothers was 0.18 m<sup>2</sup>KW<sup>-1</sup> which is slightly lower than the South Asian mean of 0.21m<sup>2</sup>KW<sup>-1</sup>. The mean for number of winter layers used by these mothers was 3.6, which is only slightly above the mean for South Asian mothers of 3.4. Therefore, the difficulty in keeping the house warm was not compensated by South Asian mothers using more insulation or layers.

Absence of a heating system in the infant's room, or even house, in addition to considerations of cost meant that some mothers were not heating their infant's rooms as much as they would have liked to do. This might have encouraged them to substitute ambient heating with extra insulation for their infants, or it might have exposed infants to unnecessary cold stress. It is possible that some of the first generation Pakistani mothers felt more comfortable with a very warm house, and so second-generation Pakistani mothers were brought up in very warm houses. Another consideration is whether the participants had any control over their heating. Where mothers lived in a multi-generational house where others had a variety of different thermal needs and priorities, there were fewer choices to

modify the infant's thermal environment. A recently married Pakistani mother would have a lower status than elder sister-in-laws, her mother-in-law, and most of the men in the house (Shaw 1988), so would not always be able to choose how much or little heating was on because of her the lower household status.

### **8.2.3 Thermal Properties of houses**

The thermal properties of houses are relevant to clothing and bedding use because the difficulty in keeping the house warm or cool enough will affect the infant's thermal comfort. Mothers noted different thermal properties of their houses. This determined how difficult it was to maintain warmth in the house irrespective of the heating.

“The windows are open in the summer but because it is a naturally cold house I don't need to open them much” (Participant 26WB).

The mothers noted that single glazing made it hard to heat a house, whereas double glazing could make it too warm. Comments on the general tendencies of a house to be easy or hard to keep warm or cool were, for example:

“It's a small house so it's quite easy to keep warm” (Participant 79SA).

Mothers noted the differences between attic rooms and the rest of the house, and some would not even call these a bedroom:

“We are decorating at the moment so everyone is sleeping in the attic room. It is very hard to keep the room warm. It's easier to keep the bedrooms warm” (Participant 1SA).

Absence of any heating system was normally temporary, although this could still mean they went for a whole winter without heating. Some of the South Asian families lived in terraces knocked together with a number of different generations living in the houses, each with differing thermal needs and preferences.

### ***8.3 Heat loss through evaporation and convection (air flow)***

This section looks at the infant's potential heat loss through evaporation and convection. Information on how much ventilation infants experienced whilst sleeping was obtained by asking whether windows and doors were open or closed and how draughty mothers thought the infant's room was. The use of oils and moisturisers on the infant's skin is also relevant to this section because oils slow down the evaporative heat loss of the infant (Fernandez and colleagues 1987).

#### **8.3.1 Windows**

There was little difference between the two groups in terms of windows being open, partially open, or closed on summer and winter nights. On winter nights, there was a small number in both groups (8% and 9%) who left the window partially open at night. On summer nights, 95% of South Asians and 90% of white British mothers left open the window of the room where their infant slept, either partially or completely open. However, there were many reasons why the windows were left open or closed, not all of the reasons being for thermal care.

Mothers cited the following as reasons for keeping windows open: to cool the room down; open in the daytime only and for fresh air (i.e. clean air rather than cool air). Windows were closed to keep dust from the street out, and to keep noise from the street out. Windows were also closed because the window was too big to leave open or because the baby slept close to the window. Windows were closed because of a fear children might fall out of an open window, and fear property or even the baby might be stolen.

One mother had the windows open on winter nights because she felt her baby was always hot, irrespective of the weather:

“He gets very warm, even in the winter, that's why I have to keep the windows open” (Participant 22SA).



### 8.3.2 Doors

In contrast to the windows, there was a difference in doors being left open or closed between the two groups and a difference between summer and winter nights. More South Asian than white British infants slept in a room with a closed door in both winter and summer. On summer nights, 41% of the South Asian infants' doors were completely closed compared with 22% of white British infants. 16% of South Asian infants' vs. 38% of white British infants' doors were completely open on summer nights. 90% of the white British infants who slept alone had doors that were either partially or completely open compared to 64% of the white British infants who slept in their parent's bedrooms.

More South Asian than white British mothers (63% vs. 26%) had the door of the infant's room completely closed on winter nights. This suggests doors could be having more of a heat-conserving effect on the South Asian infants during winter. Doors were also closed to keep dogs and cats out, for privacy in multi-generational households, or to keep light out of the room.

"I would never leave the doors open at night. My husband is very light sensitive and wakes up very easily with the smallest bit of light" (Participant 41WB).

Doors were kept open for night-time supervision of other children where the infant slept in the same room as the mother:

"I have to leave the door open a bit so I can hear the other two" (Participant 29WB).

Doors were also left open because a mother's older children were scared of the dark:

"All our bedroom doors are open. I don't know why but my daughters won't sleep with the door shut. I think it was because when they were young they were scared of the dark, I used to leave the hallway light on and the doors open. Now they got used to it and can't sleep with the door shut" (Participant 86SA).

Some very consciously had the door open for ventilation in summer:

“Her room is where the sun goes down so we keep the door open in summer to cool the room down a bit” (Participant 66WB).

There were thus a multitude of reasons why doors and windows were kept open or closed that could override decisions about thermal comfort.

### **8.3.3 Is the room draughty?**

26% of South Asian and 6% of white British mothers said the room where their infant slept was draughty. This is another indication that some infants are more exposed to heat loss from conduction and evaporation. Mothers may or may not decide to compensate for this by adding extra insulation.

### **8.3.4 Use of oils and creams**

Apart from bedding and clothing, oil was a common insulator for the infant, although this insulation value was not the primary intention. Fernandez (1987) explains how oils can help an infant stay warmer through reducing evaporative heat loss. Oils and moisturisers were used by 68% of South Asian and 55% of white British mothers. Oils and moisturisers were used for eczema or dry skin, as a massage oil (baby massage classes are likely to be making baby massage oils more commonly used), and in bath water and applied after a bath.

“I have to put creams on her every night because of her eczema” (Participant P43SA).

“He’s always had dry skin so I had a cream for him but I always use a moisturiser anyway” (Participant 30WB).

## **8.4 Humidity**

8% of South Asian and 2% of white British mothers said that the room the infants slept in had a damp problem. This was something about which the participants did not feel they had much control. One (white British) mother was taking her landlord to a small claims court because of the serious damp problems in her flat and her infant’s room, but had no solution in the foreseeable future.

Another (South Asian) mother was very concerned about it but did not know what

to do about it. Increased humidity makes it harder for an infant to retain heat when it is cold and to lose heat when it is warm. Damp housing has been explored as a possible contributory factor for SIDS because of toxins on mould spores being inhaled, observed in some infants living in damp conditions and causing pulmonary haemorrhage (Etzel 2007). Damp housing is associated with low-income families, as is SIDS. Links have not yet been explored with thermal impact on infants, especially with regard to SIDS.

### ***8.5 Conclusion to environmental conditions***

This chapter demonstrates the variety of environmental factors affecting the infant's thermal comfort that the mother may or may not have any control over. Air flow, humidity and environmental temperature are factors that vary widely between different types of houses. The modification of these factors, such as curing a damp problem, might not be under control of anyone in the household, or there might be a conflict of priorities and needs within the household. In addition, modifications such as opening or closing doors have other implications such as for safety and supervision of other children. The environmental conditions in which infants sleep are relevant to their thermal care, and therefore it is important to understand what choices mothers make, and are or are not able to make, in adapting this environment to the infant's needs. Lone sleeping infants were not only in a different thermal environment to South Asian, co-sleeping infants, but also to many of the white British sleeping infants in terms of environmental conditions and supervision of thermal comfort.

Most homes had central heating, but this did not always extend to the room where the infant slept. Some infants' rooms had no heating at all. More white British than South Asian mothers felt they could keep their house warm enough during the winter. First generation South Asian mothers in particular found it hard to keep their houses as warm as they would like. South Asian mothers had more concerns about keeping their houses warm, and three South Asian infants slept in rooms with no heating at all. The mothers did not appear to compensate for this by increasing the clothing and bedding for their infants. The mean insulation values

for winter clothing and bedding for first generation South Asian mothers was  $0.18 \text{ m}^2\text{kw}^{-1}$  which is slightly lower than the South Asian mean of  $0.21 \text{ m}^2\text{kw}^{-1}$ .

Apart from uses of oils and creams, heat loss through evaporation and convection was something that was not always in the control of the mother regarding ventilation of the infant's room. Other priorities can override thermal considerations, such as keeping doors open to hear other children, or doors closed for privacy,; to keep pets out, and to make the room darker. Ventilation was reduced by keeping windows closed to keep traffic noise and pollution out and for fear of the child being harmed by an intruder. The differences in ventilation from open windows was obviously thermally motivated since the windows were open more on summer nights, but there was little difference between the two groups. It is possible however, that keeping doors open or shut was more thermally motivated among the South Asian mothers. 63% of South Asian mothers had the infant's door closed on winter nights, compared to 41% on summer nights. There was less variation with the white British mothers, with 26% having the door closed on winter nights and 22% on summer nights.

In addition, many of the white British infants (39%) were sleeping alone in their own rooms on cold nights and were more likely to have their door open than the co-sleeping white British infants. These lone sleeping infants were not benefiting from the body heat and respiratory heat of other family members sleeping in the room. They were also less accessible for all-night monitoring of temperature. Therefore, the lone sleeping infants were at greater risk of cold stress because of heat escaping, higher air velocity, and lack of body heat from room or bed companions. Leaving doors open to hear if the infant is in discomfort may be counter-productive, because the infant may get too cold with the door open and then cry due to discomfort. Having the infant in the same room as the mother allows the heat to be retained and the infant to be supervised.

The questions about doors and windows being open or shut at night revealed that there were other priorities competing with ventilation solely for thermal care concerns. South Asian participants would have less need to leave doors open to

hear older siblings in other rooms because of a preference of having children at least up to primary school age sleeping in the same room. One South Asian participant who lived with just her husband, baby and toddler in a four bedroom house all slept in the same room, showing that some families sleep in the same room by choice and not necessarily because of overcrowding. Attitudes towards 24 hour care of children, and cultural beliefs regarding whether an infant should sleep in the same room as the parent or sleep alone (DeLoache 2000; McKenna 1996), may partly explain this difference and may also explain why South Asian mothers closed doors at night since all family members were together. Maintaining optimum room ventilation for thermal comfort by opening or closing doors and/or windows was not always an option, but clothing and bedding was still a variable over which mothers had control.

There was little difference between the South Asian and white British mothers in how often their windows were open, but during winter months more South Asian infants slept in rooms with closed doors. This difference could be explained by the South Asian mothers trying to keep the room warmer, and the white British mothers wanting to hear an infant that sleeps in a different room to the mother. The lone sleeping white British infants may be at more risk of cold stress because of added ventilation from open doors at night. Considering all these factors, a mother's intention to provide ideal thermal conditions for her infant may be complex, difficult to manage, and at times completely outside her control.

Use of oils and moisturisers was common among both groups and would contribute to retaining heat through reducing heat loss through evaporation of sweat. Some infants were sleeping in rooms with damp problems, subjecting them to several SIDS risk factors such as inhalation of moulds, pollutants, and pathogens, as well as challenging the still immature thermoregulation of young infants by making it harder for them to lose heat when it is hot and retain heat when it is cold.

The results show us that the thermal environment of the infant at night can be complex. These complexities have to take into account ambient temperature,

ventilation, and humidity. They are factors that are constantly changing over the course of the night and day, and are taken into consideration by the mothers when they assessed the thermal conditions of their infants. The mothers were not necessarily in total control of the conditions, as they may have had inadequate access to heating, problems with damp or draughts in the house, they may not have been the decision maker for paying and controlling the heating, or they may not have been sleeping in the same thermal environment as the infant all night to be able to judge if it was adequate.

This chapter has demonstrated how many variables there are in the environmental conditions of where infants sleep and how many competing priorities there are in the modification of a given environment. Simplistic advice to provide specific infant sleeping conditions related to room temperature may ignore many of these competing factors and may not be appropriate for individual infants. Likewise, it may not be possible for the parents to achieve specific conditions within their individual circumstances and housing conditions. This is further evidence that infant thermal care should be more tailored towards the needs of the individual infant in their own particular environment, paying greater attention to the infant's expression of thermal comfort or discomfort in the provision of appropriate and healthy thermal care for that infant.

# **Chapter 9 Interpretation of the infant's Temperature and thermal comfort**

## ***9.1 Introduction***

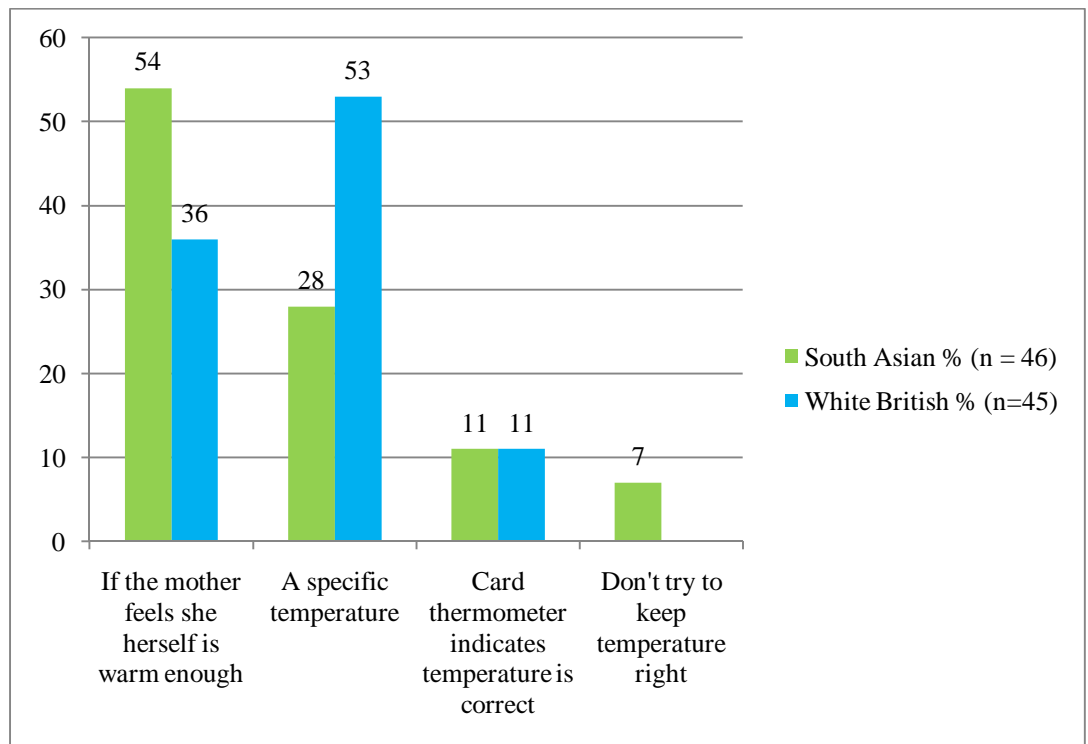
This chapter explores the different ways mother determine if their infants are too hot, too cold, or in any way suffering thermal stress. Rather than just relying on devices to assess skin or room temperature, mothers use a complex range of judgements to assess their infant's thermal comfort. Section 9.2 explores how mothers judged whether the room temperature was adequate for their infants by using thermometers or by judging the room temperature without instruments. Section 9.3 explores how mothers judged the infant's temperature by using or not using instruments. Section 9.4 covers the infant's expressions of their own thermal needs to their mothers or caregivers.

## ***9.2 Judging room temperature***

### **9.2.1 Methods of judging room temperature**

Figure 17 below indicates how mothers judged if the environmental temperature was adequate for their infants.

**Figure 18 Showing method of judging room temperature**



The main method for judging temperature used by white British mothers was aiming for a specific temperature using a thermometer. The second most common method involved relying on what the mother “felt was right.” The main method for the South Asian mothers was to go on what they “felt was right” and the second most popular method was to use room thermometers.

### **9.2.2 Possession of thermometers**

Possession of thermometers did not necessarily imply that mothers were using them. Some of the thermometers were given as presents, especially the card room thermometers which were given to almost all new mothers by health visitors.

53% of South Asians and 74% of white British mothers had a thermometer. Possession of card thermometers was about the same for both groups. 35% of the white British and 12% of South Asian mothers had an electronic thermometer. Among South Asian mothers possession of a digital thermometer in the South Asian group appeared to be related to education rather than income since 80% of



these mothers had a degree or higher qualification, whereas only 18% of all South Asian mothers had a degree or higher.

Possession of electronic thermometers among white British mothers appeared to be income related, with 64% of them reporting an income of £30,000 or more whilst for the whole group only 24% had this level of income. The most commonly cited thermometers were those already included in baby monitors.

More people possessed card thermometers, which was unsurprising as they are commonly given out by local child safety equipment schemes, by health visitors, given free with baby products, or with the bounty packs given to new mothers in hospital. The popularity of these give-away schemes among health professionals is surprising given that their efficacy has not been proven.

### **9.2.3 Optimum room temperature**

28% of the South Asian and 53% of the white British mothers aimed for a particular room temperature for their infant's sleep space. When asked what temperature they tried to aim for, some gave precise temperatures whereas others gave a temperature range. Whilst there were a couple in both groups who specified a particular temperature even though they had also reported that they did not possess a thermometer, most of those who specified temperatures did possess a thermometer. The average temperature given by South Asian participants was 19.7°C and by the white British mothers 18.7°C. Although there were slight differences between the groups, neither exhibited extreme attitudes towards optimum temperature.

Comparing possession of thermometers with method of judging temperature in Figure 18 shows that despite possession of thermometers, many mothers still relied on their own thermal comfort to judge an adequate room temperature for their infant.

Thermostats for central heating may also have been used to obtain the correct temperature. 70% of white British mothers and 43% of South Asian mothers said

they had a thermostat. One white British mother had every room controlled by a thermostat.

#### **9.2.4 The ‘infant care product’ industry**

Alongside the promotion of other infant care products, such as infant sleeping bags to help prevent overheating and SIDS, infant thermometers are often promoted as a way to monitor recommended room temperatures. Several products exist that are specifically designed with infant thermal care in mind. Some of these are high tech, some of them are incorporated into baby room monitors, and some of them are simple card thermometers.

It is evident that many mothers are using non-technological methods to judge the appropriate room temperature for their infants. Some made no use of thermometers at all whereas others were using thermometers in addition to seeking other signs of thermal stress in their infants. Reliance on judging the room temperature by “feel” was potentially problematic where the infant slept in a different thermal environment due to direction of room in relation to sun, size, ventilation, efficiency of heating, etc. Furthermore, the mother’s capacity to evaluate room temperature could be affected by an altered physiological state due to alcohol consumption (Freund et al 1994) or illness, impairing her normal judgement. In addition, infants often have different experiences of thermal conditions than their mothers, even when the two are located in the same room (Ball 2002).

#### ***9.3 Mothers’ interpretation of infants’ thermal discomfort***

Aside from assessing room temperature and environmental conditions, looking for physical and behavioural signs from the infant was a common approach to judging the infant’s thermal needs. Several physical and psychological signs were used by mothers to assess the thermal comfort of the infant. There were several immediate indicators the mothers were using to determine whether their infants were too hot or too cold. These included not sleeping, being irritable, crying, red skin, blue skin, temperature of extremities, thorax or neck, breathing affected, itching, rashes, and kicking covers off.

### 9.3.1 Skin colour and temperature

The skin looking blue was an indication that the infant was too cold or was in thermal discomfort:

“She’d cry, I feel her hands through the night and if her hands are cold I put a blanket on her” (Participant 101SA).

But one mother, a GP, did not believe blue hands indicated harm:

“And people comment ‘ooo, she’s got purple hands, she’s cold.’ No, actually she’s really warm, she’s just got purple hands, that’s just an old granny’s tale that purple hands means she’s cold” (Participant 63WB).

Overall, though, surprisingly few people mentioned the infant’s skin feeling cold as an indicator of the infant being cold. There was a difference between where on the body South Asian and white British mothers would check their infants’ temperatures. The South Asian mothers, when touching the skin to judge the infant’s temperature, would touch the extremities:

“I’d check if she got too cold, check her ears, feet, hands. If she got too cold I’d put an extra layer on so she didn’t get flu” (Participant 43SA).

The white British mothers would touch the baby’s stomach or nape of the neck:

“I would check his chest to see what temperature he is, his chest not his head” (Participant 63WB).

The part of the body checked for thermal stress could make a difference to when thermal stress is detected because an infant with cold hands may be beginning to suffer cold stress whereas an infant with a cold chest will be severely cold stressed (Parsons 2003). By checking the extremities, the South Asian mothers would be able to detect thermal stress before the core temperature was affected. As mentioned above, having cold hands and feet does not mean the infant’s core temperature is in any way affected, and depending on the individual, the infant may not actually feel any discomfort. The white British mothers were more concerned about the core temperature being abnormal, and were not detecting thermal stress

or discomfort before a drop in change in core temperature occurred. The difference between the two methods is that the South Asian mothers were checking for thermal stress which would precede an abnormal core temperature, and the white British mothers were not detecting thermal stress in the absence of an abnormal core temperature. The South Asian mothers might therefore be able to prevent any of the adverse consequences of thermal stress and might be more able to provide thermal care that is finely tuned to the maintenance of balance. Note also that Participant 101SA quoted above, a South Asian mother, did not only rely on her infant expressing thermal discomfort through crying but checked her infant's extremities through the night, indicating that she was providing 24-hour supervision and not only responding when the infant woke her up at night. By checking the infant before he or she wakes up, she has the capacity to detect thermal stress even before it has resulted in waking the infant. Consequently, not only are nearly all of the South Asian infants in my sample co-sleeping with their mothers, making it easier for the infants to alert their mothers to thermal stress during the night, but there is evidence that South Asian mothers are proactive in their detection of signs of thermal stress throughout the night, even when their infants are asleep. Therefore, they may be more able to detect and correct thermal stress much earlier than a typical white British mother, whose infant sleeps alone in a room and needs to cry to wake his or her mother, and after doing so has only his or her core temperature checked. white British infants, especially those who do not co-sleep, may therefore be at greater risk of suffering undetected thermal stress.

### **9.3.2 Mothers comparing their own thermal comfort to that of their infant's**

When a mother judged the thermal environment based on how she felt, some mothers believed their babies would feel exactly the same as they did. They only adjusted insulation or environmental temperatures when they themselves were uncomfortable.

“If I feel hot or cold the baby must too but the baby can't talk” (Participant 71SA).

There was an awareness that the infant might actually be in different conditions than the adult. Some mothers had noted babies they had seen in pushchairs barefoot in the cold and without blankets. They thought this was because the infants were experiencing different conditions than the adult pushing the pushchair. The adult was active whilst the infant was lying motionless, exposed to more of the elements. The following conversation involving the White British mother and grandmother of an infant in the sample illustrates this point:

Mother: “Like you see them with no bonnet on or no blanket and you think they must be cold.”

Grandma: “Like there was this tiny baby the other day [October/chilly wind/sunny] that must have been . . . :

Mother: “. . .about a month old.”

Grandma: “About 2-3 weeks old, you know, just a tiny baby and all it had on were a babygro.”

Mother: “No blankets or hats or anything.”

Grandma: “And it were chilly on Monday even though it were bright, the poor thing must have been freezing. They’re not like us, walking around they’re laid flat like that [points to her baby granddaughter].”

(Participant 69WB, interviewed in the month of October)

Others believed their infants felt the cold more than adults, or found it harder to adjust to extremes. In such cases mothers tried to intervene, taking these differences into account. One white British mother said she had heard the baby needed a layer more than adults, but found her baby was happy with the same number of layers as the adults. There was awareness of different reasons why an infant would not feel the same as an adult:

“She tends to get warm and cold quicker than us” (Participant 87SA).

Some mothers also understood that the differences in the baby's body proportions meant that body heat can be lost more easily from the infant's head and that the infant cannot retain heat as easily:

“Yes the other day there was this little baby up at the school and it was quite chilly. They only had a babygro on her and my mum said, ‘I’m cold, can you imagine how that baby feels?’ Cos they’re only little aren’t they? And they can’t keep their heat in. If we feel it they can feel it” (Participant 29WB).

In the case of the mother with the infant in a pushchair, the mother was more active than the infant because she was walking and the infant was lying still. Therefore, the infant and mother could be experiencing very different thermal environments and hence have different responses. If the mother only uses how she feels to judge the infant's temperature, she is unlikely to consider whether her infant may be feeling cold if she does not feel cold.

Mothers also reported that there was a need to pay more attention to getting the environmental temperature right for a baby because it needed more help keeping warm, or was more susceptible to thermal stress than adults:

“I see people with too little clothing on their babies, like no blanket. Just because it’s warm for us doesn’t mean they feel warm” (Participant 15WB).

There was also an awareness that one infant may be different from the next. No assumptions could therefore be made about how much insulation all infants needed:

“Every baby is different and every person is different so you can’t tell them what to do” (Participant 51WB).

### **9.3.3 Infants with special vulnerabilities to thermal stress**

Some infants were regarded as especially vulnerable to thermal stress, even compared to other infants. These extra-vulnerable infants included those who were recently circumcised, first born, underweight, low birth weight, premature (these infants were seen as needing extra help keeping warm and as extra vulnerable to

respiratory infections), and infants with siblings who were premature or ill when born (which made the mother nervous that her next baby would be equally delicate).

“She was born early so she’s prone to colds. She always has a cold, so I keep the heating on for her. Even in the summer I’ll put the heating on for an hour or so so she doesn’t get too cold” (Participant 26WB).

One of the perceived vulnerabilities to thermal stress was being asthmatic:

“My oldest one has asthma and it’s scary. He’s the first in the family to have asthma, not me or my mum or my husband’s family. That’s why it’s so important. I put a jumper and thick trousers on him [the baby], but I don’t put too much clothing on him. The health visitors tell me to not put so much clothing on him, but you know [shrugs shoulders], you’ve really got to put clothes on him. Especially him [older child], he was my first born you know. You’ve really got to protect them” (Participant 33SA).

Other infants who were seen as being especially vulnerable to thermal stress included those who had previously had fits or high temperatures and/or were considered to have a “weak constitution.” Being born in a warmer climate was also seen as contributing to vulnerability to cold stress by one first generation South Asian mother:

“I only open the window a bit in the summer because my little boy has problems with his chest because he was born in Pakistan and is not used to the cold here” (Participant 92SA).

Therefore some mothers, especially the South Asian mothers, were taking an individual approach to assessing their infant’s vulnerability to thermal stress.

#### ***9.4 Infant’s expression of thermal stress***

No research was found that evidenced the infant’s agency in influencing his or her own thermal care. Because maintaining an adequate body temperature involves both physiological and behavioural thermoregulation, it is logical to

expect infants to be born with at least some behaviours that alert caregivers to the infants' thermal needs. Even from birth, maintaining a healthy body temperature is essential to survival, so we should not be surprised to find the infant has the capacity to express his or her thermal needs. For that reason, the infant's agency in negotiating thermal care should be explored alongside research on the behaviour of caregivers in relation to thermal care. My results revealed several ways that the infant's agency was interpreted by mothers and how infant cues influenced their thermal care decisions.

#### **9.4.1 Infant's expression of thermal discomfort**

One of the most common observations mothers made regarding the infant's agency in alerting the mother to thermal discomfort involved infant crying or irritability. Terms used by mothers to describe these cues included crying, screaming, being uneasy, fidgety, uncomfortable, irritated, whinging, frustrated, restless, cross, plays around in sleep, and cranky. Crying was mentioned as a response to infants being too hot or too cold, whereas the other terms were used specifically when the infant was judged to be too hot. This illustrates how mothers distinguish between heat and cold stress by interpreting their child's behaviour. Mothers perceived that infants express heat stress differently than cold stress. According to the mothers in this sample, a heat-stressed infant is more likely to show restlessness, irritation and crying:

“He likes to be snug, but if he gets too hot he gets cranky and sweaty so I want to keep him happy” (Participant 69WB).

A cold-stressed infant was thought to just cry:

“I wouldn't be so worried about him getting cold. He might cry that's all” (Participant WB).

Because an infant who gets too hot becomes irritable and restless, it is possible that this combination of behaviours is sufficiently persuasive that mothers respond promptly. The South Asian mother below demonstrates how persuasive the protests from her overly hot infant were:



“If he gets too warm it irritates him and he doesn’t like that. Like when we were at my mums, he was sleeping and she put a towel on him and a pillow on that. He slept and after 20 minutes he was screaming and his face was really red. I said to my mum ‘Look, he’s too hot with that on.’ I like to take his trousers off, he likes to be in just a vest and t-shirt . . . Once or twice that he has been warm he started screaming and he’s like ‘get this stuff off me!’” (Participant 86SA).

White British mothers also identified this persuasive behaviour, demonstrating how the infant’s agency is an important factor in the mother’s thermal care behaviour:

“He wouldn’t let me put too much on, he’d just cry or kick them off” (Participant 17WB).

#### **9.4.2 Kicking covers off and removing clothing**

Similar to the theme of mothers differentiating between infant behaviours which were thought to indicate that infants were too hot or too cold, kicking covers off was regarded as a behaviour that suggested an infant was feeling too hot.

“He’ll kick off the quilt if he gets too hot” (Participant 56WB).

18% of mothers said their infants would kick the covers off if they were too hot, although some mothers thought the covers were kicked off unintentionally. Some examples included the following:

“I’ll take the blanket off if he’s too hot. If he kicks it off I’ll leave it off, if I think he is still cold I’ll put it back on him” (Participant 4WB).

Some mothers thought their baby kicked the covers off because they simply did not like them on, not because of being too hot. These mothers then put extra layers of clothing on the baby to compensate for the lack of bedding, or they would make the room warmer.

“I have to keep him covered [with clothes] because he always takes his covers off – he either kicks or pulls them off” (Participant 85SA).

Mothers reported observations of barefoot infants outside on a cold day:

“Sometimes I see people that don’t put socks on their baby but the baby also takes hat off, etc. so you can’t blame the parent. Babies can undress themselves. I know my baby takes his hat off and loses his socks and shoes” (Participant 1SA).

Mothers were aware that babies can take off clothing, especially hats, gloves, socks and shoes. One mother of a 12-month old infant reported:

“The baby takes her shoes off by herself and they tell me to put them back on because they [mother’s mother and sisters] think she’ll be cold without her shoes on. She takes her gloves off too” (Participant 102SA).

### **9.4.3 Sleep as an indicator of thermal comfort**

Seventeen mothers said their babies would not sleep if they were too cold.

“And they wouldn’t sleep if they’re cold” (Participant 63WB).

Not sleeping and/or being irritable was mentioned as an indicator that the baby was too hot:

“Well they’d overheat obviously. I know when she’s too hot because she wakes up crying and I strip her off straight away, him as well” (Participant 106SA).

Eleven of these mothers were South Asian and six were white British.

“And he tells me if he’s hot or cold, he just wakes up. He won’t sleep if he’s feeling too hot or cold” (Participant 85SA).

“[With too little on him] won’t sleep, he needs to be nice and warm” (Participant 75SA).

South Asian participants cited not sleeping as being an indication of being too hot or cold almost equally, but crying or being uncomfortable was mentioned much more as an indicator of being hot than cold.

#### **9.4.4 Activity and body language as an indicator of thermal discomfort**

One grandmother standing by as I was discussing baby thermal care with her daughter noted straight away that she thought the baby on the participant information leaflet looked too hot because the infant has its arms out. This was considered a behavioural response to thermal stress, since it helps the infant lose heat by maximizing the exposed surface area of the body. This body position represents the opposite response of curling up into the foetal position, where heat is conserved through a reduction in exposed body surface area.

As with infants who kicked the covers off, other infant movements and activity were interpreted by mothers as indicating that the baby was too hot, whereas other mothers simply thought these movements were a function of the baby's age or character. One mother believed her infant managed feeling hot by moving to a cooler part of the cot:

“She moves around in the cot a bit to where it's cooler, I put her in her blanket but she moves back” (Participant 102SA).

Another mother just accepted that her infant had become more active as she was growing up:

“She's getting quite active now, she'll crawl around her cot at night. I'll put her to bed with her blankets on and in the middle of the night she'll have kicked her covers off and be at the end of the cot” (Participant 26WB).

About half of the mothers described their infants as being active during sleep, and the other half as inactive, with little ethnic difference. Mothers of the twenty-five breastfed infants in this study did not describe any difference in night-time activity compared to the bottle-fed babies.

Some mothers noted their babies kicked the covers off but were not sure whether it was because of general activity or because they were hot.

“[She] has tendency of throwing it off so what I do is put a blanket on and tuck it in, but she's always you know . . .” (Participant 87SA).

This mother checked her infant to see if he was cold when he kicked his covers off:

“If he kicks it off I’ll leave it off, if I feel he is still cold I’ll put it back on him” (Participant 4WB).

One mother dressed her baby with a babygro on underneath its day clothes. There was therefore no way the baby could rub its feet together and end up with bare feet. One of the reasons for using a baby sleeping bag was to prevent the baby becoming uncovered in the night through kicking and other movements.

“One of those sleeping bag things.. She used to kick the sheets off” (Participant 12WB).

“[On a cold night baby wears] full babygro and vest, instead of socks because she kicks them off” (Participant 93SA).

There is no evidence to prove whether young infants can kick covers off with the specific intention of cooling themselves or whether these are just random movements resulting from increased activity. However, the perceived problem of infants kicking covers off, or getting frustrated in an infant sleeping bag, did motivate mothers to find different methods of providing thermal care at night:

“He didn’t used to be that active, but he’s starting to crawl now so is active at night. We used to have one of those sleep pod things but he was turning over at night and he’d get all cross because he’d get twisted in the sleep pod. We’ve got a blanket for him now” (Participant 53WB).

Regardless of the reasons why infants kick covers off at night, it appears that increased activity caused by being too hot and the problem of covers being kicked off is one factor in mothers’ thermal care decisions.

#### **9.4.5 Itching and irritated skin**

Another behaviour mentioned that the mothers interpreted as being indicative of the infant being hot was itching, especially with infants already experiencing

skin problems such as eczema or history of heat rash. South Asian mothers cited not sleeping as being an indication of being too hot or cold almost equally, but crying or being uncomfortable was mentioned more often as an indicator of being hot than cold.

“When she gets cold or hot her eczema gets worse, and when she’s too warm she goes red and itches” (Participant 90SA).

Skin colour and sweating involve involuntary physical responses, and are addressed in section 9.5.

#### **9.4.6 Mothers’ judgements – behaviour indicates the infant is too hot or too cold?**

Of the indications of thermal comfort mentioned by the white British mothers, not being able to sleep was more commonly mentioned as an indicator of being too cold (9 mothers) rather than too hot (4 mothers). Crying, screaming and being uncomfortable were equally cited as an indication of being too hot or too cold. Among the South Asian mothers, indicators of the baby being too hot (23 mothers) were mentioned twice as much as indications of being too cold (12 mothers). South Asian mothers reported that lack of sleep was an indication of being too hot or cold almost equally, but crying or being uncomfortable was mentioned much more as an indicator of being hot than cold. One father listening into my conversation with his wife thought that some mothers did not understand why their baby was crying. It is reasonable to suppose that a mother may misinterpret the meaning of a cry or complaint. One Bangladeshi mother and her husband discussed their views on the behaviour of Pakistani mothers:

“I’m not being funny or anything, but you know they [Pakistani mothers] have them dressed up in loads of clothes and the baby is always crying and they don’t think it’s because they’re too hot, they keep wondering why the baby is crying” (Participant 59SA).

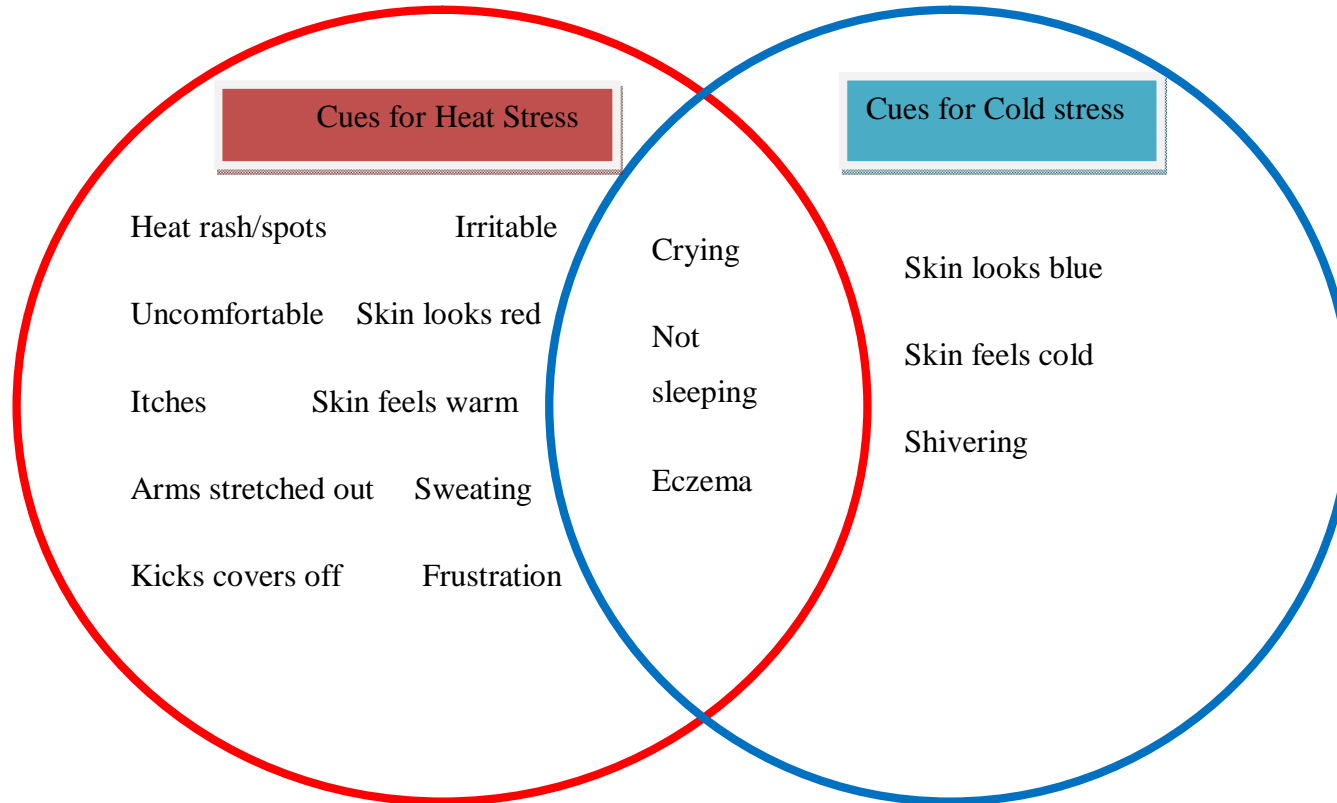
Mothers also described a hierarchy of interpretations in response to infant waking, whereby they evaluated the likelihood that different factors, such as hunger, cold, heat, comfort, or pain, had caused the baby to awaken:

“If he wakes up I’d first think he’s woken up because he hasn’t been covered up”  
(Participant 4SA).

### ***9.5 Summary of physiological and behavioural expressions of thermal stress.***

The diagram below demonstrates that mothers in this study have used several cues to assess whether their infant is suffering from heat or cold stress. A few of the cues are considered indicators of both heat and cold stress, but most of them referred to heat stress specifically.

**Figure 19 Diagram showing immediate physiological and behavioural cues of thermal stress reported by mothers**



## ***9.6 Conclusion - Mothers depending on infant crying, complaining, not sleeping or kicking about to interpret thermal needs***

Crying, protesting, and removing bedding and clothing are all expressions of a baby's thermal needs (Parsons 2003). Some mothers relied on these behaviours to know if the baby needed more or less layers, and some were unhappy if the babies could not express themselves in these ways.

More of the white British mothers' observations about thermal stress had to do with being cold rather than hot, whereas South Asian mothers were more focused on the effects of heat. It is possible that these divergent emphases developed because white British infants were subject to more cold stress and South Asian infants were experiencing more heat stress or because the two groups of mothers had differential interpretations of their infant's behavioural cues.

The difficulty with these behaviours is that their meaning partly depends on the mother's interpretation. While some mothers might interpret infant cues as indicative of thermal stress, others might attribute the same cues to other causes, such as hunger, illness, colic, etc. Still others might instead assume that their infants simply had an awkward temperament or that they were naturally poor sleepers. Trial and error may result in the mother discovering what the source of discomfort actually is for the baby, but this is not always the case. Where there is a heightened focus on a baby becoming too hot or cold, this factor may be disproportionately emphasised by mothers as an explanation for a baby's displays of discomfort.

Leading on from what the mother assumes will be the most likely cause of discomfort is a baby that is judged to be an inherently "warm" or "cool" baby, or a baby that has a strong preference for being warm or cool. This can be partly influenced by cultural beliefs about what is good for a baby. For example, the Ayurvedic system of medicine holds that there are "hot" people and "cold" people, each of whom has a tendency to feel too much of either extreme and to be vulnerable to the maladies caused by each extreme (Surinder and Kanti 1986; Nichter 1987; Pool 1987). According to



Ayurvedic medicine and other humoral belief systems, babies are believed to be in a cool state and in need of heat. Nevertheless, signs of thermal discomfort, such as frequently having blue hands, can be dismissed by explaining such signs as a result of infant resistance to such discomfort, the capacity of infants to cope well with cold, or by citing the benefits of cold for infants as commonly espoused by white British culture.

There are different ideas about when it is necessary to intervene in cases of thermal stress. The mother quoted above was certain that her baby was fine even with purple hands, and she likely was focusing on the infant's core temperature and not the condition of the infant's extremities. Whilst a vaso-constricted baby with cold hands will usually have a normal core temperature, the South Asian mothers may be focusing on maintaining thermal comfort as well as a clinically correct core temperature. For these mothers, then, cold hands may not be an indication of thermal stress but they are an indication of thermal discomfort.

There is a medical basis for the infant's inability to cope with extremes of heat as well as adults, of which some parents will be aware. There are also different cultural beliefs that view a baby as being "born cold" and warming up only as it progresses to adulthood, which informs the view that infants are more vulnerable to cold than healthy adults (Pool 1987). However, in this study mothers' perceptions that infants might feel colder or warmer than an adjacent adult involved factors beyond the infant's age or developmental status alone.

In research about thermal care of infants little, if any, attention has been paid to the infant's role in influencing its own thermal care. Thermal care is assumed to be under the control of the main caregiver, and hence mothers are targeted for thermal care advice. This overlooks the other half of the infant-mother dyad, and fails to recognise how the mother interprets the behaviour and communication of her infant. Speech as a form of communication in infants less than one year of age is not yet relevant, but the participants in this study revealed a number of ways in which they used other forms of infant communication to interpret how hot or cold their infants were. These behavioural cues serve as a means of communication that is readily apparent from the time of birth, and allows the infant to communicate its needs to its caregiver, although this process

depends upon the ability of the caregiver to correctly interpret the infant cues. These observed behaviours which are thought to express thermal discomfort include the infant getting irritable, crying, screaming, not sleeping, not settling, taking clothes and bedding off, and changing level of activity. There were a number of ways mothers interpreted their infant's level of comfort, illustrating how complex assessing the infant's thermal needs can be, and how it can be done without the use of devices such as thermometers and thermostats. The mother's judgement makes use of her intimate knowledge of her child's needs, preferences, and normal and abnormal behaviour and routines. This process of forming individual judgements tailored to the needs of an individual child is consciously recognised by some mothers. Despite the subjectivity of interpretation involved, the infant's ability to express thermal discomfort is supported by evidence of its reliance on its main caregiver for vital needs such as food and warmth. Infant expression of hunger from birth is well documented (Widström and Thingström-Paulsson 1993), so it would be expected that the human infant has evolved ways of expressing thermal discomfort as well.

Research on thermal behaviour has shown that humans, like other animals, will curl up into a foetal position to conserve heat when cold and will spread arms and legs out when hot in order to lose heat more rapidly (Parsons 2003). Thus, a baby with arms spread out may indeed be feeling hot, as observed by one grandmother who was quoted above.

The position of this infant is consistent with a posture that maximizes heat loss through increasing the body surface area that is exposed:

**Figure 20 Infant body posture when warm**

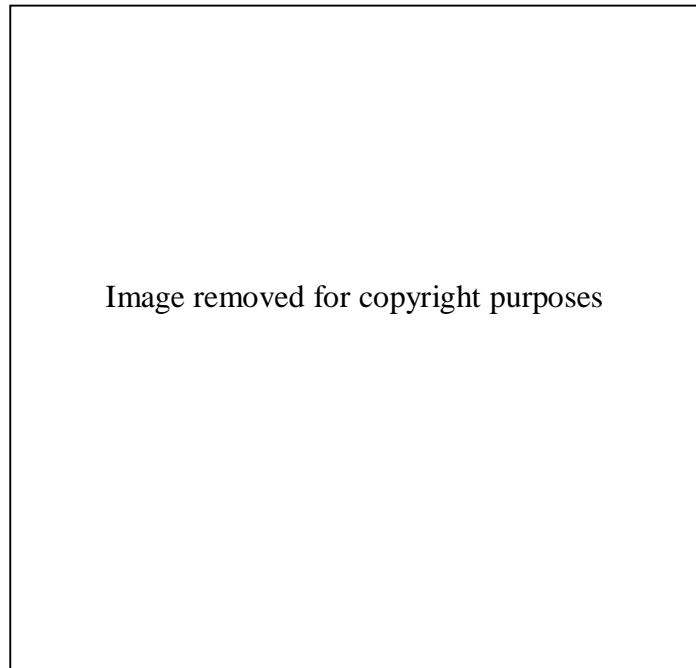


Photo: Sistema Scotland 2009

As mentioned in the methods section, the mothers might not necessarily know how active their infant is at night, especially if they sleep in separate rooms. Activity was also described in different ways, some as frequent waking, others as moving or crawling around the cot, and the latter activity is age-related. As lack of sleep was mentioned as an indicator of thermal discomfort, could it be that some of the active babies are not achieving thermal comfort? Likewise, it is possible that the moving around the cot makes them lose their covers, which could be advantageous to the baby if it is too hot. A mother's capacity to replace the covers if the infant's thermal condition subsequently changes would require night-long vigilance on the part of the mother, and obviously this would be easier for the mother if the baby was sleeping in the same room. Proximity during sleep might support a mother's ability to detect changes in infant activity, to wake briefly to inspect infants and check the position of the bedding. Furthermore, bedsharing would allow mothers to automatically feel the thermal conditions to which infants were exposed. There is no conclusive evidence that kicking covers off is an intentional behaviour of the baby and not just a consequence of

increased activity. However accidental it might have been, raised activity levels resulting from heat could result in covers being kicked off, thereby allowing the baby to cool down.

Warmth can also cause deeper sleep, so restlessness alone can never be a consistent indicator of the baby feeling hot. Such behaviour can be judged by mothers as part of a bigger picture leading to judgement on whether or not the baby is hot or cold.

Likewise taking socks, shoes and hats off was regarded as an expression of the infant not liking the clothes. It was not judged to be a function of the baby playing or practicing taking clothes off while being unable to put them back on again. Crying, protesting and removing bedding and clothing were all considered expressions of the baby's thermal needs. Some mothers relied on these behaviours to know if the baby needed more or less layers. Some would be unhappy if the baby could not express themselves in these ways.

Many behaviours were observed by mothers and were considered cues that their infants were too hot or cold. Not all behaviours were observed by any one mother, and the same behaviours were sometimes interpreted differently. Such behaviours included crying, complaining, kicking covers off, removing clothing, not sleeping, moving to a cooler place, itching, and changing body position. During the night, these behaviours can be powerfully persuasive because the mother has an inherent desire to get the baby to sleep and to sleep herself. Therefore, mothers allow the baby to dictate how many layers it has on, what kind of clothing, where it sleeps, and what environmental temperature it prefers, some more than others. Nonetheless the baby can succeed in either changing the behaviour of its caregiver or at least expressing its preferences, engaging in a constant dialogue about thermal care within the mother-infant dyadic relationship. These behaviours are as varied as the thermal factors of clothing, bedding, environmental temperature, and activity are, and we would therefore expect several behaviours to exist which allow infants to exhibit thermal discomfort. Infants are reliant on their caregivers to relieve it of thermal stress, and therefore infants require the ability to communicate their thermal needs right from birth. However, mothers' interpretations

of these behavioural cues are not uniform, and leads to several thermal care arrangements and the encouragement or discouragement of certain preferences of the infant.

Whilst health promotion advice on preventing overheating has focused on the use of thermometers to measure room temperatures, leading to several thermometer giveaway schemes, evidence cited in chapter 4 demonstrates that assessing whether the extrinsic thermal conditions of the infant's microenvironment are suitable for the infant or not is also dependent on several other environmental factors. Continuous intrinsic thermal state is vastly more complex than can be measured by thermometers alone. Whilst thermometer use varied among the participants, the way they assessed their infant's thermal needs involved much more complex factors than attention to thermometer readings only. In addition to assessing room temperature, mothers also relied on a range of signs from the infant to alert the mother to signs of thermal stress. These signs included: skin temperature, colour and irritation; inability to sleep; crying; irritability; posture; activity; and removal of bedding or clothing.

Compared to white British mothers, South Asian mothers were better able to be highly sensitive to the thermal needs of their infants for a number of reasons. The first reason is that almost all South Asian infant slept in the same room as their mothers, and so were in close enough proximity that mothers were able to detect even subtle cues from their infants. The second reason is that South Asian mothers touched their infant's peripheries to check their temperature, rather than the thorax as the White British mothers tended to do. Therefore, the South Asian mothers responded to signs of thermal stress even if their infant's core temperature was adequate. If certain conditions are affected by thermal stress and not just by an abnormal temperature, protection from potential thermal stress is beneficial to the infant. The third reason, which is discussed in more detail in the next chapter, is that South Asian mothers exhibited a strong preference towards maintaining thermal balance and not allowing the infant to get either too cold or too hot, whereas the White British mothers were mostly concerned about preventing the infant from getting too hot.

# Chapter 10 Mothers' Concerns of Heat and Cold

## *10.1 Introduction*

This chapter explores mothers' beliefs about perceived thermal threats to their infants, and how their thermal care decisions are influenced by these perceived threats. The perception that heat and cold can threaten infant health and survival, although not always consistent with biomedical perspectives, is central to understanding maternal behaviour regarding thermal care of infants. Beliefs must be taken seriously if we are to understand whether "inappropriate" thermal care practices (such as heavy wrapping) require intervention, and if so, how best to accomplish this, or whether these practices are not as 'inappropriate' as assumed. Understanding the threats perceived by mothers can help explain their behaviour regarding infant thermal care. The perceived association between overheating and SIDS, on one hand, and the association between chills and the risk of pneumonia on the other, illustrates how differently threats to infant health are viewed by mothers and by clinicians. A mother who wraps an infant well to avoid pneumonia is seen by health professionals to be ignorant of the risks of overheating and SIDS. In communities where SIDS is extremely rare, as among South Asians in the UK, there has been a significant history of infant death via pneumonia in their previous and/or overseas generations. However, the UK South Asians live in a culture that prioritises the prevention of SIDS and therefore discourages the practices South Asians undertake to protect infants from what they consider to be a more significant threat to health and survival. Given this disconnect between lay and clinical perspectives, this chapter examines mothers' beliefs about the effects of heat or cold stress on the infant and how they prioritise various care practices as a result of these beliefs.

Some thermal care related outcomes, such as infants not sleeping, were attributed by mothers to heat or cold stress. Other outcomes were specifically the result of either heat or cold stress. Section 10.2 covers concerns related to overheating and section 10.3 addresses mothers' concerns about infants becoming too cold. Section 10.4 provides an

overview of all the concerns mothers had regarding the risks of not providing appropriate thermal care for their infants. Section 10.5 addresses whether heat or cold was considered more dangerous for infants and the reasons why this was the case. Section 10.6 looks at the difference between medical and lay explanations of causality in relation to thermal care. Differences between the white British and the South Asian mothers are discussed in each section.

## ***10.2 Concerns about heat stress***

This section explores the concerns of mothers regarding the effects of heat stress on their infants. There were several ways mothers believed overheating could cause death, including SIDS, overheating, suffocation, loss of consciousness, and dehydration. Four specific issues emerged: heat stress causing death; illness; discomfort; and worry. Twenty-two concerns about the effect of heat on infants were identified and are discussed below. The quotes provided in this section are taken from mothers' comments that specifically referred to their concerns about the effects of overheating on infants.

### **10.2.1 Heat causing death**

Many White British mothers and only a few South Asian mothers believed that overheating could cause death. Causes of death resulting from overheating were thought to include SIDS, uncontrolled temperature, suffocation, fits and unconsciousness, and dehydration. Some mothers could not always explain fully why overheating could be so dangerous.

One cause of death caused by overheating, which was especially feared by white British mothers, was SIDS. 35% of white British mothers believed overheating led to SIDS, whereas only 4% of South Asian mothers were concerned about overheating leading to SIDS. The fact that this was a major concern among white British mothers is unsurprising, given the publicity given to SIDS prevention and given that SIDS is the main cause of infant death after 1 month of age.

“If too hot she could die of cot death . . . I really worry about cot death, especially after they had it on Emmerdale Farm recently, I had to turn off the TV when she came down the stairs” (Participant 12WB).

Mothers usually referred to SIDS as “cot death.” Fear of SIDS among white British mothers was possibly more common among mothers who used infant sleeping bags (43.5%) than White British mothers who didn’t (32%), although the numbers do not allow this to be confirmed from statistical tests. One Bangladeshi mother was concerned that her sister-in-law in Bangladesh should know about the risk of SIDS:

“My sister-in-law lives back home and I send stuff [SIDS prevention advice] over to her so that she gets stuff they don’t know about there” (Participant 59SA).

Mothers also seemed to be making a causal association, believing that overheating was a direct cause of SIDS rather than a contributory factor. SIDS is believed by some to be a condition itself, despite the fact that in clinical terms it is by definition an unknown cause of death. The language used reveals how SIDS is understood as something the infant can “get”:

“I’d be worried, he could get cot death if he’s too warm” (Participant 58WB).

Because of this perceived direct relationship, it is possible that overheating is considered by mothers to be far more dangerous than intended by SIDS prevention campaigns. There were many examples of where mothers believed overheating to be dangerous in itself and where SIDS was not explicitly mentioned:

“Overheating”. [Why?] “I don’t know really, I just read they can overheat” (Participant 13WB).

The following mother had a friend whose baby had died of SIDS and thought the cause was overheating:

“Yes, I would, she’d get overheated. My mate’s baby died of overheating when he was 6 weeks old so I’d be really worried about her overheating” (Participant 44WB).

When I asked her why she thought the baby had died of overheating, she replied that her friend was told this by staff in the hospital.

Some mothers believed if the infant became too hot their temperature could get uncontrollably high with or without a fever-inducing infection:



“He’ll overheat, and he can’t regulate his temperature” (Participant 25WB).

These mothers had little or no confidence in their infants to regulate their own temperature at all:

“They can get convulsions and a temperature if they get too hot, can’t they? I think it’s easier to warm a baby up than cool them down. Once they’ve got hot it’s hard to cool them down again” (Participant 53WB).

These fears were much more prevalent among white British mothers, which is consistent with the theory that some Euro-American societies see heat as more threatening to infants than cold (Betz 2006; Gehri et al 2005).<sup>38</sup>

Although for some mothers overheating was itself a negative outcome, other mothers specified that overheating could lead to fits and convulsions:

“ [If he gets too hot] this will raise his temperature; high temperature leads to convulsions” (Participant 6WB).

The fear of overheating leading to convulsions was far more common for the white British mothers:

“I don’t know really. They say they have fits when they get too hot don’t they?” (Participant 17WB).

The damage thought to be caused by fits by the white British mothers in my sample was attributed to brain damage, even if death did not occur:

“I suppose I’d worry about her getting overheated, going into a coma or something” (Participant 56WB).

Other mothers thought that overheating could lead to collapse:

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“She’d collapse if she was too warm” (Participant 37WB).

How these mothers believed their infants developed fevers is therefore not consistent with medical beliefs. Above there are two explanations given, where fever is caused either by too much heat or by a virus. Furthermore, mothers believed that infants are unable to control a fever if it develops. In many of the world’s cultures, there are multiple explanations for the cause of fever and white British culture is no exception.<sup>39</sup>

Among South Asian mothers, the concern about overheating was less about fits and convulsions and more about suffocation and death:

“He’d get overheated.” [What would happen?] “Umm, he’d suffocate” (Participant 22SA).

Although at first it may seem confusing that mothers link getting overheated to suffocation, that could be because we typically think of suffocation being caused by blocked airways. Some of the mothers had a full-body concept of respiration, where not only were the lungs a site of respiration but so too was the skin. This concept holds that the skin “breathes,” allowing sweat to be released into the air.

Loss of consciousness was a concern for some white British and South Asian mothers. This provides further evidence that South Asian mothers are indeed concerned about the adverse effects of overheating, which is congruent with their culturally-informed belief that good health results from being in proper balance between heat and cold and that either extreme can be harmful.

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<sup>39</sup> Walter (2005) describes explanation of fever in the Indian Siddha medicine tradition. These explanations include: constipation; chronic cold (phlegm); toxins from diet; toxins; sleeplessness; physical exhaustion; anger/irritability; suppressing vital functions such as urine, hiccough, appetite, stools, thirst, and sleep; consuming very cold water; change of place/country; variations of the mind; and indigestion. There is notably no mention of too much clothing or sun.

### 10.2.2 Heat causing illness and physical problems

Mothers were also concerned that heat stress would cause vomiting or skin problems. These concerns were not thought to be life-threatening, but preventing them was nonetheless a priority of thermal care practices.

South Asian mothers linked heat stress to vomiting:

“They vomit if they have too many clothes on and don’t sleep” (Participant 94SA).

There was no suggestion by mothers that vomiting was caused by gastrointestinal disease, and appeared to be more as a result of general stress to the infant such as crying, not sleeping, going red, and fainting.

Commonly, although not exclusively, the South Asian mothers talked about heat causing different skin problems. Heat rashes were seen as a result of the infant getting too warm:

“When she’s too warm her face goes red and she gets rashes on her face” (Participant 81SA).

Interestingly, heat spots were not only mentioned by South Asian mothers as a result of heat stress, but a number of them had been told by health visitors doing home visits that their infants had heat spots because they were being kept too warm either by too much clothing or heating. This suggests that the health visitors seemed to commonly believe that South Asian mothers were keeping their infants too warm. Eczema was another common concern among the South Asian mothers, whereas only one White British mother mentioned eczema. South Asian mothers tried to avoid letting their infants get too hot if they suffered from eczema:

“If I do [use the electric radiators in the bedrooms] their eczema flares up. We usually just heat the house using the gas fire in the lounge because of the girls and try not to let the house get too hot because of the eczema, but don’t let it get cold either” (Participant 43SA).

Eczema was said by some South Asian mothers to be caused by overheating:

“I see some people who put too much clothing on their baby and they have really bad itching. The baby [with eczema] they used to have too much clothing on him and leave him too close to the gas” (Participant 27SA).

The skin going red was seen as an indication that the infant was too hot, but no adverse effects were mentioned as a result of going red.

### **10.2.3 Heat causing discomfort**

The infant’s comfort, whilst not seen as a matter of life or death, was still a high care priority for the mothers. Infant discomfort was undesirable, but not life-threatening and caused distress to the mothers, who felt that comfort was important to keep infants happy or to enable them to go to sleep and stay asleep:

“He likes to be snug, but if he gets too hot he gets cranky and sweaty so I want to keep him happy” (Participant 69WB).

Infant discomfort was a common sign used by mothers to assess whether their infant felt too hot, in which case they adjusted the clothing and bedding until the infant felt more comfortable and was not irritable or crying any more:

“She cries, she feels uneasy. I take some of her clothes off and she feels easy again” (Participant 92SA).

Not everyone involved in caring for a baby always interpreted being uncomfortable as a sign that the baby was too hot. For example, the family of one South Asian mother did not believe that the baby was complaining because he felt too hot but the mother disagreed, asserting her unique knowledge of her infant:

“Yes, but they disagree with me, then I tell them that I know they feel too hot because I know him [the baby] and I know he cries when he’s too hot. And he plays around in his sleep if he’s got too much on” (Participant 28SA).

Difficulty sleeping was another sign read by the mothers to decide whether or not the baby was too hot. They used their success of getting their infant back to sleep by adjusting clothing and bedding as evidence for their judgements.

In addition to the infant not settling or sleeping, crying was also taken as a sign of heat stress:

“Well they’d overheat obviously. I know when she’s too hot because she wakes up crying and I strip her off straight away, him [toddler sibling] as well” (Participant 105SA).

Sweating was seen as something undesirable for infants, primarily because this was an indication that the infant was too hot and at risk of SIDS, or an indication that the infant was uncomfortable:

“I’d be more worried about her sweating. She gets warm very easily so yes I’d be worried. She sweats even when I hold her. You hear these horror stories don’t you about cot death?” (Participant 45WB).

#### **10.2.4 Heat causes worry**

Some mothers were concerned about the infant’s inability to communicate the heat stress they were experiencing:

“If he got too hot it would lead to cot death. I’d rather he got too cold than too hot. If he’s cold you can feel him and put more layers on him. If he’s too hot you can’t tell, he’d just go into a deep sleep and get all snugly” (Participant 30WB).

For example, they were anxious because this was more difficult to manage than the infant getting too cold because there was a limit to how much could be done to cool the baby down:

“They get drowsy and wouldn’t wake up if they had a problem, whereas if they’re cold they complain and tell you” (Participant 63WB).

This inability to communicate was perhaps related to the fear that the infant would lose consciousness. Concerns over an infant’s thermal needs, even where the effects

were not apparently life threatening, were of significance to some of the mothers. An example was the mothers who did not like their infant to get too warm and go into too deep a sleep. Although the deep sleep was not a problem in itself, the inability on the part of the infant to communicate his needs was cause for concern.

Some of the white British mothers had non-specific concerns. They thought overheating was “bad” but they couldn’t say why:

‘I don’t know why, I just know I don’t want him too hot’ (Participant 19WB).

They just had a feeling that the infant getting too hot was a problem and they wanted to stop it from happening, but could not verbalise a reason. It simply was not a situation to which they wanted their infants exposed. Instead, they focused on prevention of overheating. Some mothers said they could not answer this question because they could not conceive of letting their infants become overheated under any circumstance:

“I wouldn’t put more clothing on her ever” (Participant 44WB).

### ***10.3 Concerns about cold stress***

This section deals with mothers’ concerns about cold stress on infants. It is divided into the same topics as presented above: cold stress; death; illness; discomfort; and worry. Mothers identified 23 different outcomes associated with cold stress, ranging from death caused by SIDS or hypothermia, to crying or not sleeping. Some outcomes were the same as those arising from heat stress (from clothing/bedding as well as fever), but mothers specified cold stress as a different mechanism for these outcomes.<sup>40</sup>

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<sup>40</sup> For example, heat stress was said to cause fever because the infant was thought to get too hot and could not control its own temperature. Cold stress was said to lead to a cold, flu, or pneumonia, and the infection was thought to be the reason for the fever. Therefore the same outcomes were identified by mothers as having different causes.

### **10.3.1 Cold causing death**

Although there is little or no SIDS prevention advice focusing on the risk of the baby being too cold, some of the mothers made their own assumptions that cold could put infants at risk of SIDS. One participant was perhaps not sure whether it was the heat or the cold that put the infant at risk in this case:

“If it’s too warm it could lead to SIDS. And if they’re wrapped up when they get taken out in the cold – that’s not proven is it?” (Participant 8SA).

All of these acknowledged that overheating was also a risk factor for SIDS.

Perhaps predictably, mothers also believed that infants would get hypothermia if they got too cold, although what level of clothing and bedding would result in hypothermia was not specified.

“If he got too cold he’d freeze to death” (Participant 15WB)

The mothers did not think their infants were at risk of hypothermia but many of them made observations of other mothers who they considered were putting their infants at risk by being underdressed in very cold weather:

“Yes I have seen babies in town with just tiny little skirts on, no socks or hats. I would worry about them getting hypothermia or just generally getting ill, colds, etc.” (Participant 2WB).

### **10.3.2 Cold causing illness**

The most significant issue raised by mothers in both groups about cold stress was that this could lead to colds, flu, or pneumonia. The direct link between getting cold and catching a cold was made clear by many of the mothers, in both the South Asian and white British groups:

“She would get cold. She was born early so she’s prone to colds. She always has a cold, so I keep the heating on for her. Even in the summer I’ll put the heating on for an hour or so so she doesn’t get too cold” (Participant 26WB).

White British mothers worried more about pneumonia than flu:

“If cold she’d get pneumonia or a chest infection or flu and things like that”  
(Participant 59WB).

Developing flu as a result of the infant getting chilled was even more prevalent among South Asian mothers, however:

“He could get a cold or flu if he’s not covered up properly” (Participant 105SA).

South Asian mothers referred to insufficient clothing and bedding rather than heating as a reason for an infant getting too cold:

“He gets coughs and colds if he has too little clothing on” (Participant 1SA).

Despite the medicalisation of white British infant care, my data show that this belief among white British mothers still exists:

“If he’s cold he might get a cold. He’s got a snuffly nose at the moment, maybe that’s because he got cold” (Participant 16WB).

This concern was more apparent among the South Asian mothers:

“Getting cold would lead to her getting a runny nose or catching a cold”  
(Participant P73SA).

A quantitative assessment of the higher prevalence of this view among South Asian mothers is presented below in section 10.5.

The infant getting cold was paradoxically believed to be a cause of fever caused by a cold, flu or pneumonia:

“If he’s too cold he can get a fever. Getting cold gives them a fever” (Participant 35SA).

Again reference to adequate clothing was made in to in the protection from colds and flu that can cause fever:



“You know it’s better to put clothes on because if you don’t they’ll catch a cold. I get scared you know, they get a temperature and get sick” (Participant 32WB).

This is a different cause of fever than overheating, which results in an infant’s temperature getting out of control. The mothers were specifically linking cold stress to an infection that results in fever, just as they linked cold stress to respiratory infections.

Another concern was the effect of being cold on breathing, either from asthma or from breathing patterns that were a cause of concern for both white British mothers and South Asian mothers:

“She’d get too cold, her breathing goes right proper funny when she gets cold” (Participant 49WB).

“. . . She could catch a cold and it could affect her breathing” (Participant 98SA).

Mothers whose children suffered from asthma were particularly concerned about the effects of cold on asthma, having witnessed their child going through frightening and sometimes life-threatening attacks. Again, thermal care is something mothers can control for their infants and thus they feel they can provide a limited amount of protection from asthma:

“My oldest one has asthma and it’s scary. He’s the first in the family to have asthma, not me or my mum or my husband’s family. That’s why it’s so important. I put a jumper and thick trousers on him [the baby], but I don’t put too much clothing on him. The health visitors tell me to not put so much clothing on him, but you know [shrugs shoulders]. You’ve really got to put clothes on him. Especially him [older child], he was my first born you know. You’ve really got to protect them” (Participant 32SA).

### **10.3.3 Cold causing discomfort**

Cold stress resulting in discomfort was not necessarily seen as life or health threatening by mothers, but was still an important factor driving thermal care decisions because discomfort kept infants from settling or sleeping, and because mothers did not want to see their infants unhappy. The link between cold stress and discomfort was not

interpreted uniformly by all mothers, however, such as the mother quoted in the previous chapter who did not think purple hands was a sign her daughter was cold.

A very common concern among South Asian mothers about the cold was that it caused wakefulness in infants. Although this was not a direct threat to the infant's life or health, it was a concern for their well-being and a high priority for the mothers. Some said the infant would not sleep in the first place:

“If he's cold he doesn't like it. You know when they're warm they sleep really well but when they're cold they can't sleep and they make a fuss” (Participant 33SA).

Others said the infant would wake up if too cold:

“If he wakes up I'd first think he's woken up because he hasn't been covered up” (Participant 4SA).

Getting the infant to sleep by making it warmer was seen to confirm to the participant that the cold prevents them from sleeping:

“I see babies in the crèche who come in with no socks, few clothes and when the mum leaves they won't stop crying so I cover them up and they sleep really happily” (Participant 4SA).

There was much far less concern about the cold stopping infants from sleeping among the white British mothers:

“She wouldn't come to any harm I don't think. She'd just be uncomfortable and not sleep” (Participant 40WB).

This concern was not completely absent concern among White British mothers:

“She'd shiver get cold, wake up and be restless” (Participant 24WB).

Crying and complaining were also commonly cited as an indication that the infant felt too cold:

“My sister in law doesn’t cover her baby up and the baby is always crying”  
(Participant P4SA).

This is a perfect example of the infant’s agency in how others provide it with thermal care, and how mothers listen to and interpret their infant’s expressions. Infant shivering was seen as an indication of suffering and thus required action on the part of the mother:

“She’d start shivering and screaming and make sure I’d give her more clothing”  
(Participant 51WB).

There were no serious consequences seen as a result of shivering, just that it made the infant uncomfortable.

#### **10.3.4 Cold causes worry**

Just as some mothers were afraid that if their infant became too hot it would prevent him or her from communicating thermal needs, other mothers worried about similar issues related to the cold:

“That’s not good because if they fall asleep they [mothers] can’t tell if the baby is cold because the baby doesn’t tell me if she’s cold” (Participant 71SA).

Some mothers could not explain why they didn’t like their infant getting cold, just stating that they felt it was not good for the infant:

“I don’t know, maybe too cold.” [What would the problem be with that?] “I don’t know, actually be worried about him getting too hot as well. No, I don’t care if he gets too hot, that’s not a problem. He can cope with it but I do worry about him getting too cold” (Participant 11SA).

Even if the baby has a fever, this South Asian mother is worried about the baby feeling the cold:

“If my baby’s ill, has a fever, I will still keep him covered. Just because the head is hot it doesn’t mean to say he doesn’t feel cold. Only if he is burning up or has rosy cheeks I’d leave him in a t-shirt, never totally uncovered” (Participant 4SA).

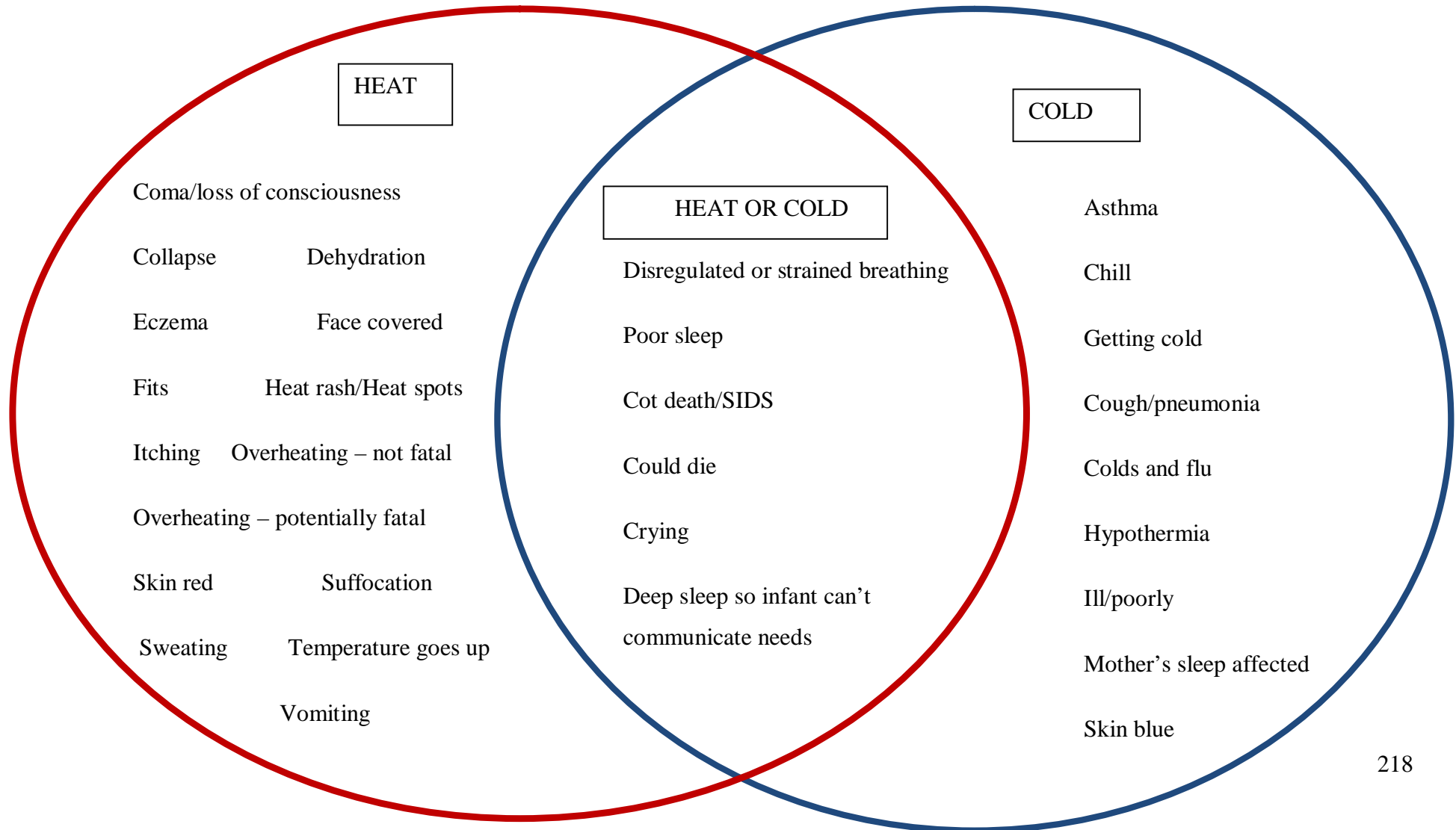
The mothers who said they were not concerned about their infants getting too cold only said this because they believed their thermal care practices protected their infants from the cold:

[Regarding baby getting too cold] “I’ve never let him do that, I never let him have less clothing” (Participant 32SA).

#### ***10.4 Results of overall concerns***

Thermal care is one essential factor for survival, other than food, hygiene, attention and transport, that a mother needs to provide for her neurologically immature, caregiver-dependent infant, especially in the first year (Hrdy 1999; Martin 2007). In many Western societies, health professionals prioritise attention to infant feeding, development, and psychological care. Yet thermal care is a major and constant concern for mothers. Below is a list of the issues that mothers mentioned as a concern for their infant that they believed to be caused by thermal stress or inappropriate thermal care:

**Figure 21 Mothers reported major outcomes of infant suffering heat and cold stress**



Some of the above concerns were believed to be the result only of heat stress. These include heat rashes, eczema and fainting. Some were thought to be the result of cold stress, such as pneumonia and shivering. Some of the concerns were believed to be caused in different ways by either heat or cold stress, such as poor sleep and crying. The results above show that there are over 30 different harmful effects believed by mothers to be related to thermal stress. Twenty-four concerns were raised about the effects of heat stress and twenty-three about cold stress, ranging from skin irritations to sleep, from comfort to death. Nine of the effects of thermal stress were found in both heat and cold stress, although the mechanisms believed to produce the effect were different. This demonstrates that thermal care is central to infant care in general. Mothers constantly observe, judge and prioritise many variables which affect their decisions of how cool or warm to allow their infants to become. It would therefore seem unreasonable to expect mothers to base their thermal care decisions with SIDS prevention alone in mind. The prioritisation of SIDS prevention depends partly on how significant the threat of SIDS is relative to other threats to infant health and survival.

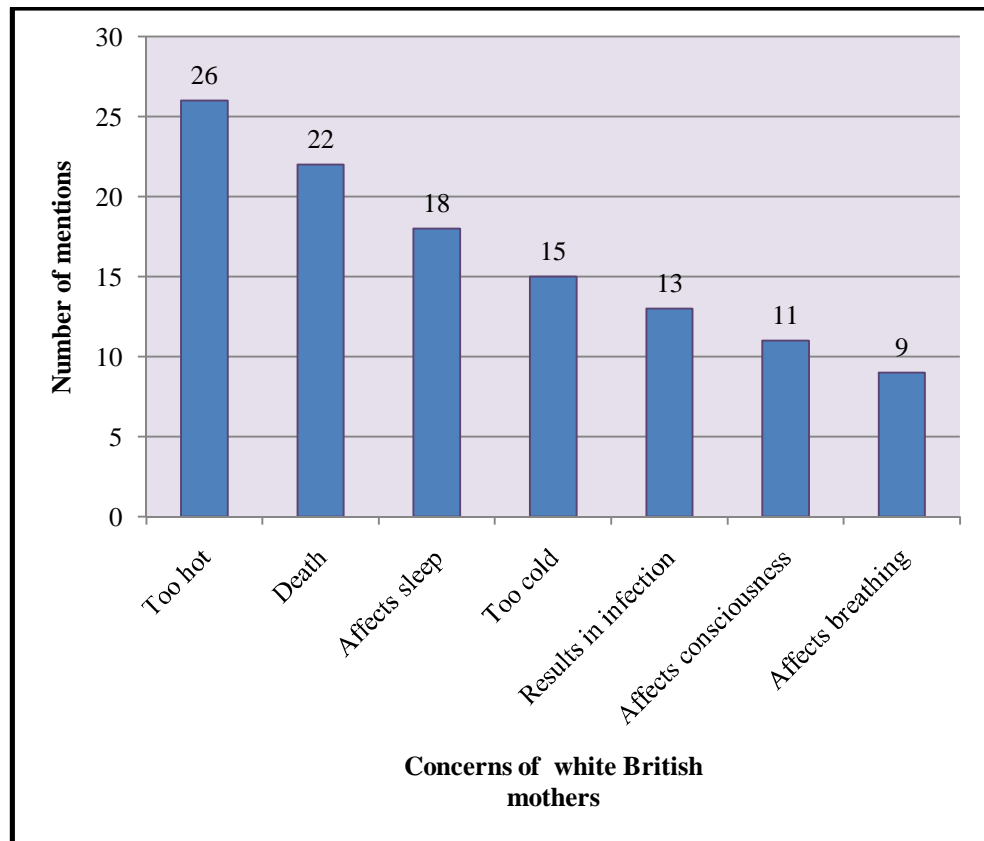
### ***10.5 Thermal care priorities***

This section looks at the priorities of the many different concerns mothers had about thermal care. In the sections on anxieties over heat and cold stress, 24 concerns about heat stress and 23 about cold stress were identified. The hierarchy of these concerns is of significant interest. This may give us a broader understanding of what physical and psychological considerations are most important to the mothers in terms of thermal care, and what the differences between white British and South Asian beliefs and practices might be.

#### **10.5.1 Mothers Concerns of thermal stress reported by white British mothers**

The major thermal care concerns for the white British mothers are presented below. Figures 22 and 23 have been calculated by taking the number of times a particular concern was mentioned, not counting each concern more than once per participant.

**Figure 22 Major concerns regarding thermal stress reported by white British mothers**



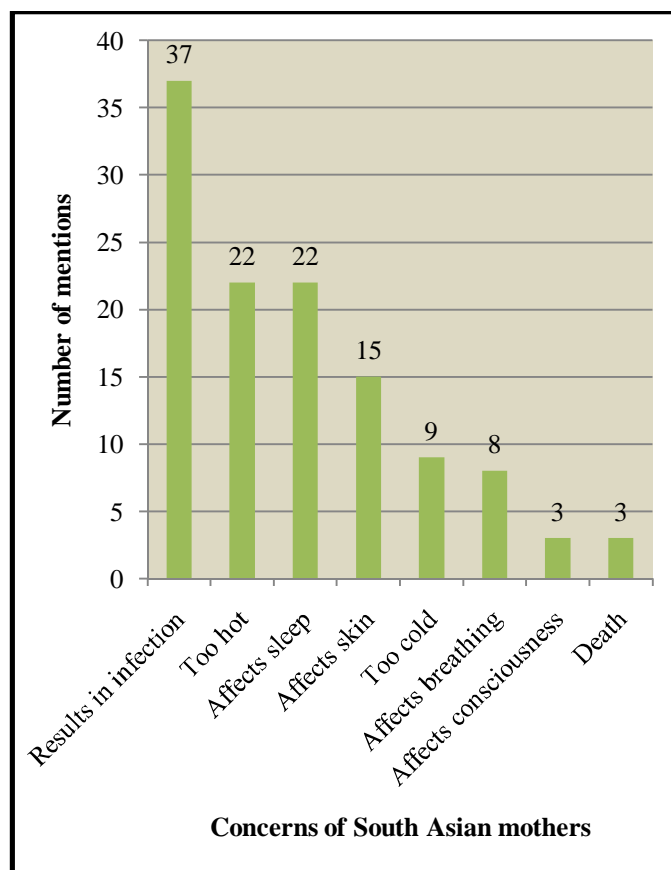
White British mothers appeared to be worried mostly about the infant getting overheated, something that was seen as dangerous even if they could not say why this was so. The second highest concern was about the infant dying because of SIDS, together with a few references to fever. This illustrated that the effects of the infant getting too hot are of extremely high concern to the white British mothers. A few mothers mentioned death from fever caused by an infection that resulted from the infant getting too cold. However, it was still fever due to overheating that frightened the white British mothers most. Sleeplessness caused by the infant becoming too cold or too hot was also a concern. White British mothers, despite a possible bias towards anxiety over heat, did also have concerns about the cold, believing that a chill might lead to a cold or flu. This partly answers my research question in Chapter 4 if the white British mothers were only concerned with overheating, as it seems they also hold some degree of concern regarding the harmful effects of cold. It also went against my hypothesis that only South Asian mothers were worried that infants who became too cold would

succumb to a cold. The belief, whilst not dominant, was still present amongst the white British mothers in my study. Other concerns were related to consciousness or breathing being affected, which could be seen to have acute effects on infant health, including fatal outcomes. One reaction to the fear of an infant getting into a sudden, uncontrollable condition is to do everything possible to reduce the exposure to this risk, even if the avoidance behaviour is disproportionate to the actual risk.

### 10.5.2 Major concerns of thermal stress mentioned by South Asian mothers

The main thermal stress concerns for the South Asian mothers were as follows:

**Figure 23 Major concerns reported by South Asian mothers**

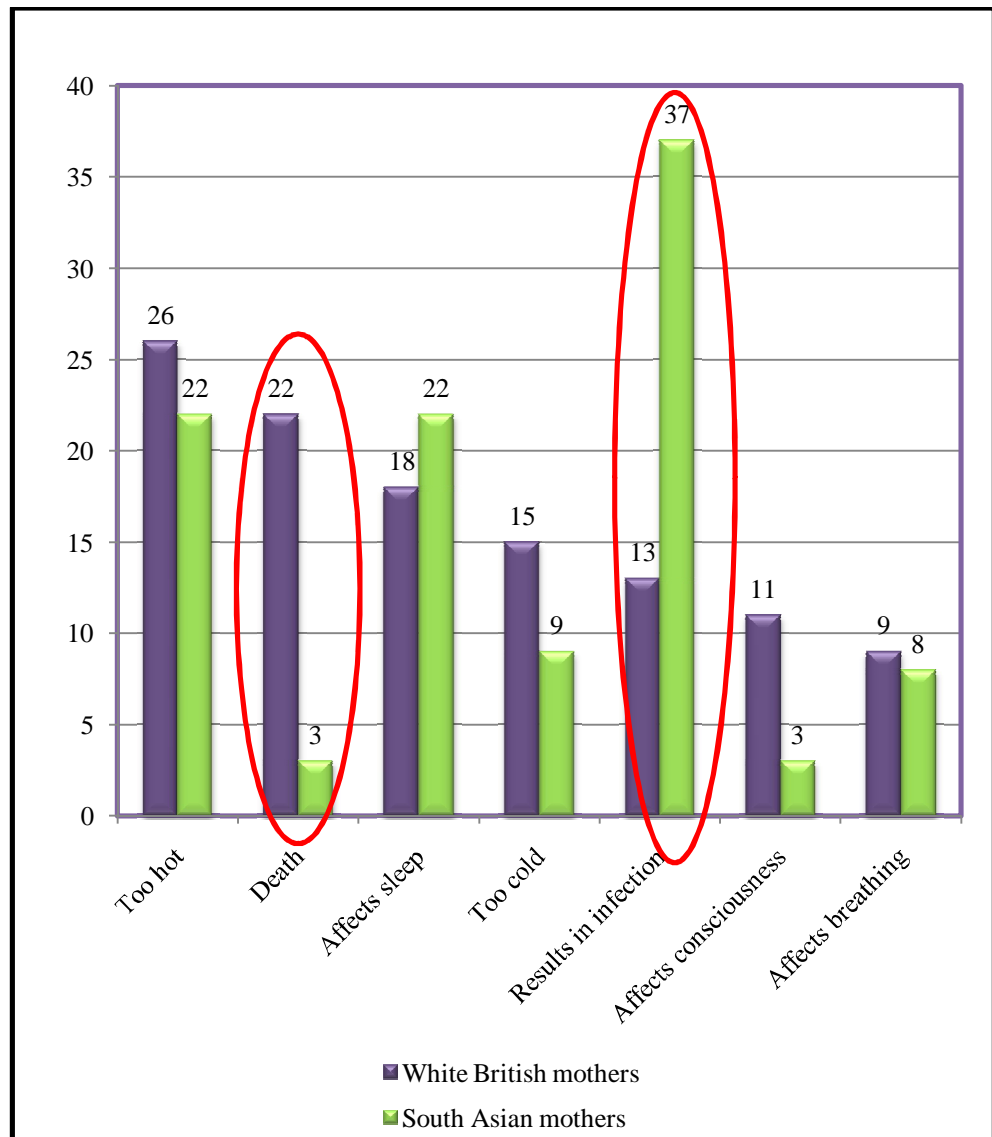


Comparing white British to South Asian major thermal stress concerns

A comparison of the two groups reveals different priorities related to thermal risks to infants:



**Figure 24 Comparison of concerns of thermal risks to infant of South Asian and white British infants**



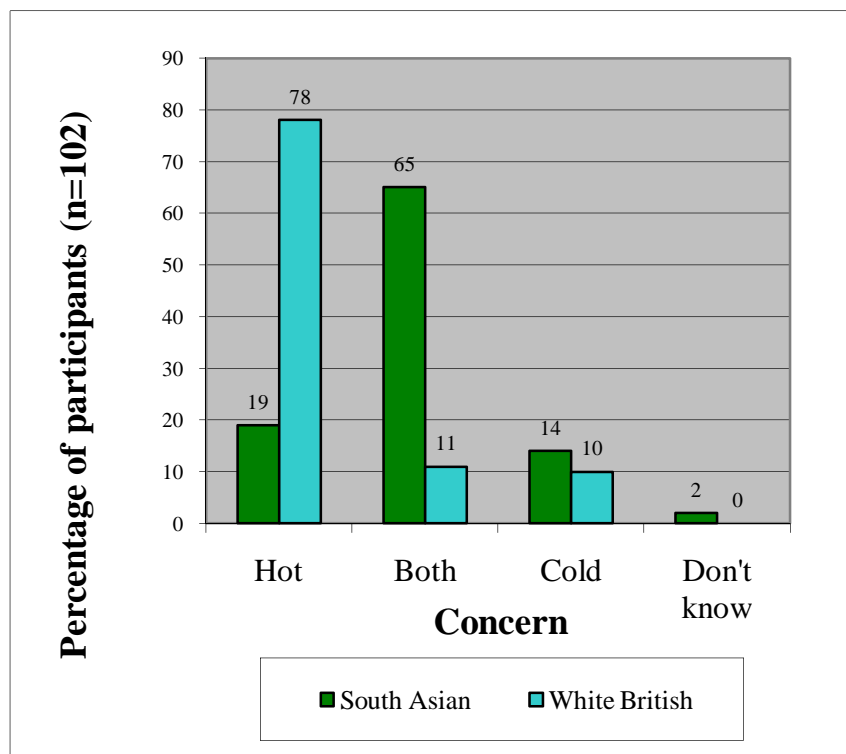
Comparing concerns about infant mortality between white British and South Asian mothers (22:3), we can see that concern about mortality is a vastly higher priority for the white British mothers. The number of references to infant overheating among the white British and South Asian mothers was similar (26 and 22, respectively). The most outstanding concern for the South Asian mothers was cold causing infections. This was mentioned by 37 South Asian mothers, but was also mentioned by a considerable number (13) of white British mothers. The top priorities for the South Asian mothers were distinct from the white British ones. The concern about cold causing infection was

by far the main concern, although this was not seen as a fatal risk. Fear of death was eighth on the list for South Asian mothers compared to second for the white British mothers. Concern about the infant getting too hot was second for South Asian mothers, revealing that heat was in fact of concern to South Asian mothers, despite the stereotype that they habitually overwrap their infants. Negative effects on sleep were also a concern. This fits my original hypothesis that the white British population focused more on the fatal consequences of overheating, primarily through fever and SIDS, and the South Asian mothers focused more on the infant getting cold and catching an infection. This reflects the different views on infant survival in the two groups, which inherently determine what each group considers to be a priority. South Asian mothers also exhibited more concern regarding the effects of heat on skin, by causing rashes, irritation and eczema, in the same way as highlighted by Nichter (1987) who cited beliefs about cold as a cause of infection and heat as a cause of skin problems.

#### **10.5.2 Are mothers more worried about the heat or the cold?**

Some mothers commented on specific reasons why they were more worried about one kind of thermal stress rather than the other, and which could be merely a result of individual concerns or specific conditions unique to a particular infant.

**Figure 25 Percentage of mothers worried about infant getting too cold, too hot or both**

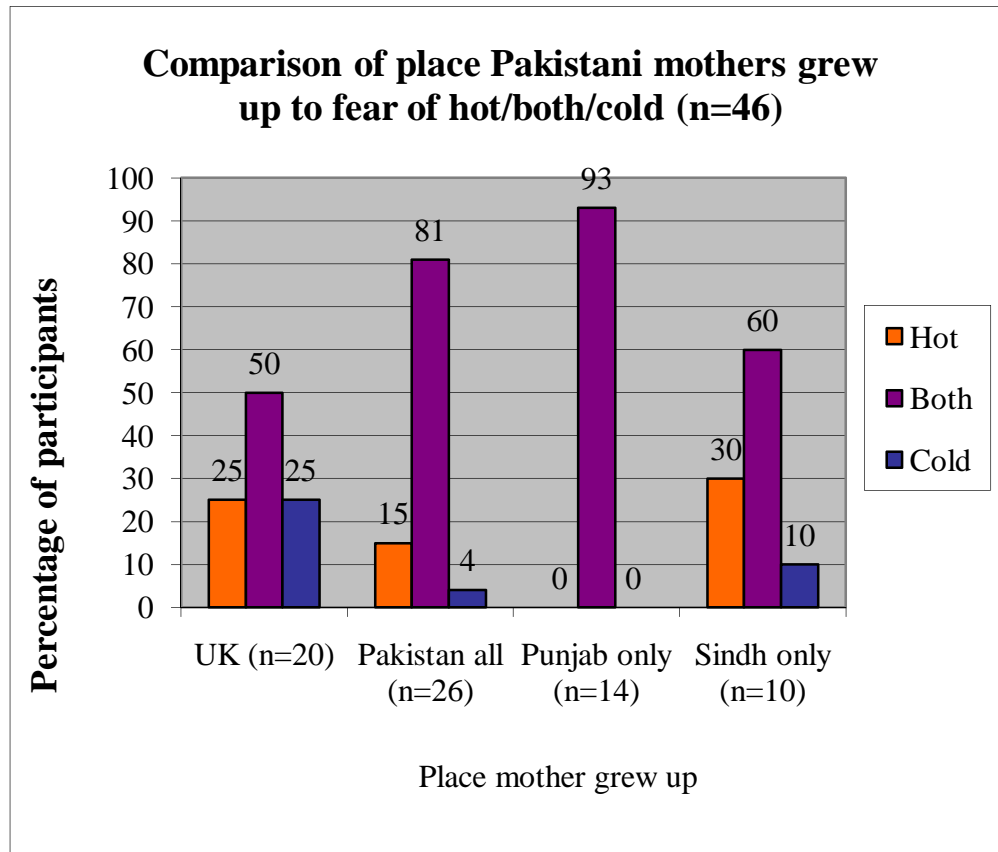


A Pearson Chi Squared test gave a significance of  $<0.0001$  (Pearson chi squared statistic = 37.0), demonstrating that there is a highly significant difference in beliefs about thermal stress being most harmful to the infant, with most South Asian mothers concerned about both heat and cold stress and most white British mother concerned about heat stress alone.

However, as mentioned above, it is an over-simplification to treat South Asian beliefs as uniform, since despite some similarities in beliefs there is still expected to be a variation within and between South Asian countries and cultures. Punjab (North East Pakistan) and Sindh (Southern Pakistan) regions have different cultural influences, which may have had an effect on thermal care beliefs (Visweswaran 2011). Pakistani Punjab has been invaded in the past by Arabs, Turks, Persians, and Afghans. Sindh also has had considerable Arabic and Persian influences, and has also been influenced by Punjabi culture (Wynbrandt 2009). As most of the South Asian mothers were of Pakistani origin, it was possible to make a comparison between first and second

generation mothers, and among the first generation mothers it was possible to distinguish those who were most likely to be of Punjabi or Sindhi origins in Pakistan.

**Figure 26 Comparison of place mothers of Pakistani origin grew up and fear of heat and cold**



This graph shows that thermal balance appears to be more important to the first generation mothers. However, breaking down the Pakistani women into regions where cultural beliefs may vary, the Punjabi mothers were focused on balance and the Sindhi mothers were more likely to believe that protecting their infants from heat was more important than keeping a balance or protecting them from the cold. If there are differences in beliefs about the dangers of heat and cold between Sindh and Punjab regions, this was not passed on to daughters of Pakistani women who grew up in the UK. Of the second generation mothers whose mothers came from the Sindh region, 14% believed heat was more harmful, 50% said both heat and cold were harmful, and 36% said that cold was more harmful. Of the second generation mothers whose mothers

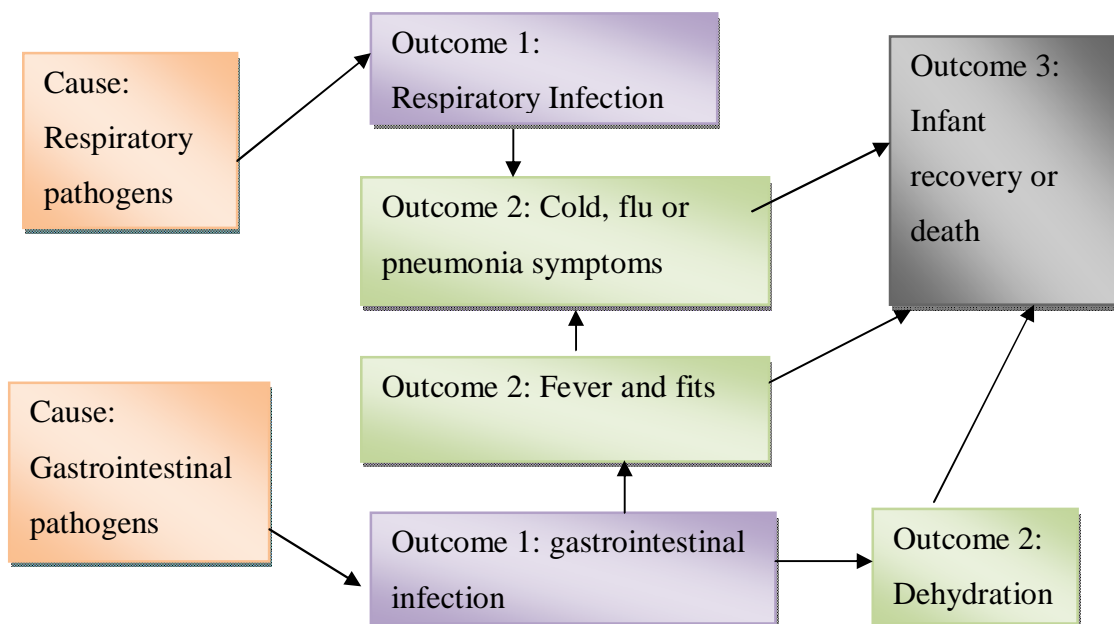
came from the Punjab region of Pakistan, 67% said heat was more harmful, 38% said both were harmful, and none said the cold was more harmful.

### 10.6 Causality

Mothers' explanations of disease, such as the belief that getting cold causes a cold, may appear to medical professionals to be based on ignorance or culturally-informed belief alone. Some of the information mothers are using, which is then subject to their own interpretations, often comes from public health campaigns or contact with clinicians. For example, parents who link overwrapping to an uncontrollably high temperature should in theory be matching the origin of overwrapping to the outcome of heat stress (but not a fever), or the origin of a pathogen to the outcome of a fever. The pathways are different although may have similar components.

Clinical science seeks to create simplistic causal pathways, emphasising direct relationships between cause and outcome even if several steps are involved. Mothers are not restricted to scientific methods and may think more holistically, considering a much wider range of factors that can affect their infant because in the practice of caring for their infants they have to manage so many different factors that can impact infant health. Their priorities do not necessarily match public health priorities.

**Figure 27 A causal pathway to explain risk to infant life from fever from the perspective of a health professional**



**Figure 28 A causal pathway to explain risk to infant life from fever from the perspective of a mother**

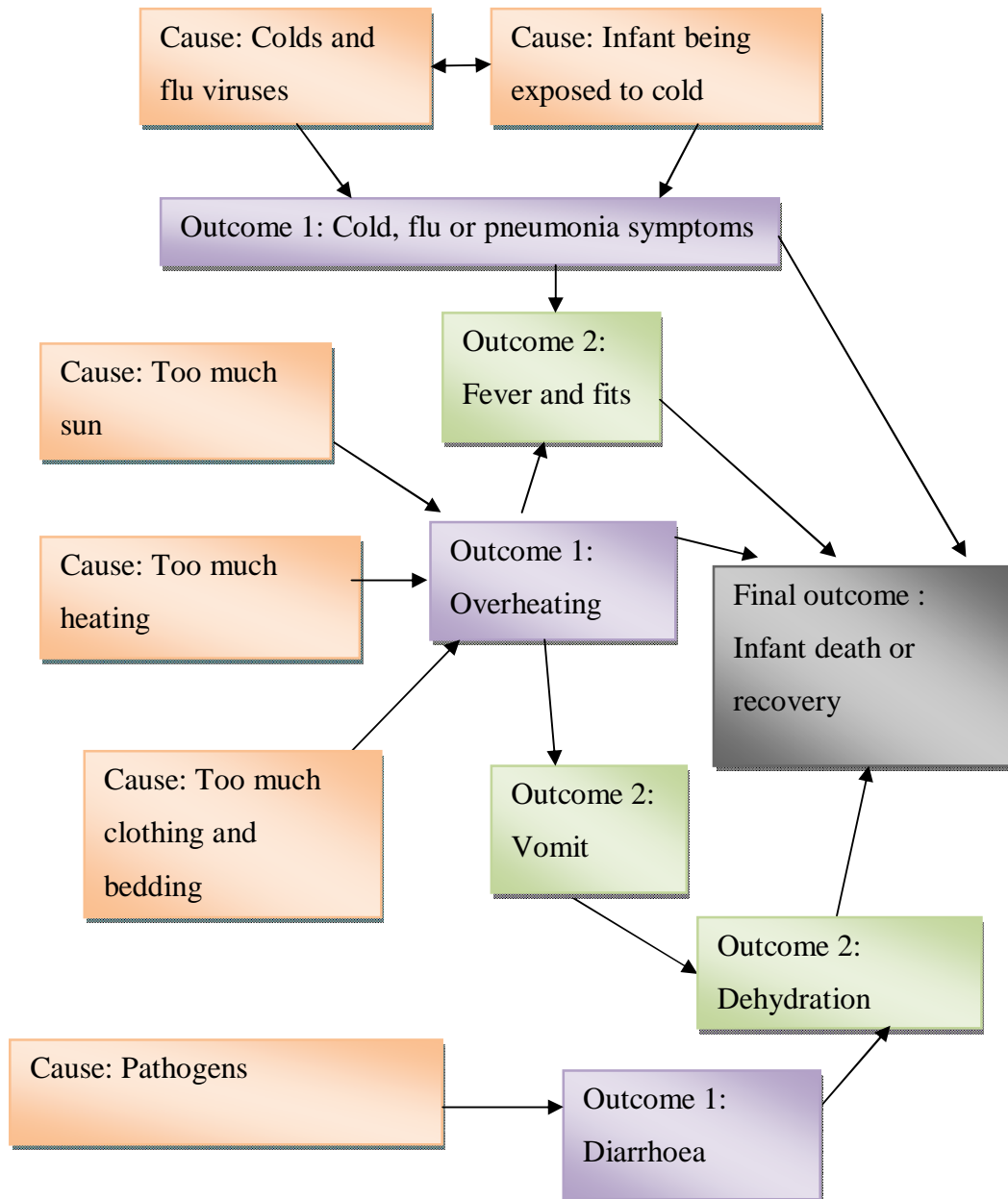


Fig 27 shows how much information a mother is managing at one time and, whilst she may be thinking of similar causes and outcomes as the health professional, the links are different and include different explanations. The mother is dealing with a complex array

of information, including some clinical and some cultural information. The mother's perspective is more holistic than that promoted by clinical science. This model does not include any beliefs such as evil eye, divine intervention, bad luck, or predisposition to outcomes, as an explanation for these outcomes, which would complicate the picture even further.

### ***10.7 Conclusion***

Thermal care of infants is a major concern for white British and South Asian mothers. Mothers reported that they are managing over thirty separate infant care concerns relating to thermal care. There were twenty-three concerns regarding heat stress and twenty-three from cold stress. These concerns ranged from major concerns such as death to more minor concerns such as poor sleep. When trying to prevent thermal stress, mothers are dealing with a more complex and holistic scenario of causes and outcomes than is typically considered by biomedicine. These pathways may be similar to medical aetiologies, but are not necessarily completely congruent, as the pathways perceived by mothers may involve more numerous factors and more variable outcomes than typically acknowledged by biomedical models.

Heat stress is believed to have the potential to cause death by SIDS, overheating, fever, suffocation, and dehydration. Heat stress is believed to lead to health conditions such as disordered breathing, vomiting, heat rash, eczema, and itching. Heat stress is also believed to affect infants' comfort and sleep, and some mothers did not want heat to make their infant sleep too deeply which might prevent the infant from alert the mother to any problems. In this sense, being awake enough to alert their mothers was a worry linked to fatal outcomes. The mothers did not think that the deep sleep would be fatal, but the infant's inability to express distress or pain would not allow the infant to alert the mother if they were in crisis.

Whilst medical professionals may insist high fever is almost always caused by pathogens, mothers in my sample were not confident this was the case and they placed more emphasis than expected on how they protect their infants from heat stress. In a sense, the mothers are right. They are aware of the infant's dependence on their caregivers to help them regulate their temperature, nutrition, etc., and know that they

cannot rely on the infant alone to safely thermoregulate. Whilst it is a clinical fact that infants have an immature thermoregulatory system until they are over 6 months old (Wailoo 2003), and that neonates are at high risk of hypothermia, this does not mean that most infants are completely unable to maintain an adequate body temperature or express their thermal stress to their caregivers. There are two issues emerging from the concerns about heat expressed by mothers in my research. The first is that overheating caused by too much clothing, heating, and bedding can lead to an uncontrolled high temperature. The second issue is that illnesses causing fever can also result in the same uncontrollable high temperature.

The fear that overheating can lead to the infant experiencing convulsions is common among physicians and lay people in the UK and USA. Betz and Grunfield (2006) showed that 82% of caregivers were “very worried” about fever. Temperatures that were considered to require treatment were relatively low. Caregivers fear central nervous system damage, seizure, and death. Gehri and colleagues (2005) found that physicians also had an excessive fear about cerebral damage from fever, and these fears contribute to the fears held by caregivers.. However, the real risk is far less than is generally assumed by lay people and medical professionals (Al-Eissa and colleagues 2001; Gehri and colleagues 2005; Sarrell and colleagues 2002) and is restricted to certain individuals with particular genetic make-ups (Mukherjee and Mukherjee 2002). Febrile convulsions are mostly experienced by children aged 6 months to 5 years, with certain groups being more at risk. These children are those with a relative with a history of febrile convulsions, a neonatal stay of more than 30 days, and a developmental delay. There is a recognised genetic predisposition to febrile convulsions and such convulsions are thought to be less dangerous to the child’s nervous system than these alarming episodes appear. Many children will never develop febrile convulsions (Mukherjee and Mukherjee 2002), but the fear of overheating leading to fits and cerebral damage is common.

Humoral beliefs of the effects of heat stress primarily involve external conditions and affects to the skin, whereas cold stress is thought to lead to respiratory disease and affects on internal conditions (Nichter 1987; Pool 1987). It is interesting to see evidence



of this same pattern in the current data, with skin ailments being overwhelmingly, although not exclusively, a concern of the South Asian mothers.

Infants cope with thermal stress differently, which might explain why some infants wake frustrated and restless with heat and others sleep deeply. If an infant has adapted to heat stress by sending blood to its peripheries, it may relieve the heat stress but this also results in a drop in blood pressure which may induce a deeper sleep. If the infant does not adapt in this way and heat is not lost through blood being sent to the peripheries, the infant will continue to suffer from heat stress, be unable to sleep, and become frustrated and uncomfortable, expressing this discomfort to the mother through cries, lack of sleep, and restlessness (Tappin and colleagues 2002).

Concerns about death from cold stress included SIDS and hypothermia. Conditions included colds, flu, pneumonia, fever, disordered breathing, asthma, and the infant going blue. Regarding comfort, cold stress was believed to affect sleep and to cause infants to cry, be uncomfortable, and shiver. Mothers were also concerned about cold stress, just as they were with heat stress, causing an infant to sleep too deeply to be able to alert the mother if the infant's life or health was in danger.

For many decades, the medical debate has continued about whether the British old wives tale of "getting a chill will mean you'll catch your death of cold" has any clinical evidence base (Cambridge University Press 2006; Zuger 2003). Recent medical research has found some evidence to support this cultural theory (Blatteis 2002; Johnson and Eccles 2005; Molony and colleagues 1999), but the evidence is insufficient to explain the causal mechanism. The medical stance that chills do not cause colds therefore largely remains. On the other hand, medical science has not been able to disprove this cultural theory either and there is some evidence that keeping warm may help the immune system be more effective (Blatteis 2002; Kluger 1986; Mackowiak 1994; Padopoulos and colleagues. 1999; Rodriguez and colleagues 2006). Both Save the Children and UNICEF widely promote keeping children warm in the fight to reduce the millions of child deaths to pneumonia each year (Save the Children 2008; UNICEF

2005).<sup>41</sup> Meanwhile, cultures across the world insist that cold temperatures can lead to pneumonia and protect vulnerable people accordingly. This belief has roots in white British culture as much as it has in South Asian culture, and represents on point of commonality between the two.

Whilst the beliefs about cause of a cold, flu or pneumonia might exist in both groups, how dangerous the outcome is believed to be, I propose, could differ because of a different epidemiological experience of infant morbidity and mortality in recent history. Lower respiratory tract infections (also referred to as pneumonia) are the single largest killer of children worldwide, with 1.8 million children under 5 years old dying each year from them (World Health Organisation 2009). In Pakistan, there are 13 pneumonia deaths per 1000 for under fives (World Health Organisation 2010b).<sup>42</sup> This is 32 times the death rate of UK infants from SIDS (Office for National Statistics: 2007) and so is therefore, justifiably, a much more pressing concern to South Asian mothers. It is unsurprising then that concern about infants contracting respiratory infections is emphasised, since such infections are linked to a potentially fatal outcome that is widespread in these groups. Interestingly, the South Asian mothers in this study did not link respiratory infections with death, but nonetheless it was their most significant concern related to thermal care.

It is also worth exploring what mothers might mean by a chill “causing” an infection. The medical profession has struggled to persuade mothers that a chill does not cause a fever since the discovery of germ theory. Before the discovery of contagion by pathogens (Magner 2005) there were, and still are, many cultural explanations as to

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<sup>41</sup> “UNICEF concentrates its efforts on reducing the incidence of acute respiratory infections and stopping deaths from pneumonia by providing warm clothing and basic medicines to children” (UNICEF 2005). “With rainy season here, it’s vital that young children get warm clothes to keep them from getting diseases like pneumonia” (Save the Children 2008).

<sup>42</sup> Under 5 mortality rate in Pakistan is 90 per 1000. 14.5% of these die from pneumonia, the highest cause of death after perinatal conditions and “other” causes. There are 13 deaths per 1000 under 5’s who die from pneumonia in Pakistan.

what causes disease, such as the evil eye, God's wrath, bad air, ancestors' anger, and a bird's shadow, for example (Burleigh and colleagues 1990; Escobar and colleagues 1983; Kresno and colleagues 1994; Laderman 1987; Spiro 2005). For over a hundred years, medical professionals have battled to educate the world about the pathogenic theory of disease and to rid cultures of the "ignorance" of cultural theories of disease (Baer and colleagues 2008). This battle continues to the present day with medics trying to persuade the public that catching a chill does not *cause* a cold and that microorganisms cause the cold. However, just because lay people believe a chill causes a cold does not mean they are ignorant of the theory that microorganisms are also involved. It could be their own observations and beliefs that have led them to believe a chill will *lead to* a cold. A possible explanation for this lay-medical conflict is that both are right to some extent. Restricting the causes of diseases such as pneumonia to pathogens alone may hinder efforts to stop millions of children dying from this disease each year if getting cold does contribute to an infection taking hold. If only a small percentage of the millions of children dying from pneumonia each year could be saved by appropriate thermal care practices, it would be worth investing in efforts to promote such practices. In developing countries, where 95% of childhood pneumonia occurs (Wardlaw and colleagues 2006), mothers have little control over pathogens developing but they do have control over the thermal care of their infants. Where lives are at risk and protection from the cold is believed to save lives (Winch 2005), clothing and bedding then become something that is both in the control of the mother and at the same time protecting the infant's life. Given that this involves a low-technology, non-clinical intervention and given that there is a lack of clinical evidence, it is unlikely that efforts to promote thermal care practices will be embraced by clinicians, despite the implementation of thermal care efforts by UNICEF, Save the Children, and other major child public health organisations.<sup>43</sup>

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<sup>43</sup> Facts for Life is a publication produced by UNICEF supported by W.H.O., UNESCO, UNFPA, UNDP, World Food Programme, and the World Bank. "Coughs, Cold and More Serious Illnesses" is one of the 14 themes targeting child mortality and morbidity. One of the central messages states, "a child with a cough or cold should be kept warm and encouraged to eat and drink as much as possible" (UNICEF 2010: 102).

Asthma is another condition thought by many cultures to be caused by an imbalance of hot and cold (Pachter 2002), but there is a far greater recognition and agreement of the link between getting cold and asthma among health professionals than there is of the link between getting cold and developing a respiratory infection (Cockcroft and Davis 2006).

How cold mothers believe their infants feel is a subjective judgement. The white British infant daughter of the G.P. mentioned in section 10.3 could quite possibly be comfortable despite many people telling the mother that her daughter must have painfully cold hands. The vasoconstriction of peripheries does cause a blue-purple colour because of the lack of blood near the skin's surface, although the infant may still be maintaining a perfectly adequate core body temperature (Parsons 2003). What may vary from infant to infant, however, is the level of thermal comfort associated with this condition. Vaso-constriction is an indication of some degree of thermal stress, as the body is showing it is unable to maintain a neutral temperature without an intrinsic adaptation to its micro-environment. This may cause pain or discomfort in some infants and not in others (Goldman and Kampmann 2007; Parsons 2003). Therefore, despite the distress of onlookers, it could be that the infant above was comfortable despite having purple hands, and if the infant was not comfortable she would let her mother know by crying or not sleeping. On the other hand, as the mother was so convinced no harm was possible, she may have dismissed her daughter's attempt to express her thermal discomfort as another kind of discomfort such as hunger, tiredness, boredom, or she might have assumed that her infant was a poor sleeper.

Both having trouble getting to sleep and staying asleep were mentioned by mothers as an indication of cold stress, as it was with heat stress. Difficulties in sleeping could be caused by exposure to extremes of temperature, but equally to non-extreme temperatures that did not happen to be adequate for thermal comfort (Goldman and Kampmann 2007; Parsons 2003). Research into thermal comfort of outdoor sleeping bags suggests that the insulation required for sufficient thermal comfort to allow an

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adult to fall asleep is greater than that to allow the adult to stay asleep. So, the infants who are waking because they are cold are probably exposed to more cold stress than those unable to fall asleep. The waking infants may not be able to get back to sleep without the addition of extra insulation (Kampmann 2007). It is not surprising that some infants wake because of the cold in the night, because bedroom temperatures were found to be at their lowest in white UK dwellings between 4am and 8am and at their highest between 10pm and midnight (Yohanis and Mondol 2009). The lowest body temperature of the infant during sleep is 2-3 hours after going to sleep, due to the infant's circadian rhythms (Holtzclaw 2007; Richard 1999; Wailoo 2003; Weinerta 2007). Thus, for infants put to bed at 7 pm, their lowest body temperature would coincide with a warm bedroom. However the timing of the lowest infant temperature is likely to differ between a white British infant that is put to bed at 7 pm and a South Asian infant that is put to bed at midnight.<sup>44</sup>

Daily variations of room temperatures in South Asian households are not known. Therefore it is possible that white British and South Asian infants experience different room temperatures when their body temperatures are at their lowest during sleep. However, if the mother is misinterpreting the reason for the infant waking as hunger, that all infants wake up in the night, or that cold stress is completely harmless, then the infant may be awake for hours before he/she sleeps again, which could turn into habitual infant waking and frustration on the part of a sleep deprived parent. Maternal sleep deprivation is itself a risk factor for SIDS (Baddock 2007; Blair and colleagues 1999). Where discomfort is concerned, the infant may show no other sign of being cold than not being able to sleep, so the mother may not realise this is the reason. This may explain why older children or even adults who habitually wake at night do not tell their

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<sup>44</sup> The normal hours of sleep in the South Asian families I visited was midnight to mid-morning. This was confirmed by being advised by my interpreter and her mother not to visit before 10.30am and when visiting people's houses around this time the mother and children still had pajamas on. On enquiring, it was not a problem to talk to mothers in pajamas, which would have been a problem with white British mothers. The difference in sleep hours could be influenced by the men's employment which often involved shift work in the catering and textiles industry and taxi driving. Families would eat late at night as well.

parents it is because they are cold. They may not be cold enough to be aware of it, but too cold to feel comfortable enough to sleep. One of the reasons being well wrapped might help infants, or adults, fall asleep is that a drop in blood pressure aids falling asleep (Tappin and colleagues 2002) and making the body warmer makes blood flow to the peripheries and causes a slight drop in blood pressure. Some of the mothers were aware that cold could be a reason for waking or not sleeping of course, and the nursery worker was aware extra insulation would help the infants in her care to sleep.

The highly significant Chi squared test result of  $p < 0.0001$  for South Asian mothers being more concerned about both heat and cold and white British mothers mainly about the heat supports the hypothesis that South Asian mothers aim to expose their infants neither to heat or cold stress and that white British mothers are far more preoccupied with the dangers of heat stress.

This does show however that the second generation Pakistani mothers whose mothers were from the Sindh region were more concerned about cold, and the second generation mothers whose own mothers were from the Punjab region were much more concerned about the heat than the cold. Neither can we assume that concern about the heat in second generation mothers is the product of being influenced by white British beliefs. It also shows us how generalising about South Asian mothers or even Pakistani mothers obscures differences within these cultures. The graph in figure 25 compares South Asian mothers who grew up in Pakistan and their concern about heat and cold stress. It also compares those who grew up in the Punjab region (North East Pakistan) to the Sindh region (South Pakistan) to see if there were any differences within the first generation Pakistanis. In all categories, protection from heat and cold was seen as the most important, but to a greater extent among those who grew up in Pakistan. The concern first generation Pakistani had about either heat or cold appears to be restricted to those who grew up in the Sindh region.

Whilst most South Asian mothers were first or second generation Pakistani, with only a handful of Bangladeshis, we cannot overlook the differences that exist within Pakistani culture. Concern about balancing both heat and cold was not as distinct among the second generation Pakistanis (50%) as with the first generation Pakistanis (81%).

Secondly, the first generation mothers who grew up in the Punjab region in North East Pakistan were all concerned about both heat and cold, whereas the answers were more mixed for the Sindh region in the south. Whilst the numbers are not sufficient to test the significance of this difference, it is completely plausible that mothers coming from different cultural groups and different geographic regions in Pakistan may hold different thermal care beliefs. We should therefore be careful not to make assumptions about Pakistani or South Asian culture in general. Furthermore, there was a difference between first and second generation Pakistanis, but the second generation behaviour was not necessarily reflecting an assimilation of white British beliefs and practices. I was told by several professionals working with the South Asian community in Bradford and Keighley that most of the Pakistani families were from the Miripur area, which is in the Sindh region. Only ten of my mothers had grown up in the Miripur area, so my data might reflect wider cultural differences within the Pakistani population than expected, highlighting again the need not to assume cultural uniformity in the South Asian community in the Bradford district.

The difference between the first and second generations suggests that the belief in balance originates in South Asian culture, as the second generation mothers are subject to a lifetime of influence of British culture, even if limited, and some of the first generation mothers a few years. Indeed, “culture is a blueprint for human behaviour, one that helps us gain a clearer understanding of individual behaviours. The new mother is the product of all her history: what she has learned about infants and feeding, and what she has seen” (Riorden, in Liamputtong 2007: 3). This belief in balance fits with the influence of humoral beliefs. We can also see that the South Asian mothers are also concerned about the infant getting too hot, and not just cold. A further 4% and 15% were most worried about cold and heat, respectively. This shows that, as a population, there is no apparent cultural bias towards fear of heat or cold, while the white British group showed a bias towards fear of heat. This is a further contradiction to the stereotype that South Asian mothers overwrap their infants and do not understand the fact that overheating is dangerous.

South Asian mothers’ interest in balance helps to eliminate stressors that put certain vulnerable infants more at risk of SIDS. This emphasis on thermal balance, and

thus protecting the infant from thermal stress of any kind, is possibly one of the explanations for the low SIDS rates in the South Asian community (Gantley and colleagues 1993). Although how and why heat stress contributes to SIDS, and whether cold stress can contribute to SIDS, is not understood, it is plausible to propose that protecting infants from thermal stress of any kind is of benefit to any vulnerable infants at risk of SIDS.

Although the range of concerns was similar among white British and South Asian mothers, the prioritisation of these concerns was very different. As predicted, because of the focus on overheating causing SIDS, fever phobia, and a historically positive attitude to cold stress, the top concern of white British mothers was about the infant overheating. The second major concern was death from SIDS or fever, and the third was related to sleep being affected. Although South Asian mothers' top concern was that if the infant was cold it could lead to colds, flu or pneumonia, this was not thought to be a fatal risk. The strength of the concern about cold, flu and pneumonia is however likely to come from South Asian cultures who have suffered millions of infant deaths due to respiratory infections in past decades. The stereotype that South Asian mothers overwrap their infants is not supported by these data, and in fact the evidence suggests that South Asian mothers are concerned about protecting their infants from both heat and cold stress. This emphasis on balance may be a protective mechanism for SIDS risk among South Asian infants, which might explain their low SIDS rates. The over-focus on heat stress among white British mothers may in turn be detrimental to white British infants, whose suffering from the adverse effects of cold stress might be overlooked. The South Asian emphasis on balance is supported by anthropological literature which documents humoral beliefs and beliefs about thermal balance. These views hold that heat affects the external organs (skin) and cold affect the internal organs (principally lungs), and these patterns were observed in my research. However, there are differences within the South Asian mothers in this data set. Among the Pakistani mothers, there was least emphasis on balance among second generation mothers and a high emphasis on balance among the first generation mothers from the Punjab region of Pakistan. Therefore, there are generational and cultural differences among South Asian mothers with a possible loss of focus on thermal balance occurring with time spent living in the U.K.



# Chapter 11 Discussion

## *11.1 Overview*

Ensuring that an infant maintains an adequate temperature involves an interaction of a) the infant's internal state and ability to thermoregulate, b) its caregiver's ability to interpret the infant's thermal needs, and c) the caregiver's beliefs regarding correct thermal care of infants and their thermal priorities for a given set of environmental conditions. These are described, in order, below.

Regulation of infant body temperature, is achieved through both physiological and behavioural means. Therefore, it is essential to understand both the role of different thermal care behaviours and individual expression of thermal discomfort, which each have the capacity to affect infant thermoregulation and physiology. If the infant's body temperature is not maintained within a given range there can be serious or even fatal consequences, such as hypothermia, pneumonia, or SIDS.

Caregivers often rely on multiple sources of information to assess infants' thermal needs. Although the use of room thermometers is often recommended, mothers judge infant thermal comfort in several ways other than using room thermometers. One way they do so is by assessing their own thermal comfort. However, even given identical environmental conditions to which an infant and a caregiver are exposed, including similar clothing and bedding, the infant may not necessarily experience the same degree of thermal comfort or discomfort as his or her caregiver. Therefore, it is important that the infant's expression of its own thermal state and thermal comfort level is recognised.

Although infants display thermal discomfort through behavioural means, mothers do not necessarily interpret these behavioural cues in the same way and the mother's beliefs regarding correct thermal care may override her judgements about what her infant appears to need in terms of being made warmer or cooler. Although different cultures may prescribe norms for bedding and clothing in different environmental conditions, there are a number of factors that result in individual infants responding differently to these prescribed practices such as age, time of day, level of activity, thermal sensitivity, and state of health.

Given these multiple factors that contribute to thermal balance in infants and thermal care practices of caregivers, understanding these practices and the beliefs which inform them represents a topic well suited to the approach of medical anthropology.

The process of completing fieldwork for this study, combined with an extensive review of the literature, produced several key points related to thermal care practices and beliefs. These include:

- **Several health conditions are believed to be caused by heat and cold**

Beliefs regarding adverse effects of heat and cold on infant health are commonly influenced by humoral beliefs, but in the UK and Nordic countries there is a greater fear of heat than cold. Heat and cold are believed to cause different problems, including infections, skin problems, fever and asthma, and, in Western countries, SIDS.

- **In the UK, the adverse effects of heat on infants has received greater attention than the adverse effects of cold**

There is a bias in clinical research and practice towards protecting infants from heat, and relatively little concern has been shown regarding the adverse effects of cold. The link between heat stress and SIDS is not fully understood, and studies on the thermal impact of clothing and bedding have underestimated the complexity involved. Despite a lack of strong evidence and understanding of how and when heat may be dangerous to an infant, much effort is invested by parents, health professionals, bedding manufacturers, and health researchers into protecting infants from overheating. In contrast, research on the link between SIDS and cold stress is almost non-existent. Some evidence exists to support the theory that keeping an infant warm protects him or her from developing respiratory infections because the immune system is more effective at higher temperatures

- **A mixed methods approach is advantageous in an exploratory study of infant thermal care**

In an exploratory study, a mixed methods approach is advantageous because it generates a wider range of data. In this study I was able to use the quantitative results of the

clothing and bedding insulation values to do a statistical analysis on the use of bedding and clothing, and the qualitative data to explore what mothers believe about how they should provide thermal care for their infants and what dangers are posed by heat and cold.

- **The sample of white British and South Asian mothers was representative of their existing communities in the Bradford District.**

The sample included a mixture of socio-economic groups, mothers' ages and ages of infants. The South Asian mothers group was half first generation and half second generation, which is the same proportion that exists in the Bradford District. This broad cross-section of education, income, employment, age and culture generated data that enabled a meaningful comparison of the different groups.

- **Use of clothing and bedding differed between white British and South Asian mothers**

White British mothers used significantly more insulation in the form of bedding in winter than South Asian mothers. This difference can be explained by the popularity of infant sleeping bags among white British mothers. There were no statistically significant differences for clothing use in winter or summer, or for bedding use in summer, between the white British and South Asian mothers. There was no significant difference between clothing and bedding use in winter or summer between first and second generation South Asian mothers.

- **South Asian infants slept in different environmental conditions than white British infants**

More South Asian infants slept with doors closed and in a room with parents and siblings than white British infants. This indicates that South Asian infants were exposed less to cooling air flow during the winter, and were closer to a sibling or parent as a heat source during the night.

- **Mothers used several methods to assess their infant's thermal needs**

To measure their infant's thermal needs mothers did use thermometers, but more commonly they made an assessment using multiple environmental, behavioural, and physiological cues. There were differences in how mothers assessed infant thermal needs between South Asian and white British mothers.

- **There were differences in beliefs and priorities about the adverse effects of heat and cold on infants between white British and South Asian mothers**

There was a statistically significant difference between white British and South Asian mothers' concerns about the adverse effects of heat and cold. White British mothers were predominantly concerned about heat, and South Asian mothers were concerned about both heat and cold.

These eight points are explored in depth in the sections below.

### ***11.2 Several health conditions are believed to be caused by heat and cold worldwide***

The literature review in chapter 2 on cultural beliefs regarding the thermal care of infants demonstrated that thermal care is a major component in safeguarding infant lives and health worldwide. Humoral belief systems, although highly variable, exist on a global level and follow the same broad principles of avoidance of extremes with regard to hot or cold. These belief systems have a major influence on thermal care practices worldwide. Where humoral beliefs appear to be less influential, such as in Northern Europe and especially in Great Britain and Nordic countries, the notion of balance is held to be less important than that of resilience. Among these cultures, infants are perceived to have a considerable resistance to cold temperatures, and it is believed that cold can actually promote health and strengthen infants' constitutions. Heat, on the other hand, especially in contemporary British culture, is somewhat feared and is believed to be life threatening, particularly for infants.

The case study from Guatemala illustrates how thermal care of infants is structured and practiced in a culture that is heavily influenced by humoral beliefs. Guatemalan infant thermal care is strongly tied to humoral beliefs about the dangers of heat and cold, in metaphorical and supernatural as well as physical ways, with an overriding concern about protecting infants from even the slightest exposure to cold. Whilst a bias to neither cold nor heat would be expected in a humoral culture, fear of cold in particular can be explained by the relative threat posed to human life by environmental changes that are thought to be sufficient to subject an infant to thermal stress. In Guatemala, a major threat to infant survival is pneumonia, which is believed to be caused, in part, by getting cold. The Guatemalan women who were grandmothers during the period the data were collected had experience with caring for infants in an environment where more than one in seven infants born alive did not survive the first year. Mothers who were my contemporaries still contended with multiple threats to infant life, pneumonia being one of these, with one in fourteen infants not surviving infancy. As cold was seen as a major factor in these deaths, protecting infants from cold was perceived to be urgent and worthy of a considerable investment of time and care. Careful attention to culturally appropriate thermal care designed to protect infants from the cold relied upon maternal care practices, with additional support from anyone within the infant's community, as knowledge of correct thermal care was held by men, women, and children of all ages. This "correct" approach to thermal care was also socially enforced, as I became well aware when I consistently broke the rules and was instructed by anyone, known or unknown, of any age, ethnic group or gender, in any location in Guatemala. The thermal care of infants was a communal responsibility and was not left to the mother alone to provide.

The exploration of thermal care practices and beliefs worldwide demonstrates three major points.

- a) That humoral, balance-promoting beliefs are extremely common globally.
- b) That there are some exceptions to the humoral system where heat is feared and cold is seen as health promoting.

c) That even in a humoral, balance-promoting culture there can be a strong bias towards avoiding one extreme, such as cold, where that extreme poses a disproportionate threat to infant life.

Thermal care beliefs and practices cannot be understood apart from the context of infant mortality, where heat or cold is believed to play some role in infant deaths. Where there have been rapid epidemiological shifts within a population, it is possible that thermal care beliefs may lag behind present conditions. For example, in Guatemala the preceding generation experienced an infant mortality rate almost three times higher than for my contemporaries, and this older generation exerted influence over how their daughters cared for their infants. Therefore, the extreme care devoted to protecting infants from cold in Guatemala reflected a response to this previous threat to infant life. In the UK, given that SIDS rates have only recently declined dramatically, cultural perceptions of infant thermal care could still be responding to a fear of SIDS that was prevalent in a previous generation.

### ***11.3 In the UK, the adverse effects of heat on infants is given more attention than the adverse effects of cold***

The clinical literature was explored for evidence of how thermal care can positively or negatively affect the physiology of the infant and his/her thermoregulation, regardless of the cultural beliefs and/or cultural setting in which infant care practices take place. The clinical literature review presented in chapter 3 revealed an emphasis on the significance of infant thermal care in the prevention of SIDS and the management of fever.

The most significant reduction in SIDS rates was seen after the Back to Sleep campaigns of the 1990's, when parents were encouraged to place their infants to sleep in a supine rather than prone position (McKenna and McDade 2005). There was an extremely marked drop in SIDS cases after these successful campaigns. However, packaged with the Back to Sleep campaigns' messages was the recommendation not to let infants overheat because it could cause SIDS. The UK represents a culture that was already fearful of heat, and the initiation of the Back to Sleep campaign saw a highly significant ( $p=0.0003$ ) parallel rise in mothers' concerns about the harm heat can cause

to their infants and a drop ( $p=0.0001$ ) in concern about the cold (Hiley and Morley 1994). More research into the links between heat and SIDS encouraged health professionals and SIDS preventions charities to continue to remind parents to avoid overheating. These efforts have served to reinforce this fear of heat in British culture, and preventing overheating remains an overriding concern among parents.

Although studies estimating the insulative effect of infant clothing and bedding have been attempted, the complexities involved in arriving at these calculations have been vastly underestimated (Wigfield and colleagues 1993; Fleming and colleagues 2006), as discussed in Chapter 3. Regarding the link between cold stress and SIDS, research is plagued both by methodological problems as well as a general lack of data on the topic, even though cold stress is potentially more harmful to an infant because of the many stresses and complications that can occur as a result of cold stress. We know that SIDS is rarely the result of one single cause or malfunction in the infant's internal regulation, but rather SIDS usually results from an accumulation of stresses in an infant that is already, albeit unknowingly, vulnerable to SIDS. There are so many things we do not understand about SIDS and by failing to consider and address the effects of cold stress as a risk factor for SIDS there may be an omission of potentially life-saving evidence. On the other hand, induced hypothermia of infants with neonatal problems is becoming a popular therapeutic technique (Thoresen and Whitelaw 2005), despite a lack of understanding of the effects of cold stress and hypothermia on infants.

Regarding cold putting infants at risk of pneumonia, the "old wives' tale" that "getting cold causes a cold" has been popularly dismissed for a large part of the past century, yet in reality there is no strong evidence to dispute this assertion. There is evidence that the belief holds some truth, as held by cultures worldwide for centuries, since the immune system is more active when the body is warm and therefore is better able to defend against pathogens harbouring in the respiratory tract. However, there has not been a vast amount of research done on this topic. More evidence is needed that to discover whether or not proper thermal care of infants could potentially contribute preventing pneumonia to some extent. This could affect millions of infants' lives where resources are so few that even relatively cheap pneumonia vaccinations are not available and where mothers in many cultures are skilled and knowledgeable about protecting

their infants from cold. An awareness of the dangers of cold to infants in low income countries would also aid in preventing thousands of deaths from neonatal hypothermia in countries that are assumed by lay people in the high-resource countries of the Northern hemisphere to be too hot for neonatal hypothermia to even exist.

Unlike the effects of cold, heat does not seem to be a significant cause of infant mortality on a global scale, but is believed to be a major contributory factor to the main cause of infant death in the UK, SIDS, even though the evidence is not strong and the causal mechanisms are not well understood.

To understand what healthy and safe thermal care practices might be for an infant, there are several topics regarding the infant's intrinsic and extrinsic environments that need to be considered. Intrinsic factors include how an infant thermoregulates, and how this differs according to age, activity, circadian rhythm, state of health, and body shape and size. Extrinsic factors include how the infant is affected by environmental temperature, humidity, air currents and different sources of heat, including heat provided from the sun or from another person's body. Furthermore, it is important to understand how the infant interacts with different types of bedding and clothing, and to assess how best to calculate the impact of various materials on infants with different surface areas and how such materials affect areas of the body that lose or conserve heat at different rates at different times. Given the number of factors involved and the amount of variation possible, it is hard to see how any uniform thermal care practices can be prescribed without also considering the infant's internal environment. It is difficult to recommend what clothing, bedding, or heating is required for infants without some way of judging the changing body temperature of the infant over the night-time period. These judgements can be made using devices, using the mother's assessment of the environment, and also by interpreting the infant's expression of thermal discomfort. Infants that sleep through the night in a room without a caregiver are therefore not supported in monitoring and managing their different thermal care needs throughout the night. Some may be able to adapt to challenges through their own thermoregulation, but others may become adversely stressed and challenged by the lack of thermal care support available throughout the night.



#### ***11.4 A mixed methods approach is advantageous in an exploratory study of infant thermal care***

Medical anthropology not only enhances quantitative methodology, but recognises the individual experience within a collective context and therefore reaches far beyond the clinical gaze (Agdal and colleagues 2010). The aim of this research is to provide evidence of thermal care beliefs and practices, and to address how this care may impact on infant physiology. It is a highly inter-disciplinary research question which is well suited to the perspective and methods of medical anthropology. Researching thermal care practices and beliefs of other cultures, including the South Asian groups included here, is useful not only in providing a deeper understanding of South Asian parenting in the UK but also in providing a critical assessment of white British beliefs and practices. Understanding another culture helps us to partially step outside our own culture, to think more objectively about how much our medical knowledge is influenced by culture and not by objective clinical science, and to see what direction the culture is headed. This study has the potential to produce uncomfortable results that challenge accepted norms and authoritative positions, yet these results can be useful for advancing our understanding of infant health.

By choosing a mixed methods approach in this exploratory research, I was able to address a number of different types of research questions. These questions involved the use of broad qualitative data, such as amount of insulation on infants at night, as well as in-depth qualitative data, such as explanations about why mothers made the thermal care decisions they did. Having obtained this diverse data set, I was therefore able to explore various avenues of enquiry about infant thermal care, involving both physiological and behavioural factors. This preliminary research provides a foundation for the study of infant thermal care, and can be used to inform subsequent studies. Suggestions for future research are described below.

One reason for caution in interpreting the quantitative data was the difficulty in assigning insulation values to the clothing and bedding mothers reported using for their infants at night. The actual materials used were not tested using the hot plate method, where the amount of heat that passes from one plate to another produces an insulation value for that material. For the purposes of this study, mothers reported the item,

approximate thickness, and kind of material used. To these items, insulation values were assigned based on the values produced by the British Standard on ergonomics of the thermal environment (British Standards Institute 2007).

Due to the difficulty involved in judging the thermal effect of infant bedding and clothing materials, even without taking into account design elements that result in different properties for air circulation, there is no strong evidence from the few infant thermoregulation studies conducted outside of incubators to suggest what level of insulation could actually be harmful to infants, or to which infants. Therefore, where my results have identified mothers who use much more or less insulation for their infants than most mothers this is in no way an indication of how harmful the additional insulation, or lack thereof, is for those infants. Again, the most meaningful result provided by the this study involves the group comparisons, and appropriate caution should be exercised in making any judgements regarding how much insulation is good or bad for an infant.

### ***11.5 The sample of white British and South Asian mothers was representative of their existing communities in the Bradford District.***

Chapter 6 highlighted the major similarities and differences between the samples of South Asian and white British mothers who participated in this study. There were more South Asian mothers with no qualifications, and many more South Asian mothers who did not work. Additionally, nearly all South Asian mothers were married compared to three quarters of white British mothers who were married or living with their partner. Half of the South Asian mothers were first generation South Asians and half were second generation; this allowed for some comparisons between the two generations. Another major difference between the two ethnic groups was that there were more South Asian than white British mothers with a household income of less than £13,499, although income was difficult to discern in the South Asian group because of the complexity involved in calculating income in a multi-generational household as well as an unwillingness to disclose income. Nearly all white British mothers and just over half of South Asian mothers lived in a nuclear family household. South Asian multi-generational households, despite having a larger number of residents, were not overcrowded because their properties had more rooms per household.

With regards to differences between infants in the two groups, 2% of South Asian and 16% of white British mothers reported smoking during their pregnancy but 14% of white British and 22% of South Asian infants were exposed to cigarette smoke inside the house during and after birth. The mean birthweight for South Asian infants was lower than the mean for the white British infants, and over twice as many South Asian infants were low birthweight and/or premature compared to white British infants. Almost half of the South Asian infants slept in bed with their mothers either all the time or occasionally, whereas only a quarter of white British infants slept occasionally in their mother's bed. These data indicate, although do not prove, that more South Asian than white British infants sleep in their mother's bed, and these infants thus receive maternal warmth as well as the insulation they are provided with, combined with any heating used in the house at night.

The above data serve to demonstrate the differences between South Asian and white British mothers and infants in this sample, which allows the goal of a comparison of the two groups to be achieved.

### ***11.6 Use of clothing and bedding differed between white British and South Asian mothers***

In chapter 7, several results regarding the use of clothing and bedding were surprisingly significant. Because of the evidence of variable thermal care beliefs discussed in chapter 2, it was not unreasonable to expect that bedding and clothing use would be different in the two groups. The differences found involved use of bedding, and the difference in winter and summer bedding between the two groups was highly significant. One of the research questions addressed whether white British mothers would be fearful of their infants overheating and therefore would put less insulation on their infants at night. However, the results showed the reverse of this pattern, with a significantly higher level of total insulation among the White British mothers. No significant difference was found in clothing use in summer or winter for both groups, and items used seemed to be quite standard. Mothers usually put a vest and babygro on their infants in both groups in winter, and used just a vest or a babygro and vest in summer.

There was no difference between first and second generation South Asian bedding or clothing use in winter or summer. This is again surprising, because the two sub-groups of South Asian mothers grew up in different environments in terms of culture, climate and infant mortality. The similarity in choice of bedding and clothing could mean that thermal care practices are conserved across generations even after migration. The most plausible explanation for the unexpectedly high insulation used by white British mothers was the difference in usage of infant sleeping bags. Only one South Asian mother reported putting an infant sleeping bag on her infant at night, and only in the winter, whereas almost half of white British mothers used infant sleeping bags.

It is not surprising that the sleeping bags produced higher values for insulation because even the lighter ones, which were of comparable thickness to the infant duvets, covered both sides of the infant's body and thus provided twice the insulation value for the torso. In addition, mothers often knew the exact tog ratings of the infant sleeping bags they used, which were substantially higher than the value for any infant duvet or combination of infant duvets and blankets. A few of the mothers using infant sleeping bags also added sheets or blankets to the sleeping bag, making the values higher still. These higher insulation values have been found without even beginning to account for the thermal effect of the sleeping bags on the infant. The enclosed, close-fitting body design of the bags makes them more effective in trapping air than the infant duvets, which can be partially or wholly kicked off by the infant, and the trapped air in the sleeping bags is able to retain heat, thus keeping the infant warmer than I have estimated using material values alone.

Arguably, the use of highly insulating infant sleeping bags is an example of thermal care decisions that are influenced by social and cultural factors rather than being based on objective judgement of the ambient temperature and individual needs of the infant. The trend in infant sleeping bag use seems to be absent in the South Asian community. This can be partly explained by influence of peers, where mothers might see how their friends and family care for their infants with sleeping bags and subsequently develop a preference for the sleeping bags themselves. In communities where white British and South Asian mothers have little opportunities to mix due to segregated neighbourhoods and schooling, combined with fewer South Asian mothers

who are employed outside the home, peer influences tend to remain specific to a given community and do not typically cross ethnic lines.

One possible reason why the infant sleeping bag trend has taken hold among the white British mothers and not the South Asian mothers could involve the way white British mothers receive advice about caring for their infants. South Asian mothers were more open to advice from family members, even if they ultimately disagreed with the advice. White British mothers felt strongly that nobody had the right to tell a mother how to look after her children. The greater autonomy exhibited by white British mothers leaves them both more open and vulnerable to advice and recommendations from magazines, health care professionals, or companies claiming to provide infant care products that employ the latest scientific knowledge. This is not to say that there are no social pressures on white British mothers to conform to infant care techniques as practiced by their peers, but rather that the pressure does not come directly from immediate family and friends and so white British mothers may be more influenced by commercial trends.

One of the biggest infant sleeping bag companies in the UK publicises the endorsement of its products as aiding safe sleep by the UK's biggest SIDS prevention charity, Foundation for the Study of Infant Deaths. Thus, mothers anxious about SIDS are being very effectively targeted and offered a product that is sold as being protective against SIDS. With overheating being a well known risk factor for SIDS, it is ironic that these sleeping bags are providing significantly more insulation than the traditional blankets and/or infant duvet system. The Grobag marketing materials suggest that the sleeping bags are for safe sleep and imply that sleeping with blankets should be a thing of the past. There has been a rapid shift towards the use of infant sleeping bags in the UK, excluding the South Asian and possibly other ethnic minority communities. However, there is no definitive evidence that this higher capacity to keep the infant warm is in any way harmful to the infant, but because there is no strong evidence either way it is clear that promoting infant sleeping bags as a safe sleep product could be considered unethical. Likewise, one might question the ethics of a charity that is relied on by parents for unbiased evidence-based advice on how to protect their infants from SIDS, giving such high profile endorsement to a company's products that have not been

proven to be protective against SIDS., One might further question the charity's motives given the fact that it currently accepts over half a million pounds in funding for SIDS research from Grobag while endorsing their products.

Looking at this situation in a more positive light, the sleeping bags could be unwittingly protecting infants from SIDS. If there are some SIDS deaths that are the result of cold stress, and the infant sleeping bags do retain the infant's body heat more effectively than blankets and infant duvets, it could be that the sleeping bags are actually protecting some infants from SIDS in a cold-complacent culture. SIDS deaths are more common in infants from deprived backgrounds, and the white British mothers in my sample who were better educated and had higher household incomes used the sleeping bags more than white British mothers with lower incomes and lower levels of education. Could some of the white British infants from lower socioeconomic backgrounds, who are less likely to sleep in infant sleeping bags, be at increased risk of SIDS because they are more exposed to cold stress? Although the South Asian infants had the same amount of insulation as the white British infants who were not sleeping in sleeping bags, the South Asian infants were more likely to sleep in their mother's bed for some or all of the night and so received their mother's warmth to compensate.

The infant's perceived preferences regarding thermal conditions were often taken into account as well, even if the mother was aware they could be dangerous, such as allowing an infant to sleep with a blanket pulled over his or her face. Some mothers believed that their infants were attached to certain items of beddings, such as a comfort blanket, or to clothing styles such as all-in-one babygros that did not expose the feet. The mothers interpreted preferences of the infant, and some defended their infant's perceived choice even if it meant arguing with other family members about the suitability of the clothing and bedding items and even if the perceived preferences made the mothers themselves feel uncomfortable. However, mothers were motivated to give in to these preferences in order to promote sound sleep for their infants. If they felt their infant would not sleep without a certain blanket or a certain arrangement of bedding items, they typically acquiesced to their infants' preferences.

### ***11.7 South Asian infants slept in different environmental conditions than white British infants***

To understand differences in thermal care of infants, it is also necessary to understand the physical environment where infants sleep. Although I could not make direct measurements of these conditions, I was able to obtain indirect evidence. Two of the three South Asian infants who slept in a room where there was no heating at all slept in their mothers' bed and would thus not have been at as much risk from cold as an infant who slept alone in an unheated room. Half of the South Asian infants slept always or occasionally with the mother in bed, thereby receiving body heat from their mothers.

All but three of the South Asian infants slept in the same room as the mother, and were therefore under close supervision for their changing thermal needs throughout the night. More South Asian infants slept in rooms with the door shut, meaning that less air was circulating to cool down the infants. The white British infants who slept in rooms alone were more likely to sleep in a room with a door open because white British mothers wanted to be able to hear the infant if he or she woke up in the night. Therefore, a lone sleeping infant may be at more risk of getting cold because there is air circulating due to an open door. It is known that having an infant sleep in the same room as the parents is protective against SIDS, although it is not understood exactly why this protective factor exists. Being able to provide constant supervision throughout the night to ensure the infant maintains thermal comfort may be an overlooked reason for why it is safer for an infant to sleep in the same room as their caregiver.

Heating and air circulation were not always under the control of the mother. In a multi-generational house with people with differing levels of thermal comfort, metabolic rates, ages, conditions, and preferences, a young mother may not have any control over providing an ideal thermal environment for her infant. The qualitative data demonstrated that a first time mother had less status, and therefore less decision-making power, compared to a mother with more children and especially compared to a grandmother.

### ***11.8 Mothers used several methods to assess their infant's thermal needs***

As previously discussed, it is not possible to guarantee that a certain number of layers in a certain ambient temperature will prevent an infant from suffering thermal stress, although there are several room thermometers marketed to help parents maintain a “safe” room temperature. Because an infant’s metabolic rate can change throughout the night as can environmental conditions in the room, support is needed from the infant’s caregiver throughout the night to maintain thermal comfort. Thermal comfort also differs from infant to infant; some infants can be perfectly comfortable with vaso-constricted, cold hands, while other infants will suffer discomfort under the same conditions. Therefore, it is useful to understand how mothers interpret whether or not their infants are suffering thermal stress or discomfort.

There are several room thermometers on the market aimed at maintaining adequate room temperatures. In addition, there are several giveaway schemes run by health visitors that provide new mothers with card room thermometers, and some baby monitors incorporate a room thermometer. The Grobag company uses Foundation for the Study of Infant Deaths’s endorsement to promote their room thermometers. The Back to Sleep campaign resulted in twice as many (87%) mothers using room thermometers (Hiley and Morley 1994), demonstrating that concern about SIDS was a major factor in the increase in possession of room thermometers. However, the efficacy of these products for assisting mothers in maintaining a “correct” room temperature has not been evaluated despite the amount of public and family money spent on these devices. In my sample, 53% of South Asian and 74% of white British mothers possessed a room thermometer. 12% of South Asian and 34% of white British mothers possessed an electronic room thermometer, and the rest had the card thermometers given to them by midwives or health visitors.

Possession of room thermometers did not necessarily imply use, however. 28% of South Asian and 54% of white British mothers aimed for a specific room temperature, and 11% of both groups relied on the card thermometers to indicate that the temperature was “just right.” The most common method of judging room temperature among South Asian mothers was what they “felt was right.” Because nearly all the South Asian infants slept in the same room as their mothers, this method would presumably allow



these mothers to judge how warm or cold their infant's room was, but the same method would have been difficult for the lone sleeping white British infants. This perhaps explains the higher reliance on room thermometers among white British mothers. However, 34% of white British mothers also said they relied on what they felt was right, indicating that neither group was totally reliant on room thermometers. Despite the prevalent use of thermometers, this method is not entirely reliable in assessing the infant's thermal needs because there are several factors that could make the mother feel warmer or cooler than her infant even in the same ambient conditions.

Many mothers were responsive to their infant's expressions of their thermal needs. The behaviours and signs that mothers reported as specifically indicating heat stress were: irritability; heat rash; discomfort; red skin; itching; skin feeling warm; arms stretched out; sweating; covers kicked off; and being frustrated. Behaviours and signs that were seen as specific indications of cold stress were: skin looking blue; skin feeling cold; and the infant shivering. Signs and behaviours that could indicate either heat or cold stress were: crying; not sleeping; and eczema. Literature on thermal comfort of infants is practically non-existent. Despite an infant being able to maintain an adequate core and outer body temperature, he or she can still suffer from thermal discomfort which can affect an infant's sleep and comfort level. This discomfort can impact on the mother's sleep, and can affect how satisfied and confident she is about her ability to keep her infant healthy and content.

Thermal comfort of infants is an important aspect of infant care practices. The above behaviours identified by mothers are a useful starting point for research focused on developing a greater understanding of thermal comfort of infants. It is possible that some mothers do not recognise these signs of thermal discomfort, and perhaps they could be taught through peers and parenting programmes how to distinguish between heat and cold stress and how to determine when their infants are indicating they need slightly more or less insulation, even if this appears to contradict the prevailing advice for "safe" dressing of infants. Some infant expressions of thermal discomfort are quite subtle and may not wake up a mother who sleeps in a different room from the infant, although the more subtle cues could be sufficient to alert a mother who sleeps in the same room as her infant. Co-sleeping could therefore play an important role in

delivering effective responses to an infant's cues of thermal stress, potentially resulting in a reduction of adverse effects of thermal stress to the benefit of the caregiver and the infant.

### ***11.9 There were differences in beliefs and priorities of the adverse effects of heat and cold on infants between white British and South Asian mothers.***

Chapter 10 reported the mothers' concerns about how heat and cold might harm their infants. Twenty-four concerns about heat stress and twenty-two concerns about cold stress were identified by mothers. The adverse effects of thermal stress reported by mothers included disturbing sleep, causing infections, SIDS, high fever, asthma, and skin problems.

The evaluation of the Back to Sleep campaign demonstrates that the campaign reduced mothers' concerns about their infants being too cold and increased concern about them becoming too hot (Hiley and Morley 1994). An increased concern of mothers to preventing overheating as a result of the campaign was evaluated, but not concern about preventing cold stress. The fact that fewer mothers worried about their infants getting cold was not seen as a negative outcome of the campaign: "The Department of Health's campaign was associated with improvements in sleeping position, use of bed coverings, and attitudes to heating" (Hiley and Morley 1994: 703). My results show that exactly the same percentage of white British mothers in the early 1990's (19%) as in my sample (19%) were concerned about their infants getting cold, but a much higher percentage in my sample (78%) of white British mothers were concerned about their infants getting too hot compared to the Back to Sleep evaluation sample (37%). This could be because the campaign's message has continued to be promoted over the 15 or more years since this evaluation was conducted, and continues to be effective in increasing mothers' concerns about their infant overheating despite the dramatic fall in SIDS rates since the time of the evaluation. The potentially negative outcome of this increased concern about overheating is that it has reduced mothers' concerns about the infant getting too cold, and it is not yet known how cold stress might be related to increased risk of SIDS. Furthermore, the emphasis on overheating may be

creating a disproportionate fear among mothers that their infants will overheat and die of SIDS, resulting in increased maternal stress.

White British mothers were significantly more concerned about their infant getting hot, whereas South Asian mothers were concerned about their infant getting both too hot or too cold (Pearson Chi-Square= 37.019,  $p < 0.001$ ). This shows that South Asian mothers are quite focused on thermal balance. Infant care practices of ethnic minorities. It is an ethnocentric assumption that infant care practices common among immigrant cultures are harmful, and that the practices of the dominant cultural group are necessarily worth replicating, even if the advice comes from people judged by the indigenous society to be experts on child health, such as health professionals. Other beliefs and practices may be just as healthy for an infant, or in some cases such as thermal care of infants may prove to be beneficial and worth promoting. The South Asian mothers appear to have maintained a certain amount of autonomy in conserving their infant thermal care practices and beliefs, but as a minority culture they may feel under pressure to some extent to conform to what is accepted practice in the dominant majority culture. Experiences such as a health visitor taking an infant from a South Asian mother to remove layers of clothing, as described in chapter 7, are potentially humiliating and disempowering to South Asian mothers. I propose in this thesis that another difference with South Asian infant care practices is that the influence of humoral beliefs in their cultures promotes the idea of balance. By ensuring that their infants are not exposed to either heat or cold stress, they are providing additional protection against SIDS because they do not allow their infants to become physiologically stressed by extremes of temperature. This could therefore be another reason why SIDS is so low in South Asian communities in the UK.

### ***11.10 Implications for future research***

The field of research on thermal care of infants has focused mainly on the link between thermoregulation of infants and SIDS and fever, and has been weighted towards assessing the adverse effects of heat. However, there are numerous opportunities for additional research on many other topics related to infant thermal care, involving both clinical and anthropological perspectives and methods. Several specific

areas for further research have been identified throughout this thesis and are summarised below.

### **11.10.1 Social anthropology**

Future research directions in the field of anthropology and thermal care could involve the study of how SIDS-prevention advice is or is not appropriate for different ethnic groups, which have different thermal care practices and beliefs and may have different risk factors for SIDS. Other research could undertake a more detailed investigation of how humoral beliefs influence thermal care of infants, the disabled, and older people in different cultures worldwide and in immigrant groups.

### **11.10.2 SIDS**

In the field of SIDS research, there are several topics that need further investigation so that more can be understood about the role of thermal care of infants in affecting various health outcomes. Similarly, future research will be helpful in determining how to measure thermal stress, appropriate environmental conditions, and optimal use of clothing and bedding. Future studies can address:

- How to accurately capture to the complexity of the interaction between clothing and bedding on the infants;
- The thermal effect of infant sleeping bags;
- Detailed studies of the environmental conditions in which infants sleep;
- How cold stress may contribute to SIDS deaths, including cardiovascular complications occurring days after experiencing cold stress;
- The reduction in mothers' concerns about the cold resulting from advice from health professionals regarding the prevention of overheating;
- How co-sleeping might protect infants from thermal stress through mothers increased ability to detect thermal stressors and respond effectively.

### **11.10.3 Infections**

How much can cold stress contribute to an infant developing a respiratory infection, and can appropriate thermal care of infants play any role in preventing even a small number of the millions of child deaths due to pneumonia?

#### **11.10.4 Thermal comfort of infants**

How good are parents at detecting thermal comfort in their infants? How much does it concern them, and what are the infant's cues of thermal discomfort confused with? Does the infant's agency influence inappropriate thermal care during fever?

#### **11.10.5 Effect of thermal stress on general infant health and development**

If an infant has been repeatedly subject to cold or heat stress, what is the impact on the infant's growth, development, sleep, feeding patterns, and the maturing of his or her thermoregulatory system?

#### **11.10.6 Thermal care of older people and other vulnerable groups**

Cold stress has already been linked to thousands of excess deaths of older people each year in the UK due to cardiovascular complications. How could thermal care of vulnerable groups such as older, sick and disabled people, as well as infants, be better researched and gain a higher priority in the care provided to such individuals?

The variety and quantity of research opportunities discussed above almost amounts to a field in itself, and much of the research could provide answers that are not being generated in other fields of research.

### ***11.11 Conclusion***

This thesis has explored several aspects of thermal care of infants, including differences in amounts of insulation used at night, the environmental conditions infants sleep in, how mothers judge the thermal comfort of their infants, and how they believe heat and/or cold can adversely affect their infants. The homeostasis of an infant's temperature is the result of his or her physiological response to the internal and external environment. The infant's internal environment is constantly changing, and his or her response is also changing as the thermoregulatory system matures over the first year of life. The external environment, including clothing, bedding, sources of heat, air flow, humidity, and air temperature are largely dependent on the decisions made by the caregiver regarding the infant's thermal needs and how they should be met. Despite the importance of maintaining an adequate body temperature, there is much we do not know about how mothers achieve this for their infants. This thesis has begun to unravel some

of the many aspects of beliefs and practices of infant thermal care, and has examined how cultural groups differ in their interpretation of thermal stress, the dangers believed to be posed by heat and cold, and how thermal care should be provided in the context of infant survival in different communities where there are different epidemiological realities. There is opportunity for a vast amount of research to be done on this topic, involving multiple fields and disciplines. Because thermoregulation is achieved partly through internal physiological processes and partly through individual and social behaviour, the study of thermal care lends itself particularly to inter-disciplinary approaches, as has been undertaken in this thesis.

## Chapter 12 Conclusion

This thesis has taken an interdisciplinary approach to the exploration of how thermal care is provided to infants by caregivers in different cultures, and how this might affect infants' health and wellbeing. The results have shown that there are differences in how much bedding and clothing is put on infants by mothers, and that the environmental conditions infants sleep in are extremely varied for a number of reasons that are not always under the control of the caregiver. The results have also shown that mothers use many different methods, often at the same time, to judge the likelihood of an infant being subject to thermal stress. Finally, the results show that there are many different health conditions that mothers attribute to heat or cold stress, and whether mothers prioritise protection from heat and cold depends on how much danger they believe each thermal extreme poses to their infant's health and survival.

The humoral belief system is a major global theory of disease that influences many health-related practices and as a consequence, although it may not accord with clinical theories of health and illness, it cannot be ignored in clinical research and practice. This thesis has demonstrated that thermal care of infants depends in part on a caregiver's beliefs regarding the effect on infants of exposure to heat or cold. To understand thermal care behaviour, we must therefore understand the detrimental consequences that heat and cold are believed to have within any given society, and what major threats to infant life and health were common in the recent history of that society at the time of investigation. This principle was highlighted in the initial case study from Guatemala, where the preoccupation with protecting infants from the cold outweighed the concern of overheating in a somewhat tropical climate. In Guatemala, cold temperature was associated with infant susceptibility to pneumonia, which was the main cause of infant death at the time and one that had been associated with particularly high infant mortality rates within living memory.

In the UK, SIDS is the major classification for deaths of infants under a year after the neonatal period. Overheating is believed to be a risk factor for SIDS, and therefore there is a focus on the prevention of overheating in infants. However, the strength of evidence regarding the link between heat stress and SIDS is not strong and the

mechanisms remain poorly understood. Studies investigating the effect of clothing and bedding on infant overheating and SIDS have underestimated the complexity of the topic and therefore have produced unreliable results. Furthermore, I propose that there is a lack of attention to the potential link between cold stress and SIDS among parents, health professionals, and health researchers that poses a barrier to the development of a greater understanding of the role cold stress might play in SIDS aetiology and in determining the other factors cold stress might interact with to result in SIDS. Equally important is understanding how caregivers provide thermal care for their infants while their infants are unable to independently manage their own thermal care, and how caregivers interpret what their infant's thermal needs are and how they should respond.

In conclusion, thermal care of infants is influenced in part by the mothers' beliefs about the harm caused by heat and cold, and partly by the perceived threats to infant life and health experienced in the recent history of a community at a given point in time. Infants are not able to maintain their thermoneutrality independently, as their thermoregulatory system is still maturing and they are unable to modify their own physical environment in terms of heating, air flow, clothing and bedding. Therefore, they are substantially dependent on their caregiver to recognise when they are suffering thermal stress and to apply appropriate modifications of their microenvironment. The infant may have some influence in persuading the caregiver as to the required thermal care practices, but the mother's response will depend on her ability to detect thermal stress in her infant, determine what she is able to do about it, evaluate what she believes is in the best interests of her infant and how she is expected to respond. In the UK, there is a great deal of focus on the dangers of heat stress in infants with regard to preventing SIDS and complications from fevers. There is almost no concern regarding the dangers of cold stress, which is theoretically even more harmful to infants, particularly in a global perspective where cold stress can increase vulnerability to pneumonia, which is responsible for millions of child deaths worldwide. In this context, inappropriate thermal care can lead to neonatal deaths caused by neonatal hypothermia and its complications.

This thesis has explored several differences in thermal care beliefs and practices between South Asian and white British mothers in terms of bedding, clothing,



modification of the environment, detection of thermal stress, diseases and conditions attributed to thermal stress, and priorities for thermal care. Other cultures have much to teach us, especially with regard to promoting balance and responding to infants cues of thermal stress, which may prove to be highly protective for infant lives, especially for those infants with known or undetected vulnerabilities.

Policy on infant thermal care in the UK should consider several elements that have been revealed in this research. First, where there is not an absolutely solid evidence base for discouraging any aspect of infant thermal care, health professionals should not persuade mothers to change existing practices. Second, manufacturers should not be able to promote infant care products with the false impression that their products prevent infant ill-health or death if there is not strong evidence to support this, especially when their target customers are likely to be anxious about infant deaths caused by factors largely outside of their control, such as SIDS deaths. Third, when understanding people's thermal care beliefs, the main threats to infant health and survival, if linked to thermal care, must be taken into account. Thermal care practices and beliefs are not static and are responsive to the infant's social, cultural, pathogenic, and physical environment. Fourth, if certain thermal care practices are ultimately proven to be effective, for example in reducing SIDS deaths, the mother's ability to change her thermal care practices should be considered in the context of other priorities that are affected by thermal care such as sleep, skin care, and respiratory conditions that might hold a higher priority for mothers than SIDS.

Finally, despite attention to rigorous scientific methodology, clinical science is not immune to bias resulting from cultural influences on research agendas. By exploring health beliefs and practices in other cultures, bias in the choice and focus of clinical research in the UK can be understood and reduced.

This thesis has demonstrated the complexity of providing infant thermal care on a physiological, practical, and social level. Despite instruction about infant care from health professionals which are largely restricted to advice on number or layers of clothing or bedding and room temperatures, mothers navigate a much more complex reality on a daily basis. Mothers make judgements about thermal care that are informed

by their cultural beliefs, peer influences, and evaluations of infant body language, state, and behaviour, and they must assess how their understanding of optimum infant thermal care can be achieved in the context of other competing health and social factors. This thesis has demonstrated that thermoregulation of infants is achieved through both internal physiological processes as well as the thermal care behaviours and beliefs of their caregivers.

# APPENDICES

## Appendix 1 Foods classified as hot or cold by Pakistani mothers

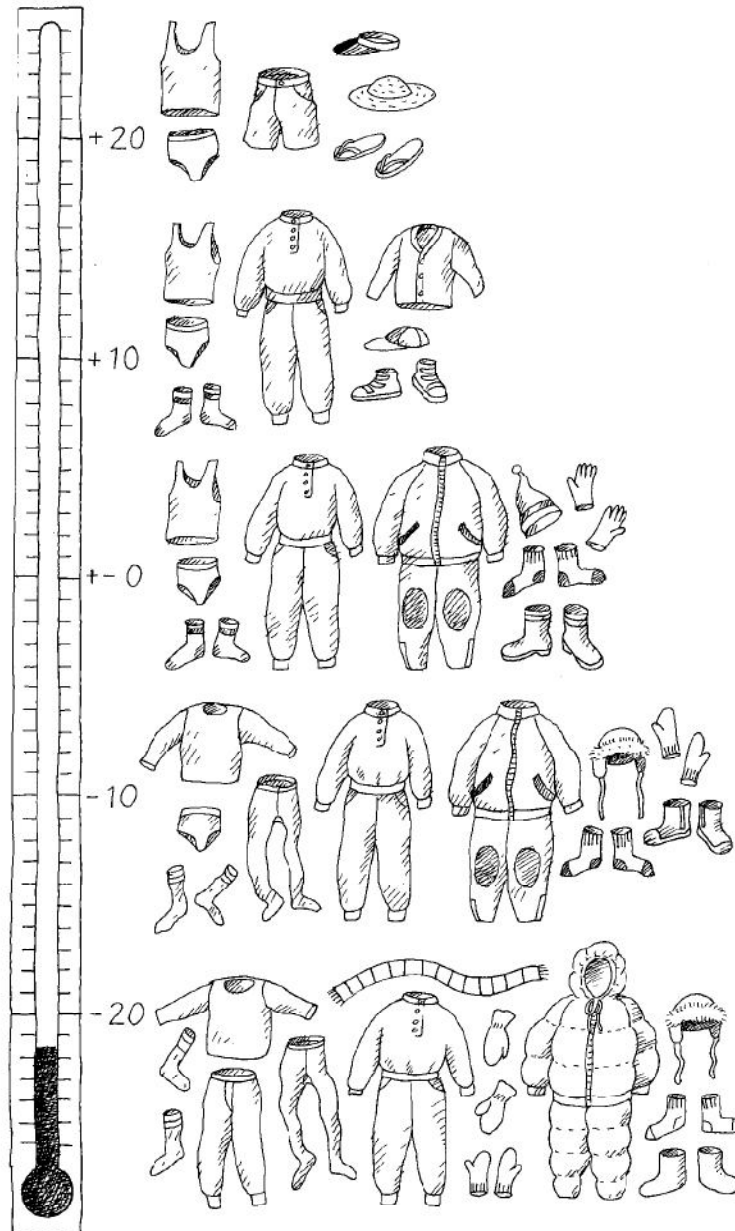
(Nizami and Bhutta 1999:300)

*Foods mostly classified as hot are in pink, and mostly cold in blue.*

Food Item	Hot (%)	Cold (%)	Neutral (%)	Don't know (%)
Egg	98	1	1	1
Chicken	92	3	21	3
Beef	73	6	5	17
Brinjal (aubergine)	73	4	3	20
Mango	71	9	8	12
Liver	62	3	9	26
Mutton	58	9	13	19
Spinach	43	36	6	15
Roti (bread)	42	5	24	28
Potato	40	21	18	21
Legume	37.1	16.1	9	38
Papaya	23	47	8	22
Apple	14	43	24	19
Milk	21	39	24	17
Gourd	17	41	2	40
Plum	16	40	4	40
Guava	14	48.4	10	28
Tomato	25	50	9	17
Squash	10	54	10	52
Sago	7	59	6	27
Grape	23	62	6	9
Water Melon	14	62	3	22
Cucumber	9	67	5	20
Banana	3	75	10	12
Carrot	9	80	3	8
Ice cream	8	82	2	7
Yoghurt	6	86	2	6
Orange	3	86.3	4	7
Rice	3	80	4	12

## Appendix 2 Infant clothing advice according to ambient temperature from the Finnish government

*Dress the baby according to the weather*



Ministry of Labour (1997)

### Appendix 3 Effects of hypothermia and hyperthermia on the body

Effect	Hypothermia	Hyperthermia
<b>Cardiovascular changes</b>	Mild hypothermia leads to vasoconstriction, arrhythmias, increased cardiac output and increases blood pressure slightly. Moderate hypothermia leads to bradycardia, a reduction in cardiac output and increased viscosity. Severe hypothermia results in a severe reduction in heart rate or cardiac arrest, resuscitation is difficult until the body is re-warmed (Mallet 2002) and so can increase hypoxia. Hypothermia can result from a sudden exposure to very cold temperatures or a prolonged exposure to slightly cool temperatures (Worfolk 1997).	Hyperthermia can lead to circulatory failure
<b>Haematology</b>	With hypothermia or cold stress there is an increased blood viscosity, fibrogen and haemocrit values. Coagulopathy also occurs due to inhibiting the clotting cascade (Mallet 2002).	Hyperthermia can lead to hemorrhagic diseases, especially diffuse intravascular haemorrhage accompanied with thrombocytopenia (Yan and colleagues 2005).
<b>Neuromuscular</b>	Confusion and amnesia sometimes occurs in mild hypothermia. As temperature drops there is more risk of delirium occurring. Peripheral nerve conduction is impaired. The person may be apathetic, have impaired judgement and a reduction in cerebral blood flow. The synovial fluid becomes more viscous and leads to stiffness of muscles and joints. There is a loss of fine motor control and sometimes postural hypotension (Mallet 2002).	Hyperthermia can cause inflammatory damage of the nervous system and neuronal damage (Yan and colleagues 2005).

<b>Respiratory</b>	Mild hypothermia can lead to bronchospasm. Moderate hypothermia can lead to impairment of ciliary function in the lungs and so predispose to aspiration and pneumonia. There is a reduction in oxygen consumption and carbon dioxide production (Mallet 2002).	Hyperthermia can result in acute respiratory distress and hypoxia (Yan and colleagues 2005)
<b>Renal and metabolic</b>	Mild hypothermia leads to diuresis. Acute renal failure occurs in 40% of patients admitted with accidental hypothermia (Mallet 2002).	Hyperthermia can result in acute renal failure (Yan and colleagues 2005)
<b>Gastrointestinal</b>	Gastric ulcers, impaired absorption of medications given orally, impaired liver function, pancreatitis	Hyperthermia can result in pancreatic damage (Yan and colleagues 2005)
<b>Immunological</b>	With cold stress blood is diverted from the throat region in studies on infants, reducing the number of white blood cells available to protect the body from respiratory pathogens. The immunological system also works less effectively with lower body temperatures and so is less able to defend the body from invading pathogens (Blackwell 2007). Contrary to belief of some it is the immunological efficiency that is most likely for fever being an adapted response to infection, not the increased temperature directly killing pathogens (Qing and colleagues 2006).	Raised body temperature is beneficial to one extent in that the immune system becomes more efficient.

## Appendix 4 Lowest ambient air temperature for comfort or 6 hours rest while asleep.

(Goldman and Kampman:2007:6b-5)

<b>Insulation value (clo)</b>	<b>Temperature to achieve thermal comfort whilst awake (°C)</b>	<b>Temperature to allow enough thermal comfort to allow 6 hours sleep without being woken due to thermal stress (°C)</b>
1	26.6	25.3
2	21.2	18.5
3	15.8	11.8
4	10.4	5.1
5	5.0	-1.6
6	-0.4	-8.4
7	-5.8	-15.1
8	-11.2	-21.8
9	-16.6	-28.6
10	-22.0	-35.3
11	-27.4	-42.0
12	-32.8	-48.7

With this table we can see that the lower the environmental temperature the higher the insulation needed for thermal comfort, with slightly lower insulation values needed for 6 hours sleep.

## **Appendix 5 Factors relevant in calculating insulative effects of bedding and clothing on the human body**

British Standards Institute:2007:4)

Air permeability,

Air temperature,

Air velocity,

Basic clothing insulation

Body heat gain or loss

Body heat storage

Boundary layer thermal insulation

Clothing area factor, dimensionless

Clothing surface temperature

Conductive heat flow

Convective heat flow

Convective heat transfer coefficient

Dubois body surface areas

Effective mechanical power

Emissivity of clothing surface, dimensionless

Expired air temperature

Humidity ratio of inhaled air

Humidity ratio of exhaled air

Local skin temperature

Mean skin temperature

Metabolic rate

Minimum required clothing insulation

Moisture permeability index, dimensionless



Neutral required clothing insulation

Operative temperature

Radiant temperature

Radiative heat transfer coefficient

Specific dry heat of dry air at constant pressure

Respiratory evaporative heat flow

Resultant boundary layer thermal insulation

Resultant total insulation

Required clothing insulation

Respiratory ventilation rate

Saturated water vapour pressure at the skin surface

Skin wettedness, dimensionless

Water latent heat of vaporization

Water vapour partial pressure

Water vapour pressure at the skin surface

Wind chill temperature

Wind speed measured 10m above ground level

## Appendix 6 Comparing methods of measuring insulation of material – summation of individual garments and ensemble.

**Example 1:** The International Standard Document for clothing insulation (British Standards Institute:2007), allows us to compare insulation values for an ensemble of adult clothing, tested on a thermal manikin, with values using the summation method of individual items.

<b>Ensemble A (#154)</b>	<b>Clothing item</b>	<b>Insulation value (clo)</b>
	Short sleeve long pajamas	0.42
	Short wrap robe	0.41
	Sandals	0.02
<b>Total summation method</b>		0.83
<b>Total ensemble value from thermal manikin</b>		1.46

<b>Ensemble B (#206)</b>	<b>Clothing item</b>	<b>Insulation value (clo)</b>
	Briefs	0.04
	Shirt	0.33
	Loose trousers	0.22
	Socks	0.03
	Shoes	0.05
<b>Total summation method</b>		0.67
<b>ensemble value from thermal manikin</b>		1.10

The ensemble value obtained by using a thermal manikin was 1.46 clo for ensemble A, but by summation only 0.83, just over half the ensemble value. The same

for ensemble B, the summation method (0.67) gave an insulation value of just over half the ensemble value (1.10).

What we are seeing are the insulation values literally disappearing into thin air when we just add the values and don't account for the air pockets. The trapped air appears to actually have more insulation value than the materials itself.

**Example 2** Fan (2006), considers the thermal insulation of the adult torso with a t-shirt; shirt; and winter jacket. The amount of insulation he found provided by the material was 0.7-1.0 clo, and of the air 1.6 clo, again demonstrating that the air is providing more insulation than the materials themselves.

## Appendix 7 Examples of estimated body surface areas from different sources

Part of body	% of skin surface area (mean) of part of body					
	Boniol et al:2007:462  (Boy 2 years)	Boniol et al:2007:462  (Girl 2 years)	Lund and Browder from 1944 in Boniol et al:2007:463  (Infant Newborn)	Lund and Browder from 1944 in Boniol et al:2007:463  (Infant 1 year)	International Standard EN ISO 9920:100 British Standards Institute 2007  (Adult)	Livingston and Lee:1999:107  (Adult)
Abdomen	2.7	3.0				
Anterior trunk	15	15	13	13		
Arms						25.2
Back	12.9	13.2			9.2	
Bosom	12.3	12.4				
Buttocks					6.6	
Chest					10.2	
Feet	6.5	6.0	7	7	7.4	7.7
Hands	4.5	4.8	5	5	5	4.0
Head	8.4	8.4	19	17		2.7
Head + neck					8.7	
Gentials and buttocks	7.1	6.8	6	6	12.2	

Legs	10.3	11.2	10	10		12.1
Lower arms	5.8	5.6	6	6		
Neck	3.9	3.8	2	2		
Posterior trunk	15	15	13	13		
Shoulders	1.9	2.0				
Thighs	14.9	14.2	11	13	18.4	22.5
Trunk						
Upper arms						38.3

## Appendix 8. Comparison of tog values for a selection of clothing items from three sources.

Note: The International standards source was for adult clothing, so values for the most similar clothing was used where possible. For example an adult ‘sleepsuit’ was the most similar to a babygro.

Clothing item	Source: British Standards Institute 2007 (adult clothing) (clo/m <sup>2</sup> KW <sup>-1</sup> /tog)	SWISS study (tog) (Blair 2007)	Watson et al (1997) (tog)
Babygro - cotton		0.7	0.7
Babygro – fleece [sleeping suit SWISS]	0.72/0.112/1.12	3.2	
Babygro – short leg, cotton			
Bib			0.7
Cardigan [SWISS medium]	0.31/0.048/0.48	0.7	
Cardigan – light	0.26/0.04/0.4	0.35	
Cardigan with hood		0.48	
Diaper wet			
Diaper dry			0.1
Dressing gown	0.41/0.064/0.64	1.3	
Hat		0.18	
Mittens - wool/polyester	0.08/0.012/0.12		
Mittens – cotton (‘scratch’)		0.08 (should be 0.16)	
Pajamas		0.7	

	0.48/0.074/0.74		
Romper vest – long sleeves			
Romper vest – short sleeve		0.5	
Shoes	0.05/0.008/0.08	0.16	
Shorts	0.08/0.012/0.12		
Socks	0.02/0.003/0.03	0.01	
Sweater – medium	0.31/0.048/0.48		0.7
Trousers – double cotton			
T-shirt	0.08/0.012/0.12	0.3	
T-shirt to knees			
Trousers	0.17/0.026/0.26	0.3	
Woolly all in one	0.72/0.112/1.12	0.7	0.7

## **Appendix 9 Example of safe bedding and clothing advice available in the UK**

Foundation for the Study of Infant Deaths (2009b)

Babies who get too hot are at an increased risk of cot death. They can get too hot because the room is too hot or because they have too much bedding or clothing. The ideal room temperature is 16-20°C.

1. Babies do not need hot rooms, all night heating is rarely necessary. Keep the room at a temperature between 16-20°C. 18°C (65°F) is just right.
2. Adults find it difficult to judge the temperature in the room, so use a room thermometer in the rooms where your baby sleeps and plays. A simple room thermometer is available from Foundation for the Study of Infant Deaths. Order from our online shop, call 020 7802 3200 or send a cheque or postal order to Foundation for the Study of Infant Deaths.
3. When you check your baby, if they are sweating or their tummy feels hot to the touch, take off some of the bedding. Don't worry if their hands or feet feel cool, this is normal.
4. Use lightweight blankets or a baby sleeping bag. If your baby feels too warm, reduce the number of layers or use a lower tog baby sleeping bag. In warm summer weather, your baby may not need any bedclothes at all. Do not use a duvet, quilt or pillow for babies under 12 months.
5. Even in winter, babies who are unwell and feverish need fewer clothes and bedclothes.
6. Babies need to lose excess heat from their heads. Make sure their head cannot be covered by the bedclothes by sleeping them 'feet to foot' (with their feet to the foot of the cot) so they don't wriggle down under the covers.
7. Babies should never sleep with a hot water bottle or electric blanket, or next to a radiator, heater or fire, or in direct sunshine.
8. When it's warm, you can cool the room where your baby sleeps by closing the curtains and opening the windows during the day. Offer your baby plenty to drink, and in very hot weather, sponge them down regularly with tepid water. Use a fan but do not place it directly onto your baby.
9. Remove hats and extra clothing as soon as you come indoors or enter a warm bus, train or shop, even if it means waking your baby.
10. A car can become very hot in the summer. Avoid direct sunlight on your baby. In winter, keep the heating low, and remove your baby's outdoor clothing. A thermometer may be helpful.



**Appendix 10 Consent form**

**CONSENT FORM**

INFANT THERMAL CARE IN BRADFORD PROJECT

DEPARTMENT OF ANTHROPOLOGY  
UNIVERSITY OF DURHAM

RESEARCHER: ANNA CRONIN DE CHAVEZ

DURATION OF PROJECT: 2007-2008

**TITLE OF PROJECT: Infant thermal care in Bradford**

(The participant should complete the whole of this sheet himself/herself)

*Please cross out as necessary*

Have you read the Participant Information Sheet? YES / NO

The Participant Information Sheet was explained to me in a language

I could fully understand, as was this consent form YES / NO

Have you had an opportunity to ask questions and to

discuss the study? YES / NO

Have you received satisfactory answers to all of your questions? YES / NO

Have you received enough information about the study? YES / NO

Who explained the project and interview process to you?

.....

Do you understand you are free decline to answer any question

you don't wish to answer without giving a reason YES / NO

Do you consent to participate in the study? YES / NO

Do you understand that you are free to withdraw from the study:

\* at any time and

\* without having to give a reason for withdrawing and

\* without any adverse result of any kind? YES / NO

**Signed** ..... **Date**

**(NAME IN BLOCK LETTERS)**.....

## Appendix 11 Participant participation leaflet

**What will the results of the research be used for?**  
It is hoped that the results will be used to contribute to understanding how to improve infant health, in particular the prevention of Sudden Infant Death Syndrome (SIDS) or cot death. Summaries of the results will made available to all participants where requested.

**If I want to participate, what shall I do?**

If you are a mother of a baby aged 1-8 months, please ask the researcher Anna Chavez for a consent form and interview. The consent form is necessary to be sure you give permission for any information to be used for the purposes given in this leaflet. Even if you sign the consent form, you are free to drop out at any time without giving a reason any data about you destroyed. You can drop out by asking the researcher during the interview or at the addresses or phone numbers below.



**Contact details:** Anna Chavez, Department of Anthropology, University of Durham, 43 Old Elvet, Durham, DH1 3HN. Mobile: 07742 [REDACTED] Email: [Anna.crenin-de-chavez@dur.ac.uk](mailto:Anna.crenin-de-chavez@dur.ac.uk)

(To confirm identity of the researcher or validity of this project contact Professor Helen Ball, Department of Anthropology, 43 Old Elvet, Durham, DH1 3HN. 01913747207. [h.l.ball@dur.ac.uk](mailto:h.l.ball@dur.ac.uk))

### Thermal Care of Infants in Bradford District - Participant Information



**What is this project about?**

This project aims to understand more about how babies from different cultural backgrounds are protected from the heat or cold when they sleep through different clothing and bedding combinations. In particular the project hopes to identify good practices mothers are using and explore the variations in how babies are protected from heat and cold.

**Who is funding and supporting this project?**

This research is Ph.D. research for the Department of Anthropology and the Parent-Infant Sleep Research Group at the University of Durham. It is funded by the Medical Research Council (MRC) and Economic and Social Research Council (ESRC). It has been approved by the University of Durham Anthropology Ethics Committee.



**How will the information be gathered?**

The aim is to enroll 100 mothers of babies aged 1-6 months living in the Bradford District. The interviews should last about 45 minutes. Interpreters will be sought if necessary. To make the interview easier, mothers will be asked to reconstruct how their baby is dressed for sleep and what bedding they use using a magnetic stickers of clothing and bedding which will be brought to the interview.



**Is involvement in this project voluntary?**

Involvement is entirely voluntary. No payment will be possible however for any interviews. Participants should not feel under any pressure to participate, or to interrupt the normal care of any dependants while being interviewed.

**Will information given be confidential?**

Yes, all information will be treated as confidential and no individual or personal data will be passed on to any other parties, except in the case where withholding information puts someone's life at serious risk. Interviews will be audio taped only if the participant gives written consent. Any audio-tape recording of interviews will only be used to help recall and accuracy of information given and used by the researcher for the research goals only.



**Are all the questions necessary?**

Some questions, such as about income and housing may not appear necessary, but it is useful to have this information to for statistical purposes. Remember you may decline to answer any of the questions at any time you like.

## Appendix 12 Interview questions

**Infant thermal care data recording sheet**  
**Anna Cronin de Chavez**  
**Department of Anthropology**  
**University of Durham**  
**2008-2009**

### SECTION 1: ABOUT THE INTERVIEW

1. Study ID:
2. Date of Interview:  /  /   
                                  d d    m m    y y
3. Location of Interview: \_\_\_\_\_
4. What language was used for administering the questionnaire?
- English     Miripuri     Urdu     Bengali
- Any other language (please write in)
5. Was an interpreter used? Yes     No
6. Who was the interpreter?
- Study interpreter     Family member/friend
- Other

### SECTION 2 ABOUT THE MOTHER

7. Age of mother
8. Postcode or neighbourhood mother resides in
9. Main language of mother
- English     Miripuri     Urdu     Bengali
- Any other language (please write in)

10. What country were you and your baby's father born in?

<u>Country</u>	<u>You</u>		<u>Baby's father</u>	
UK	<input type="checkbox"/>		<input type="checkbox"/>	
Bangladesh	<input type="checkbox"/>		<input type="checkbox"/>	
India	<input type="checkbox"/>		<input type="checkbox"/>	
Pakistan	<input type="checkbox"/> Miripur?	<input type="checkbox"/>	<input type="checkbox"/> Miripur?	<input type="checkbox"/>
Sri Lanka	<input type="checkbox"/>		<input type="checkbox"/>	
Don't know	<input type="checkbox"/>		<input type="checkbox"/>	
Other	<input type="checkbox"/>		<input type="checkbox"/>	

You – other. Please write in

Baby's father – other please write in

11. Does the baby's father or a partner live with you?

Yes  No  Sometimes

12. If you were not born in the UK, how old were you when you moved to the UK?

13. What country were your mother and father born in?

<u>Country</u>	<u>You</u>		<u>Baby's father</u>	
	Your Mother	Your Father	His mother	His father
UK	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bangladesh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
India	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pakistan	<input type="checkbox"/> Miripur?	<input type="checkbox"/> Miripur?	<input type="checkbox"/> Miripur?	<input type="checkbox"/> Miripur?
Sri Lanka	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Don't know	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other. Please write in

14. To which of these groups do you consider you belong?

White

Mixed ethnic group

Black or Black British

Asian or Asian British

Chinese/ other

Any other group – please write in

15. What is the highest qualification that you have?

O'levels/CSEs/GCSES

A Levels/AS levels/Highers

First degree

Higher degree

NVQ level 1 or 2

NVQ level 4-5/HND/HNC

Other

None

Overseas qualification

Don't know

16. If your highest qualification was obtained in another country please specify what that qualification was and which country that was obtained in?

Qualification in:

Country:

17. Are you currently working (including if on maternity leave)

Yes  No

18. If yes to question 15 what job(s) do you do?

19. Is your partner working?

Yes  No

20. If yes to question 19 what job(s) does he do?

21. Which of the amounts on this list represents you and your partner's total income for all jobs, tax credits, benefits and other sources of income?

- |                      | Weekly | Monthly  | Annual income before tax |                          |
|----------------------|--------|----------|--------------------------|--------------------------|
| Less than            | £259   | / £1,125 | / £13,499                | <input type="checkbox"/> |
| Less than            | £379   | / £1667  | / £19,999                | <input type="checkbox"/> |
| Less than            | £577   | / £2450  | / £29,999                | <input type="checkbox"/> |
| Less than            | £769   | / £3,333 | / £39,999                | <input type="checkbox"/> |
| More than            | £770   | / £3,334 | / £40,000                | <input type="checkbox"/> |
| Don't know           |        |          |                          | <input type="checkbox"/> |
| Don't wish to answer |        |          |                          | <input type="checkbox"/> |

22. Did the biological mother of the baby smoke during your pregnancy?

- Often  Rarely  Never

### SECTION 3. ABOUT THE HOUSEHOLD AND HOME

23. What ages are those, including yourself, who live in your household or accommodation? [If not known please give best estimate]

Age	Number of males	Number of females
Under 2 years	<input type="checkbox"/>	<input type="checkbox"/>
2-15 years	<input type="checkbox"/>	<input type="checkbox"/>
16-64 years	<input type="checkbox"/>	<input type="checkbox"/>
65 years or over	<input type="checkbox"/>	<input type="checkbox"/>

24. How many bedrooms does your house have?

25. What is the main kind of heating you have?

- Storage heating
- Central heating
- Gas fire
- Oil radiators
- Electric convection heaters
- Electric radiators
- Coal/log fire



26. What kind of heating do you have in the room your baby normally sleeps in?

- Storage heating
- Central heating  Do you use a thermostat?
- Gas fire
- Oil radiators
- Electric convection heaters
- Electric radiators
- Coal/log fire

27. In winter are you able to keep your home warm enough?

Yes  No  Sometimes

28. Do you try to keep the baby's room at a certain temperature?

Yes  No

If yes, what temperature

29. Is there any sign of damp in the room the baby sleeps in?

Yes  No

If yes..

- Smell of mould/damp
- Mould on wall
- Peeling wallpaper
- Condensation on walls or windows

30. Is the room the baby sleeps in draughty?

Yes  No

**SECTION 4. ABOUT THE BABY**

31. What age is the baby now?

m / m    w / w

32. What sex is the baby?

Male  Female

33. How many weeks pregnant were you when he/she was born?

34. What was his/her weight at birth?

Pounds      Kilos

35. Do you know his/her weight at the moment?

Yes  No

If yes, weight is   pounds   kilos

36. Is the baby normally healthy?

Yes  No

If no, which illnesses or conditions does he/she suffer from?

37. Do you have a room thermometer or temperature monitor in the room where the baby sleeps (not central heating thermostat)?

Yes  No

38. Do you have a temperature monitor in the room where the baby sleeps?

Yes  No

39. Are any windows left open at night in the room where the baby sleeps?

Winter: Completely open  Partially open  Completely closed   
Summer: Completely open  Partially open  Completely closed

40. Is the door of the room where the baby sleeps left open, closed or half open at night?

Winter: Completely open  Partially open  Completely closed   
Summer: Completely open  Partially open  Completely closed

41. Does your baby sleep in the same bed as you?

Yes, often  Yes, occasionally  No, never.

42. Is your baby breastfed or bottle fed at night?

Breastfed  Bottle-fed  mixed  not fed  don't know

43. Is the baby exposed to cigarette smoke in the house?

Often  Rarely  Never  Don't know

44. Do you rub any oils or moisturisers all over the baby before they go to sleep?

Yes, often  Yes, occasionally  No, never.

45. How active do you think the baby is at night?

**SECTION 5. PRACTICAL SECTION. RECONSTRUCTION OF BABY'S USUAL SLEEP ENVIRONMENT AT NIGHT DURING WINTER**

*Using the magnetic board and stickers please try to reconstruct how the baby normally sleeps at night, including:*

46. Room Infants sleeps in	Winter	Summer
Baby sleeps alone	<input type="checkbox"/>	<input type="checkbox"/>
Room with parent	<input type="checkbox"/>	<input type="checkbox"/>
Room with adult other than parent	<input type="checkbox"/>	<input type="checkbox"/>
Room with other children	<input type="checkbox"/>	<input type="checkbox"/>

47. Type of bed infant sleep in	Winter	Summer
Cot	<input type="checkbox"/>	<input type="checkbox"/>
Moses basket	<input type="checkbox"/>	<input type="checkbox"/>
Single bed	<input type="checkbox"/>	<input type="checkbox"/>
Double/king size bed	<input type="checkbox"/>	<input type="checkbox"/>
Mattress on floor	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

Please state..... Please state.....

**48. Other persons that sleep next to the baby (may tick more than one)**

	Winter	Summer
None	<input type="checkbox"/>	<input type="checkbox"/>
Other baby (i.e. twins)	<input type="checkbox"/>	<input type="checkbox"/>
Other child	<input type="checkbox"/>	<input type="checkbox"/>
Mother	<input type="checkbox"/>	<input type="checkbox"/>
Father	<input type="checkbox"/>	<input type="checkbox"/>
Other adult	<input type="checkbox"/>	<input type="checkbox"/>

**49. Position in relation to other persons in bed**

	Winter	Summer
Alone	<input type="checkbox"/>	<input type="checkbox"/>
Infant on edge	<input type="checkbox"/>	<input type="checkbox"/>
Infant in between persons	<input type="checkbox"/>	<input type="checkbox"/>

<b>50. Bedding</b> <i>(Fill in answers in blue pen for winter, red for summer)</i>	Single (S) double (D), Cot (C), Moses basket (M)	No of	Tucked in?	Thickness	Material
Duvet					
Over blanket					
Under sheet					
Under blanket					
Over blanket					
Bedspread					
Adult oversheet					
Electric blanket					
Pillow					
Bedding other Please state..... .....					

<b>51. Garment</b> <i>(Fill in answers in blue pen for winter, red for summer)</i>	<b>Material</b>	<b>Thickness</b>	<b>No of</b>	<b>Notes</b>
Babygro – cotton				
Babygro -fleece/sleep suit				
Blouse/shirt – long sleeves				
Bootees – knitted				
Cardigan/jumper thin				
Cardigan/jumper – medium				
Cardigan/jumper – thick				
Cardigan/sweater – fleece				
Dress				
Dressing gown				
Dungarees				
Hat (knitted)				
Mittens (knitted)				
Shorts				
Plastic pants				
Quilted jacket				
Romper suit with shorts				
Scratch mittens				
Skirt				
Snowsuit				
Socks				
Sleeping bag				
Tights				
Trousers				
T-shirt				
Vest – medium				
Other Please state				

**SECTION 6. OPEN QUESTIONS (inform the participant that this part will be taped if they have agreed to it during the consent process)**

52. What might happen to the baby if you didn't dress you baby like you normally do at night in winter? Summer?

53. Which do you think would have a bigger impact, the baby getting too hot or too cold? Why?

54. Do you see any other babies being dressed with what you think is inappropriate clothing? What do you think will happen to those babies if dressed like that?

55. Do you advise other mums on the best way to keep their baby at the right temperature Who? What do you tell them?

56. Do other people tell you to put a different amount of layers on your baby? Who? What do they say?

**SECTION 6: END OF INTERVIEW**

We have now finished the questions. Have you any comments or questions?

Thank you for your time, would you like a summary of the results of this study to be sent to you when it is finished? If so, please fill in this stamped addressed envelope.

57. Was anyone present with the mother during the interview?

Yes  No  Part of

If yes, who was present?

Interview was in a community/public setting   
(i.e. several unidentified people in vicinity)

Baby's father

Mother's mother

Relative

Friend

Child

Baby

## **Appendix 13 Facilitators**

Facilitator 1: Male community worker

Facilitator 2: Female community worker

Facilitators 3 and 4: Formal interpreter and her mother

Facilitator 5: Friend of interpreters

Facilitator 6: Neighbour of interpreter

Facilitator 7: Neighbours of mothers

Facilitator 8: Shopkeeper



## **Appendix 14 Other people present in interviews**

- a. People in shopping centre
- b. Husband/partner
- c. mother of mother
- d. Younger children
- e. Interpreters
- f. Older children
- g. Sister in law
- h. Mother in law
- i. Older children

## **Appendix 15 Interpretation of words**

### **i. Partner/husband.**

In British culture it is commonly accepted to ask if a woman has a partner rather than a husband to avoid implying that being married is more morally correct than living with a partner. In South Asian culture however marriage is highly valued and living with a partner can be considered shameful.

### **ii. Baby's room .**

To avoid suggesting whether it is best for the baby to have a nursery or sleep in the parent's room I opted for the more cumbersome wording 'the room that the baby sleeps in'.

### **iii. Over/underdressed**

Asking what would happen if their baby was over or underdressed implied judgements about what was over or under-dressing so I asked what would happen if the infant had more or less clothing and bedding on than normal.

### **iv. Hot/cold.**

What mothers meant and what they thought I meant by heat and cold was subject to interpretation so I tried to discuss extremes of heat where the infant might be subject to thermal stress. Some infants however were too young to have experienced more than one season, or mothers said that the British climate was never hot.

### **v. Ethnic group**

Whilst most people were happy with the choice of ethnic group categories I had in my structured questions, some were not happy with 'South Asian' and stated they were 'Pakistani' or 'British Muslim'.

## **vii. Income**

Fewer South Asian than white British mothers disclosed their income. Although a hesitancy to estimate income for reasons of privacy would be expected, the main problem seemed to be the complexity of their income. Some of the South Asian women said their husbands dealt with matters of income, some opted out of that question, some if in the presence of their husbands referred to them and seemed to agree the 'don't know' answer was preferable. Some said outright that they didn't wish to say. Those South Asian and white British mothers who did have a fuller involvement in calculating their income, and were free to talk about it often complained about the complexity of calculating it, especially in multi-generational households. Below are a few quotes from participants trying to estimate income:

'I don't know. My mum and dad sort all that out.' (Participant 44WB teenage mum)

'Hard to say at the moment because I am on maternity leave and I don't really know what I'm earning.' (Participant 48WB)

'We've got so many different things coming in and the family tax credit is changing as well.' (Participant 66WB)

## Appendix 16 Insulation values assigned to different clothing and bedding items from my data

Intrinsic insulation values of materials taken from Ergonomics of the Thermal Environment – Estimation of thermal insulation and water vapour resistance of a clothing ensemble. British Standard Institute (2007)

Clothing materials	Intrinsic insulation value of material ( $m^2KW^{-1}$ )
Cotton (including babygro, romper vest; t-shirt; pyjama; nightie; shorts; shalwar kameez)	0.03
Fleece (including fleece dressing gown; fleece babygro)	0.15
Knitted fabric (including sweater, cardigan; knitted babygro)	0.04
Double Cotton (including double cotton babygro)	0.04

### Bedding insulation values assigned.

Note: It was assumed the material covered only half the infant's body, so the insulation values below are all halved. Where a mother said the material was doubled up or the infant was wrapped in the bedding the values were adjusted accordingly. For the infant sleeping bags, as all the torso is covered the full value was used. Also for the sleeping bags the insulation values for materials given by British Standards were used rather than the tog values sometimes stated by the mothers. The values used were therefore lower than the values indicated by some of the higher tog sleeping bags, and this should be considered when looking at the potential differences between insulation of sheets and blankets vs. sleeping bags, i.e. the sleeping bag values could possibly be much higher (but possibly still within a safe range).

<b>Bedding item</b>	<b>Intrinsic insulation value of material (m<sup>2</sup>KW<sup>-1</sup>)</b>
Adult duvet	0.84
Thick cotton duvet	0.13
Fleece blanket	0.08
Cot blanket (including flannel; shawl; cell; thin and 'baby' blankets)	0.02
Sheet (including undersheet; oversheet; frill of Moses basket)	0.02
Thin cot duvet (including Moses basket duvet; quilt; cot duvet; thick blanket)	0.07
Thin infant sleeping bag (including those said to be togs 0.5-1.5)	0.14
Medium infant sleeping bag (including that said to be tog 2.5)	0.28
Thick infant sleeping bag (including that said to be tog 4)	0.42

## Appendix 17 examples of romper vest and babygro

Example of a romper vest



Example of a babygro



## Appendix 18 Example of an infant sleeping bag



## **Appendix 19. Endorsement of infant sleeping bags**

The manufacturer Grobag ensure confidence in their products to the extent of having the Foundation for the Society of Infants Deaths endorsing them, and by being a major sponsor for SIDS research. The following information about this endorsement is provided with each sleeping bag:

*“grobag® is Foundation for the Study of Infant Deaths's recommended baby sleeping bag specialist, and grobag is proud to be Foundation for the Study of Infant Deaths's official partner.*

*Joyce Epstein, Director, Foundation for the Study of Infant Deaths, said: "We are delighted to be working with the grobag® team in what is our fifth year of collaboration. Rob and Ouvrielle came to us for safety advice 6 months before they launched and we were pleased to help them - it was obvious that safety was one of their main concerns from the start.*

*"Not only do the grobag® baby sleeping bags meet all our requirements in terms of their design and construction, but we appreciate the extra steps that have been taken to ensure their sleeping bags are used correctly by parents. For example, the free room thermometer that is supplied with every grobag® baby sleeping bag helps parents protect their baby from the dangers of overheating and on the reverse of the thermometer, parents are reminded of all the steps to make a safer sleeping environment for children.*

*grobag® was the first dedicated baby sleeping bag manufacturer to come to us and ask for extensive help in the development of their products and we have been very happy to work with them and look forward to working with them for many years to come."*

Grobag 2008



## Appendix 20 British Standard recommendations for use of infant sleeping bags

British Standards Institute 2009)

<b>Tog rating of sleeping bag</b>	<b>Room temperature</b>
1.0	24-27°C
1-2	21- 23°C
2-3.5	10-20°C

Tog = unit of thermal resistance which is equal to one tenth of a square metre Kelvin per Watt  
(m<sup>2</sup>KW<sup>-1</sup>)

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