

Bi-ethnic infant thermal care beliefs in Bradford, UK

Journal:	<i>International Journal of Human Rights in Healthcare</i>
Manuscript ID	IJHRH-06-2015-0019.R2
Manuscript Type:	Research Paper
Keywords:	Sudden infant death syndrome (SIDS), South Asian, white British , Thermal care, Infant, heat , humoral, cold

SCHOLARONE™
Manuscripts

Peer Review

Bi-ethnic infant thermal care beliefs in Bradford, UK

Abstract

Objective

Overheating is considered a modifiable risk factor for ~~s~~Sudden infant death syndrome (SIDS). This study explored differences in infant thermal care beliefs between mothers of South Asian and white British origin in Bradford, UK..

Design

This study employed face-to-face interviews with semi-structured and structured questions with 51 white British and 51 South Asian mothers in the Bradford District, UK

Results

White British mothers were more concerned about overheating causing SIDS whereas South Asian mothers were more concerned about cold causing respiratory infections. However concerns around hypothermia and chills causing colds were expressed in both groups. 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 heat and cold ($p < 0.001$), but white British mothers on lower incomes and with poorer education expressed concern about cold more so than their better off, better educated peers indicating a possible link to fuel poverty.

Research limitations

It was not possible to observe actual night-time practices and that South Asian as a cultural category is limited because could be regarded as too broad.

Practical and social implications

Whilst there guidance available to prevent infants overheating to prevent SIDS there is little or none about infants getting cold and how temperature affects other conditions. Thermal care behaviours and beliefs differ between ethnic groups. SIDS and overheating is only one

Bi-ethnic infant thermal care beliefs in Bradford, UK

concern for mothers in providing thermal care for their infants. More policy and research is needed to explore the wider impact of thermal care on infant health and survival.

Originality and value

This topic is rarely addressed despite the wide ranging implications of heat and cold to infant wellbeing.

Key words

Thermal care, infants, Sudden infant death syndrome, South Asian, White British, SIDS, humoral, overheating, cold

Introduction

Overheating of infants is a major concern in the prevention of Sudden Infant Death Syndrome (SIDS) or cot death. SIDS is one of the leading diagnoses of death of infants aged between one month and one year in the U.K. (Wolfe *et al.*, 2014). SIDS is by definition a death of unknown cause. 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 *et al.*, 2007). In a vulnerable infant, there can be a number of predisposing endogenous factors which are then affected by an exogenous trigger that lead to SIDS; this scenario is described as the 'triple-hit' or 'triple-risk' hypothesis. Some of the several risk factors associated with SIDS are maternal smoking, prone sleeping and overheating (Fleming *et al.*, 2006). Infants are at risk to thermal stress because they have an immature thermoregulatory system, high capacity to lose heat, low capacity to produce body heat, and are unable independently to modify their environment or bedding and clothing (Lyon, 2006). Appropriate thermal care is therefore essential for the health and survival of infants, yet relatively little is known about infant-related thermal care beliefs, practices and priorities in different cultures.

Bi-ethnic infant thermal care beliefs in Bradford, UK

The motivation for this study came from the first author's experience of bringing up two young children in Guatemala where locals regularly expressed major concerns that her thermal care practices and beliefs learnt in the U.K. were putting her children's lives at risk. Discussions about why there was so much concern revealed that Guatemalan thermal care focused on providing multiple layers of bedding and clothing to protect infants from pneumonia. The author's thermal care practices of using minimal layers came from advice about preventing SIDS, a practically non-existent issue in Guatemala where thousands of infants die of pneumonia each year. Pneumonia is the main cause of death of children under 5 years of age in Guatemala after the neonatal period (W.H.O. 2010). This led to the question of what 'correct' thermal care is and how clothing and bedding impacts on infant health. As the researcher was based in West Yorkshire at the time of the study two local cultures, South Asian and white British, with potentially different thermal care beliefs were chosen for this research.

Thermal stress and SIDS

Several studies have found some evidence to suggest that heat stress and SIDS may be linked (Fleming *et al.*, 1992; Fleming *et al.*, 2006; Guntheroth *et al.*, 2001; Ponsonby, 1992) and preventing overheating is now a major focus of SIDS prevention policy and practice (Lullaby Trust, 2013).

Conversely there have only been a handful of studies focusing on cold stress and SIDS (Goldsmith *et al.*, 1991, Milread *et al.*, 1993; Williams, 1996). Chu *et al.* (2011) propose that it is not cold as such that could contribute to SIDS but the physiological stress resulting from sudden temperature changes. Fleming *et al.* (2006) found that infants who slept in colder

Formatted: Font: 12 pt

Bi-ethnic infant thermal care beliefs in Bradford, UK

night-time conditions were more prone to infections and these infections are also linked to SIDS-risk (Fleming *et al.*, 2006; Moloney *et al.*, 1999).

Few or no studies have measured all the environmental and physiological thermal factors required for a complete thermal audit to establish whether heat or cold stress was actually present preceding the SIDS death. A complete thermal audit would include measurements of environmental temperature, humidity, air velocity, metabolic rate, peripheral and core temperature.

The contribution of critical medical anthropology to the public health problem of SIDS

SIDS is clearly a public health issue in the UK as it is one of the major diagnosis of infant deaths for children after the neonatal period and before one year of age. The Department of Health (FSID and Department of Health (2009) and the National Institute for Health and Care Excellence provide guidance on prevention of SIDS (NICE 2014) and unexpected deaths in infancy are monitored by the Office for National Statistics (ONS 2011). Using the theories of critical medical anthropology (CMA) could be of benefit to addressing an issue, such as thermal care and SIDS that has multiple environmental, cultural, socio-economic factors (Agdal *et al.*, 2010). Inhorn (1995) described an anthropology-epidemiology synthesis as an approach that could lead to greater findings than either discipline alone. The 'policy rainbow' social determinants of health model achieves this more holistic approach to some extent (Dahlgren and Whitehead, 2007). [The social determinants of health refer to the sensitivity of health to social environmental factors such as poverty, social exclusion, stress, early life and food \(Wilkinson and Marmot 2003\).](#) However CMA has the additional potential to create a degree of independence from medical goals and perspectives, which is the predominant paradigm in the majority of SIDS research and allows for a critical voice to the public health discourse (Campbell 2011).

Bi-ethnic infant thermal care beliefs in Bradford, UK

Potential insights from groups at low risk of SIDS

Understanding protective factors can sometimes be more helpful than understanding risk factors and represents a positive rather than negative approach to understanding how people stay well (Antonovsky, 1987). SIDS rates among South Asian populations in the UK are extremely low (Gantley, 1994; Moore, 2005). In Bradford the SIDS rate for South Asian infants is 0.2/1000 and for white British infants is 0.8/1000 (Ball *et al.*, 2012). This is unexpected given that some of the SIDS risks such as shorter gestation, lower birthweight and taking longer to establish more stable, adult-like temperature patterns, are common among South Asian infants (Petersen and Wailoo, 1994). Explanations of the lower SIDS rates among UK-based South Asian communities include lower prevalence of solitary sleep, maternal smoking and alcohol consumption and more infants sleeping in the same room as the mother for the first 6 months (Gantley, 1994; Ball *et al.*, 2012). However thermal care differences have not been explored. Anecdotally it has been suggested that South Asian families 'over-wrap' their infants relative to UK recommendations.

Providing appropriate thermal care to ensure an infant maintains an adequate temperature involves interaction between a) the infant's physiological state and ability to thermoregulate (Lyon, 2006), b) the environmental conditions (Parsons, 2003) c) the caregiver's ability to interpret the infant's thermal needs (W.H.O., 1997), and d) the caregivers' beliefs and actions regarding when and how to modify the infant's thermal environment and/or adjust clothing and bedding (Winch *et al.*, 2005). There is a likelihood of cultural variance in infant thermal care beliefs, and such beliefs may vary in an ethnically diverse population such as the UK. These beliefs may or may not coincide with clinical advice on 'safe' infant thermal care. It is therefore useful to understand more about differences in thermal beliefs and practices.

Thermal care beliefs in various cultures

Bi-ethnic infant thermal care beliefs in Bradford, UK

The interpretation of hazards posed to infants by heat and cold is contested in lay and biomedical aetiologies of disease, and the subsequent impact on the health and survival of infants. Humoral interpretations (i.e. those that prescribe balance between heat, cold, wet and dry to preserve health) contribute to pluralistic health beliefs in a significant proportion of the world's population. Humoral beliefs can be found in cultures across Southern Europe, the Middle East, China and Latin America and in Unani and Ayurvedic medical systems in South and South East Asia (Kim-Godwin, 2003; Pachter *et al.*, 2002; Scarpa, 2004).

Whilst humoral theories of disease may vary in detail and have different cultural origins; they all prioritise the maintenance of balance between heat and cold, particularly during certain vulnerable life-cycle stages such as infancy and old age, as well as during illness or pregnancy. The very young and old are thought to be particularly vulnerable to cold (Kim-Godwin, 2003). Some conditions are thought to predispose individuals to 'cold borne' diseases (e.g. respiratory infections and arthritis) and some to 'heat-borne' illnesses. (e.g. skin problems). The beliefs around inherent 'heat' or 'coldness' of certain foods prescribed by different cultures, including many South Asian cultures, are not necessarily aligned to the actual physical temperature of food (Nizami and Bhutta, 1999). A common practice to restore balance and thus maintain health in the very young, old and sick is for extra protection to be given from the cold.

[Winch et al., \(2005\) 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](#)

Bi-ethnic infant thermal care beliefs in Bradford, UK

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.

Humoral theories of disease do not appear, however, to be prominent in the white British ethnic majority in the U.K. and ~~Scandinavian~~Scandinavian cultures. In these cultures several health conditions are still attributed to heat and cold, such as flu being the result of catching a chill (Prior et al. 2010), but protection from the cold is not as highly valued as protection from heat. Indeed in some cases exposure to cold stress is believed to be protective for health, for example cold can be seen to 'toughen up' the individual and promote vitality (Ayriss, 2009). In the UK, infant thermal care has historically prescribed exposure to cold air and water as a health promoting technique (Hardyment, 2007). Outdoor sleeping for infants was a characteristic in recent generations in the UK although not widely practiced now (Hardyment, 2007, 2007). It is still common for Scandinavian infants as young as 2 weeks old to be put out to sleep outdoors in prams, albeit wrapped up, in temperatures as low as -20°C because it is believed to make them strong and aid sleep (Tourula, 2008). In contrast heat is considered dangerous, particularly the emphasis placed on fever, termed "fever phobia" amongst physicians and lay people in the UK (Teagle et al., 2014).

One of the major concerns of harmful thermal care practices in the UK is that overheating may increase susceptibility to ~~s~~Sudden ~~i~~Infant ~~d~~Death ~~s~~Syndrome (SIDS) (Blair et al 2006; Fleming et al., 2006). There is widespread awareness of heat as a risk factor for SIDS, which has been emphasised in SIDS awareness campaigns. An evaluation of the 'Back to Sleep' campaign in the early 1990s found 24% of mothers worried about their infant getting too hot pre-campaign compared to 37% post-campaign while concern about them getting too cold declined from 31% to 19% in the same period (Hiley and Morley 1994).

Bi-ethnic infant thermal care beliefs in Bradford, UK

The literature suggests, therefore, that potential differences exist in thermal care beliefs and practices between, for example, people of South Asian and white British origin. It is therefore useful to examine the differences between thermal care beliefs among these two groups.

Methods

The aim of this study, which formed part of a PhD research project conducted by the first author, was to explore differences in thermal care beliefs and practices between white British and South Asian mothers of young infants. A total of 102 mothers (51 South Asian and 51 white British) were recruited from Bradford District, West Yorkshire, UK. The inclusion criteria specified infants of 13 months or less with a parent of South Asian or white British cultural origin, living in the Bradford District. 'South Asia' was defined as including the countries of Pakistan, India, Afghanistan, Sri Lanka and Nepal. Ethical approval was obtained from [name] University. The researcher was a white British/Irish female who had a background in social anthropology and also public health practice. Whilst the different ethnicity may have affected the interviews with the South Asian mothers this researcher is also experienced in developing trust and commenting with different cultures in the UK and abroad. The research team included the researcher and her two supervisors, one a biological anthropologist and the other a consultant neonatologist. Recruitment was aided by local community organisations, Children's Centres and community contacts. The mothers were interviewed using a questionnaire with structured and unstructured questions lasting between 20 and 60 minutes conducted in a location where they were happy to be interviewed. Only a few were interviews were as short as 20 minutes, all of which were with the white British mothers who were easier to access because of the researcher's ethnic group. More time was available to develop in-depth conversation with the South Asian mothers, who almost always

Bi-ethnic infant thermal care beliefs in Bradford, UK

gave time for a longer interview. The interview questions were produced following a pilot observational study of infant thermal care in Guatemala as well as further pilot work with seven white British and South Asian mothers in Bradford, U.K. Both pilots were conducted by the first researcher.

The researcher used the questionnaire to encourage in-depth discussion on the topics covered. Some of the ethical issues considered with the South Asian women included being careful not to upset any family relations during the interviews. For this reason there was no objection to any family members sitting in on the interview to see what was being discussed. Interviews were not recorded because the pilot study indicated some South Asian mothers had reservations about being recorded. A few of the dad's sat in for the first part of the interview and then left. Many of the South Asian mothers were reluctant to discuss family finances so the interviewer was sensitive to this and reassured them they didn't have to discuss this.

The transcripts were produced by writing up extensive shorthand notes made during the interview. This was done immediately after the interview finished to maximize recall. It is acknowledged there may have been a small amount of information lost by this method, but it was felt it was more important to be sensitive to the concerns of the South Asian mothers about incidentally background conversations of people not involved in the study being picked. Most white British mothers were interviewed in a shopping centre and most South Asian mothers in their own homes. Urdu and Punjabi speaking interpreters were requested and provided for 69% of the first generation South Asian mothers (n=26) in the sample, although some of these interviews were held partly in English with the interpreter's input when the participant requested it. Questions addressed topics of infant clothing and bedding, heating, housing conditions and beliefs around how heat and cold affects infant health and wellbeing. Thematic coding methods were used to analyse the qualitative data (Thomas and Harden

Bi-ethnic infant thermal care beliefs in Bradford, UK

2008) and to generate categories to identify health concerns about beliefs and concerns about thermal care. The themes were developed inductively by manually extracting all emerging themes and sub-themes and mapping them out using mind mapping software Inspiration. There were no pre-conceived frameworks applied. ~~the~~The themes that ~~emerged~~were ~~emerged~~ were generated from the data. The organisation and classification of these themes was discussed throughout the process with the research team and with fellow students. An iterative process of refinement between the researcher and her supervisors ensured a consistent coding scheme was developed and adhered to based on a grounded theory approach (Charmaz, 2014, Strauss & Corbin, 1998). Some statistical quantification and test of association (Chi-square) were performed where appropriate.

Results

Characteristics of participants

Table 1 shows the socio-demographic characteristics of the participants.

Table 1. Characteristics of participants

Risk factors thought to play a major contribution to SIDS are smoking, low birthweight, prematurity lower socio-economic status and not sleeping in the same room as the caregiver (Blair *et al.*, 2006). In this sample South Asian mothers appeared to have some of these risk factors due to a lower socio-economic status because of their income and education, higher

Bi-ethnic infant thermal care beliefs in Bradford, UK

numbers of premature and low birth weight infants. The risk factors associated with the white British sample were that more mothers smoked, had houses that were not smoke free and had infants that slept alone.

Participants were divided into South Asian and white British groups on the basis of self-reported ethnicity. All in the category of white British mothers described themselves and their parents as white British; the category of South Asian mothers described themselves and their parents as either South Asian, Pakistani, Indian, Bangladeshi or British Pakistani. About half of the South Asian mothers grew up in Pakistan. Four of the South Asian mothers were of Bangladeshi origin and grew up in the UK, none of the participants identified themselves as Indian, Sri Lankan or Afghanistani. The results are presented using the category of South Asian which includes the data from all participants of Pakistani and Afghanistani origin. Whilst the category of South Asian and white British are used pragmatically it is acknowledged that these groups are neither homogenous nor stable (Gunaratnam, 2003) and the categories are used only to indicate potentially different beliefs and practices in comparison to the white British population. Both groups were categorized into first and second generation by asking about their place of birth, where they grew up and where their parents grew up. All white British mothers were first generation, 51% of the South Asian mothers were first generation, 49% were second generation South Asian.

Health conditions that mothers linked to heat and cold

Mothers gave multiple responses to the effects of heat and cold on their infants' health and wellbeing and these were not all focused on SIDS prevention. The primary concerns among

Bi-ethnic infant thermal care beliefs in Bradford, UK

white British mothers were about overheating leading to death or affecting sleeping. Among South Asian mothers primary concerns were that cold resulted in respiratory infections. Other concerns that emerged from thematic analysis are shown in Fig 1. below. Whilst this data does not compare beliefs around thermal risks to other health concerns it does illustrate that the health and wellbeing concerns of thermal stress are much more wide ranging than just a concern about overheating and SIDS. The analysis led to mapping out these concerns into four themes of infant survival, illness, discomfort and behavioural cues.

Fig 1. Health concerns mothers believed could result from thermal conditions

Table 2 below shows the top five concerns for South Asian mothers. The first being cold leading to respiratory conditions and the second being heat affecting the infant, but not fatally.

Table 2 Top concerns of thermal stress among South Asian mothers

Table 3 below shows that for white British ~~mothers~~mothers' heat was the overriding concern for ~~the infant's~~the infant's survival and health. Cold was a concern with regard to sleep.

Table 3 Top concerns of thermal stress among white British mothers

Beliefs of the impact of heat and cold on infant health and survival

Four themes emerged from the data. These were beliefs how heat and cold had an impact on infants for i. survival ii. illness iii. discomfort iv. physical and behavioural cues of general health

i. Heat, cold and infant survival

Fatal consequences of heat stress were predominantly a concern among white British mothers but of little concern for South Asian mothers. Potentially fatal conditions said to be 'caused

Bi-ethnic infant thermal care beliefs in Bradford, UK

by heat' were SIDS, uncontrolled temperature, suffocation, fits, unconsciousness and dehydration. "My mate's baby died of overheating when he was 6 weeks old so I'd be really worried about her overheating" (P44WB) [1]. Heat is believed by white British mothers to be causal, not an association, for SIDS "I'd be worried, he could get cot death if he's too warm" P58WB. The main fatal ~~consequence of cold were~~ consequence of cold was thought to be hypothermia in both groups: 'If he got too cold he'd freeze to death.' P15WB

ii. Heat, cold and risk of illness

South Asian mothers believed heat could lead to vomiting and stress, rashes and heat spots. Heat and eczema was linked by a few white British mothers but it was more of a concern for South Asian mothers: "If I do [use the electric heaters in the bedroom] their eczema flares up. We usually just heat the house using the gas fire in the lounge because of the girls and try to not let the house get too hot because of the eczema, but don't let it get cold either" (P43SA)

Both white British and South Asian mothers believed the infant getting cold could lead to respiratory infections. "He gets coughs and colds if he's not covered up properly" P105SA. The same belief was found amongst the white British mothers: 'She'd get cold and catch a cold, wouldn't you?' [Speaking to her baby in the baby carrier] P67WB

Table 2 above shows respiratory infections are overall much more of a concern among South Asian mothers than white British mothers. Mothers linked cold to fever through infections caused by cold exposure. "He gets coughs and colds if he has too little clothing on" P1SA

Another concern of getting cold was asthma. Keeping children wrapped up was also believed by mothers in this sample to protect children from asthmatic attacks: "My oldest one had asthma and it's scary. He's the first in the family to have asthma, not me or my husband's family. That's why it so important. I put jumper and thick trousers on him [the baby] but I

Formatted: Font: (Default) Times New Roman

Formatted: Font: (Default) Times New Roman

Bi-ethnic infant thermal care beliefs in Bradford, UK

1
2
3
4
5
6
7
8 *don't put on too much clothing on him. The health visitors tell me not to put so much clothing*
9 *on him, but you know [shrugs shoulders], you've really got to put clothes on him. Especially*
10 *him [points to older sibling], he was my first born you know. You've really got to protect*
11 *them" P32SA (Bangladeshi)*
12
13
14

iii. Heat, cold and the infant's discomfort

15
16 Preventing an infant experiencing discomfort through heat or cold was a high priority among
17 both groups, principally because it was thought to affect sleep. Infant discomfort was a
18 trigger to check whether there was too much clothing; however, there were differing
19 interpretations of what crying and irritability was caused by, including non-thermal causes.
20 Both South Asian and white British mothers mentioned cold causing discomfort and affecting
21 sleep: *"if he's cold he doesn't like it. You know when they're warm they sleep really well but*
22 *when they are cold they can't sleep and make a fuss" P33SA. This discomfort was an*
23 important factor in allowing their own infant to sleep. *"She wouldn't come to any harm [if*
24 *cold] I don't think. She'd just be uncomfortable and not sleep" P40WB*
25
26
27
28
29
30
31
32
33
34
35
36

37 The importance of sleep could sometimes override what the mother believed to be safe for
38 the child. Four mothers reported that their infant refused to sleep unless their face was
39 covered and despite the mothers being aware this wasn't safe they allowed it so the infant
40 would sleep, or the infant would cover their face while sleeping:
41
42
43
44

45 *He holds onto one of them [blanket] and kicks the covers off and holds the blanket over his*
46 *face to sleep but it doesn't cover his body. [in the summer] He'll usually pull that [the sheet]*
47 *over his face and just sleep like that.' P20WB*
48
49
50

51 Even if the infant had a fever, South Asian mothers did not want infants to experience the
52 discomfort of cold, demonstrating a balance promoting culture: *"If my baby has a fever I will*
53
54
55

Bi-ethnic infant thermal care beliefs in Bradford, UK

still keep him covered. Just because the head is hot it doesn't mean he doesn't feel the cold.

Only if he's burning up or has rosy cheeks I'd leave him in a t-shirt, never totally uncovered"

P4SA

iv. Physical and behavioural cues of general health

Infant behavioural cues were reported to be able to influence their own thermal care through signs and signals: *"He wouldn't let me put too much on, he'd just cry or kick them off"*

P17WB. Physical signs of thermal stress were also considered, but interpretation of these signs varied. One white British mother judged her infant not to experience pain through cold exposure despite being regularly told by strangers her infant's hands were purple with cold: *"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"*(P63WB).

Mothers in both groups occasionally expressed concern that heat or cold meant their infants could not communicate serious problems to them if deep sleep was induced by temperature. For white British mothers heat lead to reduced cues for wellbeing. *"They would get drowsy and wouldn't wake up if they had a problem. Whereas if they're cold they complain and tell you"* P63 WB. For South Asian mothers cold lead to reduced cues: *"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 she's cold"* P71SA

Priorities of preventing infant exposure to heat and cold

There was a significant association between ethnicity and whether mothers thought heat or cold posed more of a threat to their infant's survival or wellbeing. This question was presented as an either/or question but as it was an in-depth interview mothers were

Bi-ethnic infant thermal care beliefs in Bradford, UK

encouraged to discuss and explore their answers. The result was all mothers decided on an answer that was either heat, cold or both. The mothers' ~~responses to this question~~ was responses to this question were corroborated by their further discussions about thermal care. By using a Pearson Chi squared test a significant association was found between white British mothers being more concerned about heat as a threat and South Asian mothers being equally concerned about both heat and cold (37.0, 2 degrees of freedom, $p < 0.001$) (see Fig 2.). The question was phrased by the researcher as presenting a choice of either cold or heat as the major threat. White British mothers rarely hesitated, and sometimes said they could not stress the danger of heat enough. *'Hot [is worse than cold]. 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.'* P53WB

South Asian mothers entered into a debate about both heat and cold posing a threat and they insisted they could not choose one over the other.

'Both obviously, if it was too cold it would make her more ill, and if she was too hot her face would go red, she'd cry and get a rash.' P98SA

Fig 2. Comparison of heat and cold as a concern for infant health to white British and South Asian mothers

As acknowledged above, the categories of 'South Asian' and 'white British' do not reflect the diversity within these categories so it is helpful to examine some of the differences within the groups. The following figures examine the difference in concern about heat or cold between first and second generation South Asian mothers. Second generation mothers had slightly more concern about heat. This may have been because the first generation mothers experienced more influence of humoral beliefs of balance whilst growing up in Pakistan and the second generation mothers influenced by UK health promotion messages to prevent SIDS

Bi-ethnic infant thermal care beliefs in Bradford, UK

through prevention of overheating. This is just one way of looking at heterogeneity within the group.

Fig 3. Comparison of heat and cold as a concern for infant health to first and second generation South Asian mothers

Thermal balance was more important among first than second generation Pakistani mothers (81% vs. 50%).

Within the white British group there was an indication that the mothers who reported heat (70%) as more of a threat to their infants had a higher income and education. All of the white British mothers who said cold (10%) was more of a concern for their infant either had no qualifications or NVQ1,2,3, GCSE (or equivalent) compared to 65% of mothers with higher qualifications who were not as concerned about cold. All of the white British mothers who said cold was more of a concern for their infants' health had an income <£20,000. Of the white British mothers who said heat was a concern for their infant's health 36% had an income of less than £20,000 and 64% an income of more than £20,000. It was not possible to do the same analysis of income for the South Asian group because over half of them did not wish to supply information about their family income, also the majority of South Asian mothers believed both heat and cold were equal threats leaving small numbers who answered one of the other was of most concern. All South Asian mothers reported their educational level. Of those reporting cold to be more of an issue 71% had an educational level equivalent or GCSEs or lower, and 29% higher than this. For those reporting heat to be of most concern the numbers were 78% and 23% respectively and for those reporting both it was 66% and 34%. These numbers do not appear to demonstrate a wide ranging attitude to heat and cold according to education among South Asian mothers.

Bi-ethnic infant thermal care beliefs in Bradford, UK

Discussion and conclusion

Study limitations

This study was relatively small for statistical purpose yet a good size for a qualitative study, and was of an exploratory nature. Therefore it would be useful to cover some of the themes in more depth and employ ethnographic methods to observe how care is provided in practice in different scenarios to compare the reported ideal thermal care with actual thermal care in that culture. This study was challenging because it required data from different cultures that differed in how to access, interview and interpret them. Most of the white British mothers were easy to directly access in a local shopping centre and willing to stop and chat there. Some even said they were happy to be involved because they had come to the shopping centre to escape the isolation of home. The South Asian mothers were easier to recruit into the study by using a trusted intermediary. They were also more comfortable being interviewed at home in private and said their infant stopped them going out much, which partly explained why they were hard to recruit in the community/shopping centre. By overcoming barriers of language and trust a sufficient number of first generation Pakistani mothers were recruited and this was strength of this study because these can be hard to reach participants. Almost a quarter of live births in Bradford are to first generation Pakistani mothers, a sixth to second generation Pakistani mothers and half to white British mothers (BDIMC, 2006).

The category of 'South Asian' is an oversimplification of the multiple and complex cultures in this region and does not account for time living in the UK or in South Asia. By dividing the Pakistani mothers into first and second generations some differences in thermal

Bi-ethnic infant thermal care beliefs in Bradford, UK

care beliefs may be identified within the general 'South Asian' group. However beliefs between mothers of second generation South Asian origin are possibly more likely to be similar to first generation South Asian mothers than those of the white British group due to geographic segregation of ethnic communities in Bradford in particular. Therefore 'South Asian' is still a useful category.

Beliefs of thermal care

These results demonstrate notable differences in beliefs around the effects of heat and cold stress between and among white British and South Asian communities in the U.K.. White British mothers had an overriding concern about the threat of heat in causing death by overheating or SIDS. South Asian mothers were concerned about protecting their infants from both heat and cold in equal measure but didn't see either as being particularly life threatening. Their main concern was that cold exposure could result in respiratory infections. There appears to be some generational and cultural differences in the South Asian group in whether heat, cold or both are more of a threat to infants. There is some evidence that immigrant mothers in the UK experience an increase in unhealthy behaviours such as smoking, drinking and reduced breastfeeding. This shows that health professionals should not assume these groups are not engaging in risk behaviours such as smoking and that they should also receive health promotion messages (Hawkins, 2008).

In general little is known about the negative change in health behaviour after immigration in the UK but equally little is known about protective health behaviours immigrant mothers arrive with and are lost and misunderstood on taking up residence here. Higher risk behaviours may come through influence and contact of the majority culture in the UK but we know little about the mechanisms by which this change comes about and the nature of this change. On one hand stereotyping may lead health professionals to think all South Asian

Bi-ethnic infant thermal care beliefs in Bradford, UK

1
2
3
4
5
6
7
8 mothers refrain from smoking and on the other hand a lack of knowledge leads to
9 assumptions smoking rates are the same as the majority white British population (Crane
10 2014). A more in-depth understanding of immigrant cultures is also needed to avoid
11 assuming a simplistic uni-directional acculturation. For example, that first generation South
12 Asian mothers are influenced by white British mothers. It is possible there are also
13 acculturation processes between first and second generation South Asian mothers and their
14 communities (Salant, 2003).
15
16
17
18
19
20
21

22 There is a need to better engage with lay epidemiology to understand people's behaviours as
23 well as resilience to disease (Allmark and Tod 2005). The thermal balance promoting
24 practices of this group of South Asian mothers could be contributing to their lower SIDS
25 rates and promoting a change in their practices may be harmful to their infants, as well as
26 being disempowering for the mothers. The strength of the focus on heat as a potentially fatal
27 threat among the white British mothers could have foundations in cultural beliefs that are
28 already fearful of risks of heat and complacent of risks of cold. To an extent these beliefs
29 may be influenced by health promotion campaigns such as the 'Back to Sleep' campaign, but
30 they can also be linked to other white British cultural practices that are believed to be health
31 promoting.
32
33
34
35
36
37
38
39
40
41
42

43 Beliefs in humoral aetiology of disease are evident among South Asian mothers as different
44 conditions were attributed to heat and cold. Whilst the South Asian mothers were not
45 referring overtly to humoral belief systems there was evidence that their beliefs were
46 pluralistic in that they were aligned both to biomedical and humoral beliefs systems. Balance
47 between heat and cold exposure was a dominant theme throughout the discussions and, as in
48
49
50
51
52
53
54
55
56
57
58
59
60

Bi-ethnic infant thermal care beliefs in Bradford, UK

the humoral literature, cold was believed to result in internal illness such as respiratory infections and asthma and heat to external ones such as eczema and rashes.

Among the white British mothers fear of heat was a dominant theme which would also support evidence from the literature that white British beliefs of thermal care regard heat to be more dangerous than cold. In this sample heat was believed to be potentially fatal but not just because of SIDS. Overheating *per se* was believed by white British mothers to have the potential to kill an infant, with heat being a causal, rather than contributory factor to infant deaths. Cold was less feared and even believed to cause overheating through a respiratory infection resulting from a chill and then leading to fever. Here there is evidence that white British thermal care beliefs are also pluralistic and not wholly aligned to biomedical aetiology of disease. The lay belief that 'catching a chill will cause a cold' has long been contested in biomedicine yet was a common belief found in this white British sample. The plurality of biomedical and lay aetiologies of disease is therefore evident among both white British and South Asian mothers.

'Correct' thermal care?

SIDS prevention policy has used evidence based on associations between overheating and SIDS for decades but there have been few, if any recent or extensive studies on how cold could also produce a challenge to an infant's circulation, respiration and internal regulation in a similar way that heat does. This presents a classical ethical dilemma in health promotion practice whereby messages to avoid one extreme could be interpreted as the other extreme therefore being safe. There is however poor evidence to say how much of a SIDS risk cold is to infants.

Bi-ethnic infant thermal care beliefs in Bradford, UK

This study has found that preventing overheating and SIDS is only one of several factors that mothers have to consider when providing thermal care for their infant. Sleep, comfort, eczema, asthma, and risk of respiratory conditions are some of the many other competing concerns around infant thermal care. Respiratory conditions resulting from getting cold was a concern among both groups and indeed the million of young children who die of pneumonia each year worldwide (Liu et al. 2014) would justify concern of respiratory infections. Whilst there is no strong clinical evidence that getting cold can cause pneumonia, the belief is widespread globally and therefore can influence behaviour.

Some of the South Asian mothers felt their thermal care beliefs and priorities were not understood. Contrary to stereotypes that South Asian women in the UK overwrap their infants and therefore put them at risk of SIDS, the South Asian mothers in this study seem to be just as concerned about risks of heat stress as they are with cold stress. This difference is particularly important as the risk of SIDS is significantly lower in this group. Care needs to be taken to avoid disempowering groups with a low risk of SIDS by not criticising them for thermal care practices where there is no evidence that their practices are high risk. Conversely practices of immigrant communities may help us understand disease prevention further and indigenous infant care practices are not always the best ones to emulate in their entirety.

White British and South Asian mothers exhibit different beliefs and practices regarding thermal care of infants. South Asian mothers have a greater focus on balance between heat and cold and white British mothers are far more concerned about heat stress. These differences need to be acknowledged when providing guidance and policy recommendations so that SIDS prevention advice emphasising prevention of overheating does not allow risks of cold stress, such as hypothermia, to be overlooked. Over the past ten years hospital

Bi-ethnic infant thermal care beliefs in Bradford, UK

hypothermia admissions have more than doubled for children under four years old, alongside a similar two-fold increase in fuel prices (Hospital Episode Statistics 2014). With a growing proportion of the population experiencing fuel poverty ranging from 15% in England to 42% in Northern Ireland (DECC, 2013), and increasing fuel prices, there is a need to develop a better understanding of when and how infants can get cold and how SIDS and other health conditions may be affected. Given the paucity of research into cold stress and SIDS, efforts to research both heat and cold stress is required. Balance promoting approaches are largely congruent with the actual infant care practices of mothers in cultures influenced by humoral beliefs, where SIDS rates are often low and both heat and cold stress is discouraged.

The approach of critical medical anthropology applied to public health problems, such as SIDS, was found to be useful because it allowed the consideration of cultural factors as well as socio-economic factors. It was also useful in considering how mothers might have other thermal care priorities, such as protecting infants from chills and getting a cold, might exist alongside, or in conflict with, national public health priorities such as the prevention of SIDS. More attention needs be paid to humoral theories of disease as a major global aetiology of disease and cultural beliefs and practices that may influence multiple health behaviours. If these beliefs are not fully appreciated and understood health professionals may find it hard to promote behavioural changes for improving infant health, and priorities between health professionals and parents may be mis-matched. Whilst the focus on safe thermal care and SIDS prevention is understandable in the UK context where SIDS is one of the major explanations of deaths of post-neonatal infants in their first year, SIDS is almost non-existent in some groups such as South Asians and is less relevant. Thermal care and morbidity has been largely overlooked but a greater understanding of infant thermal care beliefs could contribute to improving infant health particularly in terms of reducing respiratory infections.

Bi-ethnic infant thermal care beliefs in Bradford, UK

improving infant weight gain and quality of sleep. This paper has shown how challenging this topic s for parents, health professionals and policy makers because protecting infants from potential harms caused by cold and heat stress involves a complex interaction of physiological, environmental, behaviour and cultural factors. This presents us with unique but fascinating challenges of understanding how to improve infant health through safe thermal care. Applying the approach of critical medical anthropology and public health biological processes such as infant thermoregulation cannot be seen not solely as internal physiological processes but intrinsically connected to the beliefs and behaviour of the infant's caregivers and their physical, social and economic environment.

[1] P= participant, WB = white British, SA = South Asian

References

- Allmark, P. and Tod, AM. (2006) "How should public health professionals engage with lay epidemiology?" *Journal of Medical Ethics*, 32 no8, (2006) 460-463.
- Antonovsky A (1987) *Unraveling the Mystery of Health* Jossey-Bass. San Francisco
- Ayriss, C. (2009) *Hung Out to Dry: Swimming and British Culture*. Lulu.
- Ball HL, Moya E, Fairley L, Westman J, Oddie S, Wright J. (2012) "Infant care practices related to sudden infants death syndrome in South Asian and White British families in the UK." *Paediatric and Perinatal Epidemiology* 26. No1 3-12.
- Blair PS, Sidebotham P, et al. (2006) "Major epidemiological changes in sudden infant death syndrome: a 20-year population-based study in the UK". *Lancet* 367 no 9507: 277-8.
- Bradford and District Infant Mortality Commission BDIMC (2006) *Analysis and Interpretation of Infant Mortality Data – Report*
- Campbell D (2011) Anthropology's contribution to public health policy development. *McGill Journal of Medicine*. 13 (1):76
- Charmaz K (2014). *Constructing Grounded Theory*. Second Edition: Sage Publications Ltd
- Chu C, Zhou W, Gui Y, Kan H (2011) "Diurnal temperature range as a novel risk factor for Sudden Infant Death" *Biomedical and Environmental Sciences* 24 no5 518-22

Bi-ethnic infant thermal care beliefs in Bradford, UK

Crane D (2014) *BradICS: Bradford Infant Care Study: A qualitative study of infant care practices and unexpected infant death in an urban multi-cultural UK population*. Doctoral thesis, Durham University.

Dahlgren G and Whitehead M (2007) Policies and strategies to promote social equity in health. Institute for Future Studies. <http://www.iffs.se/wp-content/uploads/2011/01/20080109110739filmZ8UVQv2wQFSHMRf6cuT.pdf>

DECC -Department of Energy and Climate Change (2013) *Annual Report of Fuel Poverty Statistics*

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/199833/Fuel_Poverty_Report_2013_FINALv2.pdf Accessed 9 May 2014

FSID (The Foundation for the Study of Infant Deaths) & Department of Health. (2009) *Reduce the risk of cot death*.

Fleming PJ, Azaz Y and Wigfield R. (1992) "Development of thermoregulation in infancy: possible implications for SIDS" *Journal of Clinical Pathology*. 45 11 Suppl: 17-9.

Fleming P, Young J, et al. (2006) "The importance of mother-baby interactions in determining nighttime thermal conditions for sleeping infants: Observations from the home and the sleep laboratory." *Paediatric Child Health*, 11, Suppl: 7A-10A.

Gantley M. (1994) "Ethnicity and the sudden infant death syndrome: anthropological perspectives." *Early Human Development* 38 no3: 203-8.

Goldsmith, J. and Arbeli, Y. and Stone, D. (1991). "Preventability of neonatal cold injury and its contribution to neonatal mortality." *Environmental Health Perspectives* 94,55-59.

Gunaratnam Y. (2003) *Researching 'Race' and Ethnicity: Methods, Knowledge and Power*. Sage Publications

Guntheroth, W.G. and Spiers, P.S. (2001) "Thermal stress in sudden infant death: Is there an ambiguity with the rebreathing hypothesis?" *Pediatrics* 107, no.4, 693-98.

Hardyment C. (2007) *Dream Babies; from Locke to Spock*, Francis Lincoln

Hawkins S (2008). "Influence of moving to the UK on maternal health behaviours: prospective cohort study" *BMJ* 336 No. 7652 1052-1055

Hiley C and Morley C. (1994) "Evaluation of government's campaign to reduce risk of cot death." *British Medical Journal* 309 703.

Hospital Episode Statistics (2014) Health and Social Care Information Centre 'Hypothermia national stats by age 2005-06 to 2013-14'

http://www.hscic.gov.uk/media/15004/Hypothermia-national-stats-by-age-2005-06-to-2013-14/xls/Hypothermia_national_stats_by_age_200506_to_201314.xlsx Accessed 13.1.15

Inhorn, M. (1995). Medical anthropology and epidemiology: Divergences or convergences? *Social Science and Medicine*, 40(3), pp.285-290.

Field Code Changed

Bi-ethnic infant thermal care beliefs in Bradford, UK

Kim-Godwin, Y.S. (2003) "Postpartum beliefs and practices among non-Western cultures." *American Journal of Maternal/Child Nursing*, 28, No.2, 74-8.

Kinney, H, Richerson G, Dymecki S, Darnall R, Nattie E. (2009) "The brainstem and serotonin in the sudden infant death syndrome." *Annual review of pathology* 4: 517.

Liu, L., Oza, S. Hogan, D., Perin, J., Rudan, I., Lawn, J.E., Cousens, S., Mathers, C., Black, R.E. (2014). Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. *The Lancet*, (Early online publication).

Lullaby Trust. (2013) *Avoid letting your baby get too hot*
<http://www.lullabytrust.org.uk/roomtemperature> accessed 15.10.13

Lyon, A. (2006). Applied physiology: Temperature control in the newborn infant. *Current Paediatrics* 16 No.6: 386-392

ONS - Office for National Statistics (2011) *Unexpected deaths in Infancy - England and Wales 2013* <http://www.ons.gov.uk/ons/rel/child-health/unexplained-deaths-in-infancy--england-and-wales/index.html> Accessed 29.9.15

Milread J, Norvenius G, Wennergren G. (1993) SIDS Outdoors and Seasonality in Sweden 1975-1987 *Acta Paediatrica* 82 No. 12 1039-1042

Molony, N, Blackwell, CC and Busuttill, A. "The effect of prone posture on nasal temperature in children in relation to induction of staphylococcal toxins implicated in sudden infant death syndrome." *FEMS Immunology and Medical Microbiology* 25, 109-113.

Moore, A. (1999) "Changing patterns of childhood mortality in Wolverhampton." *Archives of Diseases of Childhood*, 90, No.7 (2005) 687-91.

NICE National Institute for Health and Care Excellence (2014) *Draft recommendations to tackle Sudden Infant Death Syndrome published for consultation*
<https://www.nice.org.uk/news/press-and-media/draft-recommendations-to-tackle-sudden-infant-death-syndrome-published-for-consultation> Accessed 29.9.15

Nizami SQ and Bhutta ZA. (1999) "Self-reported feeding advice by physicians for common childhood illnesses." *Journal Pakistan Medical Association*. 49, No.12: 298-301.

Pachter, L.M., Weller, S.C., Baer, R.D, de Alba Garcia JE, Trotter, R.T., Glazer, M. and Klein, R. (2002) "Variation in asthma beliefs and practices among mainland Puerto Ricans, Mexican-Americans, Mexicans, and Guatemalans." *Journal of Asthma* 39. No.2 119-34.

[Parsons, K. \(2003\). Human Thermal Environments - the effects of hot, moderate and cold environments on human health, comfort and performance. London, New York: CRC Press.](#)

Petersen S and Wailoo M. (1994) "Interactions between infant care practices and physiological development in Asian infants." *Early Human Development*. 38: 181-186.

Bi-ethnic infant thermal care beliefs in Bradford, UK

Ponsonby, A Dwyer T, Gibons L, Cochrane J, Jones M, and McCall M. (1992) "Thermal environment and sudden infant death syndrome: case-control study." *British Medical Journal*, 304, No. 6822, 277-282.

Prior L, Evans M and Prout H. (2011) "Talking about colds and flu: The lay diagnosis of two common illnesses among older British people." *Social Science and Medicine* 73. No 6 :922-8.

Salant t, Lauderdale D (2003) "Measuring Culture: a critical review of acculturation and health in Asian immigrant populations" *Social Science and Medicine* 57 No.1 71-90

Scarpa, G. (2004). "El síndrome cálido-fresco en la medicina popular criolla del Chaco Argentine." *Revista de dialectología y tradiciones populares* (2004) 59 No.2: 5-29.

Strauss A, Corbin J (1998). *Basics of qualitative research techniques and procedures for developing grounded theory* Second edition Thousand Oaks: Sage Publications

Teagle, Alexandra R., and Colin VE Powell. (2014) "Is fever phobia driving inappropriate use of antipyretics?." *Archives of disease in childhood: archdischild-2013*.

Thomas J, Harden A (2008) "Methods for the thematic synthesis of qualitative research in systematic reviews" *BMC Medical Research Methodology* 8:45

Tourula M, Isola A, Hassi J. (2008) "Children sleeping outdoors in winter: parents' experiences of a culturally bound childcare practice." *International Journal of Circumpolar Health* 67 No.2-3: 269-78

Weese-Mayer, D.E., Ackerman, M.J., Marazita, M.L. and Berry-Kravis, E.M. (2007) Sudden Infant Death Syndrome: review of implicated genetic factors. *American Journal of Medical Genetics A*. 143 No. 8: 771-88.

[Wilkinson R, Marmot M \(2003\). Social determinants of health – the solid facts. World Health Organisation Europe. http://core.ac.uk/download/pdf/6472456.pdf Accessed 20.10.15](http://core.ac.uk/download/pdf/6472456.pdf)

Williams, S., Taylor, B., Mitchell, E., Scragg, R., Ford, R., Stewart, A., Allen, E., Becroft, D., Hassall, I., Roberts, A. and Thompson J. (1996). "Sudden infant death syndrome: Insulation from bedding and clothing and its effect modifiers." *International Journal of Epidemiology*, 25, No.2 (1996), 366-375.

[Winch P, Alam M, Akther A, Afroz D, Ali N, Ellis A, Baqui AH, Darmstadt G, El Arifeen S, Seraji M; \(2005\). Local understandings of vulnerability and protection during 326 the neonatal period in Sylhet District, Bangladesh: a qualitative study. Lancet, 366, pp.478-485.](#)

Wolfe E, MacFarlane A, Donkin A, Marmot M, Viner R (2014). *Why children die: deaths in infants, children and young people in the UK. Part A*. Royal College of Paediatrics and Child Health National Children's Bureau, British Association for Child and Adolescent Public Health

[W.H.O. \(1997\) Thermal protection of the newborn: a practical guide](#)

Bi-ethnic infant thermal care beliefs in Bradford, UK

W.H.O. (2010) *Country profiles on neonatal health - Guatemala*

http://www.who.int/maternal_child_adolescent/epidemiology/profiles/neonatal_child/gtm.pdf

Accessed 29.9.15

For Peer Review

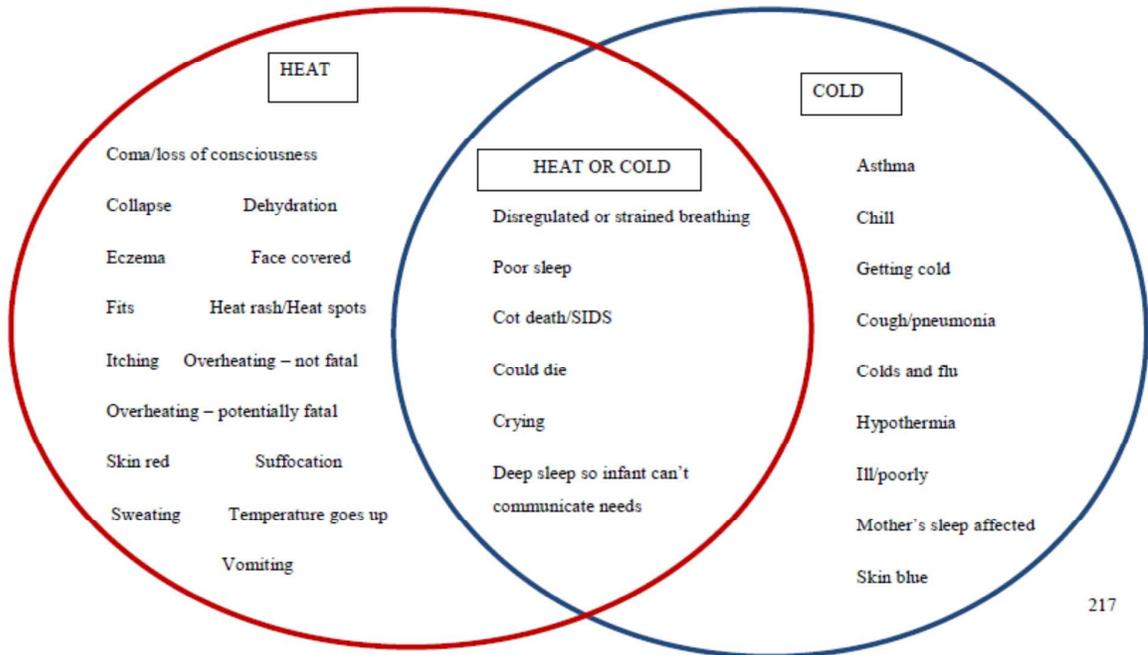
Beliefs on prevention of overheating and Sudden Infant Death Syndrome among mothers of South Asian and white British origin in Bradford, UK

Table 1. Characteristics of participants

Characteristic	South Asian (n=51)	White British (n=51)
Mean age of mothers	27 years (age range 19-40 years)	28 years (age range 17-46 years)
Proportion employed (including those on maternity leave)	25%	75%
Education – Proportion with equivalent of A' level or above	38%	32%
Proportion with no formal qualifications	28%	4%
Proportion with household income <£13,500	71%	27%
Proportions of first and second generation ¹ South Asian mothers	First generation = 51% Second generation = 49%	-
Proportions of South Asian mothers (first generation) of origin from Sindh or Punjab region in Pakistan	Punjab = 58% Sindh = 42%	-
Proportion of mothers who never smoked in pregnancy	98%	82%
Proportion who never had any smoke in home	87%	78%
Proportion of infant sleeping in same room as mother	96%	59%
Proportion of infants born premature	9.8%	3.9%
Proportion of infants born with low birthweight	17.6%	7.8%
Mean age of infant	5.7 months (age range 3 weeks – 12 months)	4.5 months (age range 4 days – 13 months)

¹ First generation here defined as having grown up in South Asia and migrated to the UK after the age of 16

Fig 1. Health concerns mothers believed could result from thermal conditions



217

review

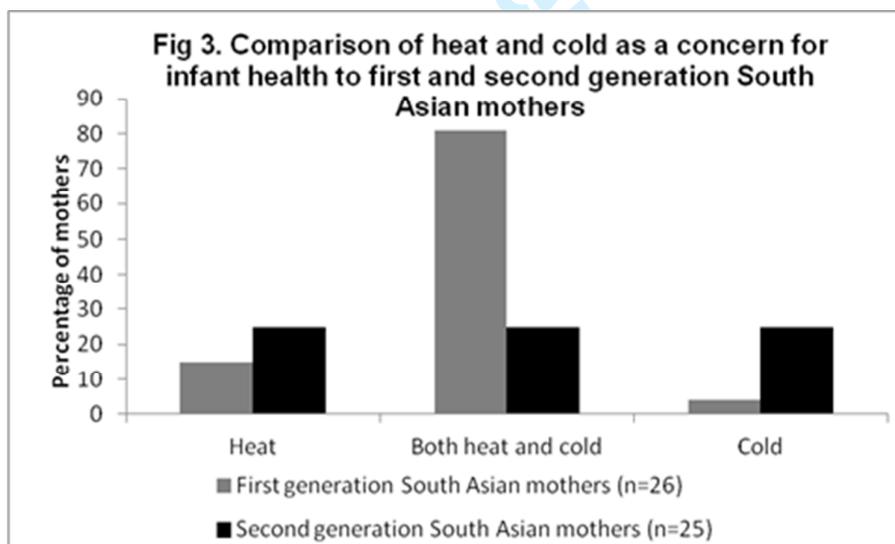
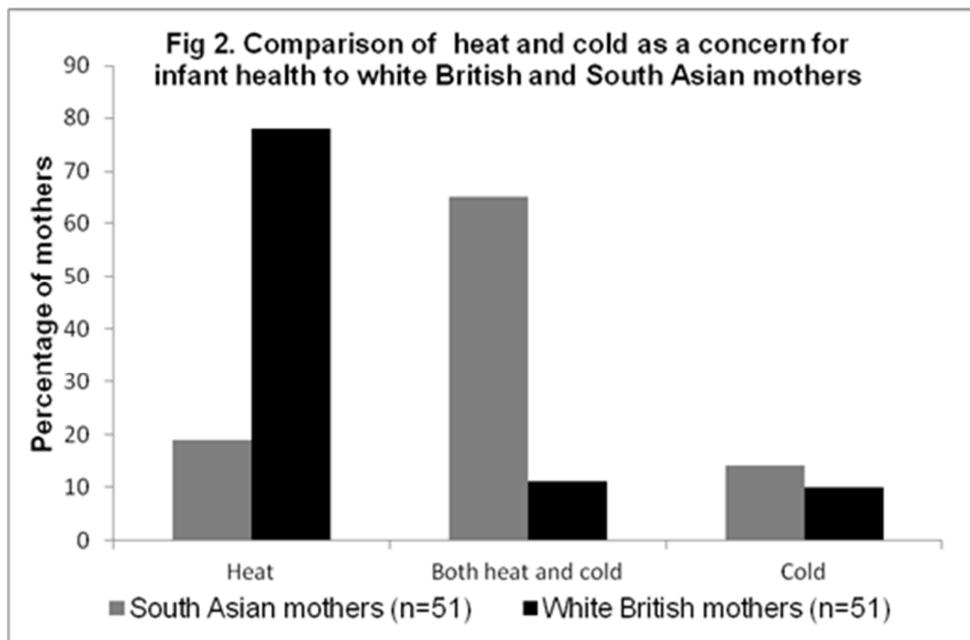
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 2 Top concerns of thermal stress among South Asian mothers

Concern	Number of mentions by South Asian mothers (n=51)
1. A chill will lead to respiratory infections	37
2. General concern of overheating (not fatal)	22
3. Being too hot or too cold will affect sleep	22
4. Being too hot affects the skin	15
5. General concern of being too cold	9

Table 3 Top concerns of thermal stress among white British mothers

Concern	Number of mentions by white British mothers (n=51)
1. General concern of overheating (not fatal)	26
2. Overheating can lead to death	22
3. Being too hot or cold can affect sleep	18
4. General concern of being too cold	15
5. Being too hot or cold can affect consciousness	11



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Article Title Page

[Article title]

Author Details:

[Author 1 Name]
[Author 1 Affiliation]

[Author 2 Name]
[Author 2 Affiliation]

[Author 3 Name]
[Author 3 Affiliation]

[Author 4 Name]
[Author 4 Affiliation]

Corresponding author: [Name]
[Corresponding Author's Email]

NOTE: affiliations should appear as the following: Department (if applicable); Institution; City; State (US only); Country. No further information or detail should be included

Acknowledgments (if applicable):

Biographical Details (if applicable):

[Author 1 bio]
[Author 2 bio]
[Author 3 bio]
[Author 4 bio]

Structured Abstract:

Keywords:

Article Classification:

For internal production use only

Running Heads:

