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ABSTRACTS

Abstracts

OP02.01 Three decades of evaluation of risk factors for SIDS based on comprehensive investigation: who is left behind?

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Background: It is not clear if the fall in SIDS rate has occurred in all groups.

Objective: To determine whether there have been relative changes in the SIDS rate in aboriginals, those found prone, exposed to tobacco, born to young or multiparous mothers, or sharing a sleeping surface.

Methods: Infant deaths notified to the Medical Examiner in Alberta, Canada, have had a consistent protocol since 1977 with a site of death investigation, an autopsy, and a review of background history. Records were reviewed of 1,752 infant deaths in five 5-year time periods and one 4-year period. The periods and number of deaths/year were (1) 1977–1981, 91.6; (2) 1982–1986, 90.2; (3) 1987–1991, 67.6; (4) 1992–1996, 48.6; (5) 1997–2001, 31.6; and (6) 2002–2005, 26. There was a steady fall in the numbers despite an increase in the birth rate. The fall was in all race groups, including aboriginals, but aboriginals became relatively more prominent, accounting for (all %) 14.85 and 13.11 in periods 1 and 2, rising to 17.75, 31.69, and 28.48 in periods 3–5, with a recent slight fall to 17.31. There were changes in other risk factors. Found prone fell from 74.45% in period 2–37.06% in period 6. Found in an adult bed rose from 16.5% in period 3–43.43% most recently. Shared sleeping rose from 12.5% in period 1–51.02% in period 6. Having a smoker in the home has remained constant at around 30% (31.17% in period 6). Those whose parents were married rose from 56.53% in period 1–79.19% in period 5. There was a variation in the ratio of young mothers (aged <25 years), but there was no consistent trend. There was a fall in multiparous mothers (>4 infants) from 33% in period 1–7% in the most recent period.

Conclusions: While SIDS rates have fallen in aboriginal infants, the fall is less marked than in non-Aboriginal infants. This review was unable to identify unique risk factors in this population. Public education is still needed in the areas of parental smoking and sleep position.

OP02.02 Bacterial toxins in the sudden infant death syndrome

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Objective: To seek novel toxins, and new roles for known toxins, which would explain the strong epidemiological and pathological evidence that bacterial toxins are involved in the pathogenesis of SIDS.

Methods: Polymerase chain reaction was used to identify toxin genes in intestinal contents from SIDS and other unexpected infant deaths (i.e., trauma) and feces from healthy babies. The following was targeted: Clostridium botulinum neurotoxin types A, B, E, F & G, Escherichia coli cytolysin A and cytolethal distending toxin, Pasteurella multocida toxin A, Clostridium sordellii lethal toxin, Staphylococcus aureus toxic shock protein and enterotoxin A, Clostridium innocuum species, Bacteroides thetaiotaomicron species, and E. coli high pathogenicity island.

Results: About 47 and 55% SIDS had C. innocuum and B. thetaiotaomicron bacterial species detected, respectively. By comparison, healthy babies and dead controls combined had 25 and 12%, respectively (OR for C. innocuum 2.7, P = 0.003, and OR for B. thetaiotaomicron 11.09, P = 5.5 × 10⁻¹¹). There was evidence for the possible involvement of S. aureus enterotoxin A (OR 3.6, P = 0.011) in SIDS, and a novel sequence of DNA from C. innocuum has been identified.

Conclusion: This study indicates significant differences between SIDS and comparison babies with respect to the detection of two bacterial species (C. innocuum and B. thetaiotaomicron) and to staphylococcal enterotoxin A. No differences were seen with the other above-mentioned toxins. The study provides a stimulus to further investigate staphylococcal enterotoxins and identify potential novel toxins linked to the Clostridium and Bacteroides spp.

OP02.03 Expression of the interleukin-6 receptor in the human infant medulla

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Objective: The relationship of SIDS to trivial infection has long been recognized. Mild infection, initiating a cascade of cytokines, is now postulated to be a major trigger for sudden death in the vulnerable infant. Cytokines may interact with an already compromised brainstem serotonergic system causing disrupted arousal patterns and/or cardiorespiratory regulation leading to sleep-related sudden death. We have shown that IL-6 is elevated in the cerebrospinal fluid of SIDS infants, supporting its relevance to the cytokine/SIDS hypothesis. Yet, nothing is known about the constitutive expression of the interleukin-6 receptor (IL-6R) and its signal transducer gp130 in medullary neurons involved in cardiorespiratory control and arousal. Thus, we undertook a baseline study of their expression in the infant medulla. **Methods:** Immunohistochemistry to IL-6R and gp130 was performed on 9 medullae from non-SIDS infants from ages 0–18 months. Anti-IL6R (Santa Cruz) and anti-gp130 (Atlas) were used on 4 µm paraffin-embedded sections. Regions assessed include serotonergic nuclei neurons and their projection sites.

Results: Virtually all neurons expressed IL-6R. The intensity of staining was high in the hypoglossal nucleus (n.), arcuate n., and dorsal motor vagal n.; intermediate in the inferior olive and lateral cuneate n.; and low in the n. raphe obscurus, n. of the solitary tract, and spinal trigeminal n. A similar, but not identical pattern was seen for gp130. These distributions were present at birth and did not change significantly thereafter.

Conclusion: The IL-6 receptor and its signal transducer are expressed constitutively in the infant medulla. This observation suggests that IL-6 elevations stimulated by infection have the potential to interact with multiple medullary nuclei and thereby help integrate homeostatic responses during infectious illness. These data provide essential baseline information for the future assessment of IL-6, IL-6R, and gp130 expression in SIDS.

OP02.04 Microbiological investigation: significance of time lap after death

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Microbiology is an important part of the autopsy protocol in sudden unexpected death in infants and children (SUDI). The interpretation of the results has been widely debated, especially concerning the impact of the postmortal time. At our Institute, bacteriological sampling has been part of our protocol since 1984, also including from 1994 the sampling by hospital admittance shortly after death. The objective of this study was to compare the findings in samples taken at hospital admittance and at autopsy and evaluate the benefit of

obtaining specimens both at hospital and at autopsy.

Methods: We included 306 consecutive SUDIs between 1994 and 2005. The cases included 89 SIDS, 58 borderline SIDS, 37 infectious deaths, and 122 controls. Blood cultures and cerebrospinal fluid (csf) were collected both at hospital and at autopsy from 100 and 97 cases, respectively. Time of death was estimated based on classical signs and information about the circumstances.

Results: Hospital samples were collected in median 4.5 h after death (95% CI 3.25–5); growth was mainly skin flora. Autopsy samples were collected in median 24.25 h after death (95.5% CI 22–25.5). The range of growth in all samples was stable over time and postmortal time had no influence on bacterial growth. Nineteen cases had pure bacterial growth in more than one sample; five of these were infectious deaths where bacterial growth contributed to the final diagnosis. Blood culture and csf showed the same bacterial growth in 4 of 6 cases of sepsis; lung specimen showed relevant growth in 5 of 17 cases of pneumonia.

Conclusions: Sampling for microbiological examination at hospital admittance is unnecessary as long as the autopsy is performed within 48 h after death. Omitting sampling at hospital admittance can reduce contamination and give more accurate results. Blood culture, csf, and lung specimens are the best predictors in our sample.

OP02.05 The role of postmortem bacteriological investigation in sudden unexpected death in infancy (SUDI): experience from a specialist center

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Objectives: Interpretation of postmortem culture results in sudden unexpected deaths in infancy (SUDI) is difficult, particularly without histological evidence of infection. This study evaluates the role of postmortem bacteriology in SUDI autopsies.

Methods: Results of bacteriological investigations were reviewed from 546 SUDI autopsies (7–365 days of age) performed in a single specialist center over a 10-year period (1996–2005). Isolates were classified as nonpathogens, group 1 pathogens (organisms usually associated with an identifiable focus of infection), and group 2 pathogens (organisms known to cause septicemia without an obvious focus of infection: groups A and B beta-hemolytic streptococcus, pneumococcus, meningococcus, *Escherichia coli*, and *Staphylococcus aureus*). SUDI cases were categorized as unexplained SUDI, explained SUDI with histological evidence of infection (bacterial infection group), and explained SUDI due to noninfective causes.

Results: Of the 2,079 bacteriological samples overall, 27% were sterile. Significantly more isolates of group 2 pathogens were detected in the bacterial infection (24%) and unexplained SUDI (19%) groups compared to the explained noninfective cases (11%, $P = <0.0001$ and $P = 0.001$, respectively). There was a significantly higher proportion of *Staphylococcus aureus* and *Escherichia coli* in unexplained SUDI (38 and 12%) than in the noninfective group (15%, $P = <0.0001$, and 3%, $P = 0.01$).

Conclusions: The higher rate of detection of group 2 pathogens, particularly *Staphylococcus aureus* and *Escherichia coli*, in the otherwise unexplained SUDI deaths suggests that these organisms may play a role in the pathogenesis of sudden death in a subset of SUDI.

OP02.06 Altered cardiovascular responses to head-up tilting during sleep in extremely low birth weight preterm infants

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Objective: Prematurely born and low birth weight infants are at an increased risk for Sudden Infant Death Syndrome (SIDS), which may be due to immature cardiovascular control. We aimed to assess the effect of birth weight on cardiovascular control during sleep in prematurely born infants.

Methods: Twenty-seven preterm infants (28–32 weeks GA) were studied using daytime polysomnography at 23 weeks, 2–3, and 5–6 months corrected age (CA). Blood pressure (BP) was recorded using a photoplethysmographic cuff (FinometerTM). Infants were tilted 15° head-up to assess baroreflex responses in quiet (QS) and active (AS) sleep. Infants were divided into low (LBW; 1,500–2,500 g), very low (VLBW; 1,000–1,500 g), and extremely low (ELBW; <1,000 g) birth weight groups for comparison and data expressed as percentage change from pre-tilt baseline.

Results: HR responses: At 2–3 weeks CA, the ELBW group responded with a significantly greater increase in heart rate (HR) in AS (6%) when compared to VLBW and LBW groups (1% increase each; $P < 0.05$). There were no significant effects of birth weight on HR responses at 2–3 or 5–6 months CA in AS. All three groups had similar biphasic HR responses in QS at all ages studied.

BP responses: There were no significant effects of birth weight on BP responses in AS at any age studied. At 2–3 weeks CA, the ELBW group responded with a significantly greater increase in BP during QS (9%) when compared to VLBW and LBW groups (3 and 2%, respectively; $P < 0.05$). Regression analysis demonstrated a significant negative correlation between birth weight and BP responses to tilting in QS at both 2–3 weeks and 2–3 months CA ($r = 0.56$ and $r = 0.49$, respectively; $P < 0.05$).

Conclusion: ELBW premature infants have impaired baroreflex responses to tilting at 2–3 weeks CA—the age when the risk of SIDS is greatest in preterm infants. Due to poor circulatory control, those preterm infants with lower birth weights may be more vulnerable to cardiovascular instability during sleep, and consequently to SIDS.

OP02.07 Infant thermoregulation during waking events: Cot versus bedsharing sleep

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Bedsharing infants are at increased risk of SIDS in some situations, e.g., after in-utero exposure to products of cigarette smoke. The mechanism is unclear but may involve infants' thermal control responses

Objective: To compare the infant thermal response to awakening during the night for regular bedshare and cot-sleep infants at low risk of SIDS.

Methods: Forty healthy, term infants, 0–6 months, who regularly bedshared with at least one parent >5 h/night and 40 age-matched, cot-sleeping infants were studied. Overnight video and physiological

monitoring, including continuous rectal, shin, and room temperature, were performed. Awakenings and parental responses were identified from the video, and temperatures were analyzed during the 30 min before and after each awakening. A random effects model was used to describe the relationship between time and temperature of the observed data points.

Results: Awakenings were more common in the bedshare group (mean 3.2 vs. 1.6/night) but shorter (3.8 vs. 6.5 epochs) and infants remained in bed at each awakening. Before waking, shin temperature was higher in bedshare infants than controls [mean (SE) 35.24(0.21) vs. 33.85(0.22)°C] despite a cooler room temperature (15.4 vs. 16.7°C). Rectal temperature increased and shin temperature decreased after waking in both groups but temperature changes were smaller (shin decrease: 0.35 vs. 0.91°C) and of shorter duration in bedshare infants. Estimates predicted by the random effects model showed the slope of the line for shin temperature after waking was significantly less in the bedshare infants (−0.04 vs. −0.23, $P = 0.02$).

Conclusion: Bedshare infants woke more often but remained in bed and thus experienced less temperature variation overnight than cot-sleep infants. We speculate that babies with poor thermoregulatory control may be compromised in either sleep situation—cot-sleep babies could become hypothermic while bedsharing babies could tend to overheat.

OP02.08 Sudden death, febrile seizures, and hippocampal maldevelopment in toddlers

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Objectives: Sudden unexpected death in childhood (SUDC) is the sudden death of a child >1 year which remains unexplained after a review of the clinical history, circumstances of death, and autopsy. Recently, we reported hippocampal abnormalities in 5 toddlers with SUDC (Kinney et al., *Pediatr Dev Pathol* 2007). The association of hippocampal anomalies with a high incidence of individual/family histories of simple febrile seizures (40%) raised concern that febrile seizures can be associated with death. In an expanded series of 64 toddlers with sudden death, we tested the hypothesis that a SUDC subset is characterized by hippocampal maldevelopment and an individual and/or family history of febrile seizures.

Methods: Cases, aged 1.0–5.9 (median 1.7) years, were studied retrospectively through the SIDS/SUDC Research Project.

Results: Of the 64 cases 49 (77%) were classified as SUDC, and 15 (23%) as known causes of death. Forty percent (19/49) of the SUDC cases had individual/family histories of febrile seizures. Of the 26 SUDC cases with hippocampal sections, 62% (16/26) had hippocampal anomalies, including 82% (9/11) of cases with an individual/family history of febrile seizures. Cases with hippocampal anomalies were all found dead during a sleep period, almost all in the prone position (87%), and often face down (67%).

Conclusion: A potential new entity may account for approx. 62% of SUDC in toddlers, defined by hippocampal anomalies and sleep-related death in the prone position, and associated with an individual/family history of febrile seizures. Sudden death may result from an unwitnessed seizure in the prone/face-down position with airway occlusion.

OP03.01 Collecting sudden unexpected infant death scene investigation and pathology data: results of a 7-state U.S. pilot study

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Objectives: Assess the quality of the information from various data sources and feasibility of collecting retrospective infant death scene investigation data using the Centers for Disease Control and Prevention's (CDC) Sudden Unexpected Infant Death Investigation (SUIDI) Reporting Form.

Methods: Seven US states, participating in the pilot study, collected data about factors and circumstances associated with SUID deaths occurring in their respective states during 2004 and 2005. Data were collected from law enforcement, medical examiner, and coroner reports attempting to complete the variables identified in the 2006 SUIDI Reporting Form. In addition, data was abstracted from autopsy findings and death certificates, and some states abstracted additional information from child death review data and birth certificates. Each state completed a final evaluation report detailing their perspectives on the availability and quality of data collected as well as lessons learned from the experience.

Results: All states had access to the required data sources, but few could get comprehensive death scene investigation data for all deaths. Those states that had a required death scene investigation form were most likely to be able to collect the key variables in the database. Every state reported that the partnerships formed to access the required data were the most beneficial aspect of the study. Collaborating with child death review teams was another major recommendation.

Conclusions: Establishing an ongoing national case registry for surveillance in the United States requires a thorough understanding of the resources and skills available at the state and local levels. A standardized methodology for prospectively collecting infant death scene investigation data and subsequently accurately and consistently classifying cause of infant deaths requires extensive training and collaborative efforts from a diverse set of professionals.

OP03.02 Infant deaths in a child death review across 5 UK regions (SW, Wmids, NE, Wales, and Northern Ireland)

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All deaths in the above regions amongst children from 28 days of age to 17 years 364 days in calendar year 2006 were studied. A sample intended to give an even distribution across age groups and geographical regions was subjected to multidisciplinary panel review.

Of the 957 deaths 100 (10.4%) were classified as SUDI (0.5 per 1,000 live births). M:F 60:39 (in one case no data was available). 15 were >1 year of age. Postmortem investigations may have later "explained" 10 of the deaths. The modal age of death was between 4 and 8 weeks. A quarter of the SUDI were in babies born either at less than 37 weeks, or weighing less than 2,500 g. Complete data were available on 95 deaths with regard to risk factors. Smokers in the household 75%. Co-sleeping occurred in 56% of cases. Only 18% were sleeping in a cot but 85% had been put to sleep on their back. Two cases were ascribed to overlaying (1) or wedging (1) on the death certificates.

Of 4 Panel cases that were "SUDI" one turned out to have been pneumococcal meningitis. In the remaining 3 cases co-sleeping and alcohol were relevant in one, and smoking, drug abuse, and prone positioning in another. About 29% of deaths <1 year were SUDI and comparing SUDI to non-SUDI (non-matched), SUDI were younger, lighter, and more mature at birth in this study.

OP03.03 Proposed multiagency guidelines for the management of SUDI, "A Scottish Solution"

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Objective: To develop multiagency guidelines for the management of SUDI in Scotland.

Methods: SUDI remains the commonest cause of post-perinatal infant death in Scotland, currently 40 deaths per annum (incidence 0.7:1,000). A 3-year SCDT case review which identified deficiencies in the pre-existing arrangements stimulated SCDT to establish a multiagency, multidisciplinary group to develop national guidelines to ensure effective and efficient investigation of these deaths wherever they occur in Scotland. To be acceptable, these needed to satisfy both the legal and health aspects of SUDI investigation.

The partners involved included the Scottish Crown Office, Police, Ambulance Services, A&E Services, SUDI Pediatricians, Pediatric and Specialist Pathology and Forensics Services, and family support services including Primary Care; Social Work; SCDT, and parents. Guidelines have been developed for all the agencies along with information packs for bereaved parents. These guidelines are designed to reduce unnecessary distress to parents by information sharing between multiple agencies, e.g., police and medical staff, and by providing early explanation of the necessary processes of investigations for parents.

We anticipate these cost-effective guidelines and associated algorithms will enhance current services and support for children and families, will provide integrated and streamlined multiagency management, including paths of communication between agencies, and will be less stressful for parents. Ultimately, they will provide accurate information on parenting practices which can contribute to awareness messages and the facilitation of high-quality SUDI investigation.

We await a national roll out following Scottish Government approval.

OP03.04 Joint home visits by pediatricians following sudden unexpected infant deaths (SUDI): part of multi agency guidelines

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In England & Wales, multiagency guidelines for responding to a SUDI (Ref. 1) include a home visit by health and other professionals. There are few published data on these visits in routine pediatric practice. Joint home visits by duty consultant pediatricians after a SUDI were introduced as part of local multiagency guidelines in 2000.

Aims: A descriptive study of the impact of introducing joint home visits following a SUDI.

Method: Prospective data were collected about the investigation of all SUDIs between 2000 and 2007 in one health district (population

250,000). Pediatricians were interviewed about their experiences and feedback was obtained from parents.

Results: Fourteen infants died unexpectedly at home, and all the families were visited by a consultant pediatrician working jointly with another professional, usually a police officer. The pediatricians were positive about the contribution home visits made both to the investigation and to communication with parents. The timing of visits was a difficulty and often involved additional cover by colleagues. Parental feedback was positive, although incomplete.

Conclusion: Joint home visits contribute to the multiprofessional response to a SUDI but require additional professional resources.

References: 1. Working Together to Safeguard Children. A guide to interagency working to safeguard and promote the welfare of children, 2006. www.everychildmatters.gov.uk.

OP03.05 Rapid response in the London Borough of Lewisham: interagency working

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Introduction: We introduce ourselves and discuss our roles in the rapid response process, including Project Indigo for the MPS and the lead SUDI pediatrician role in health.

Data: We present suitable data regarding the incidence of SUDI compared with the demographic make up of the Borough, with a comparison of similar data for the whole of London. This data will be cover some 300 cases during the years from April 2005 to March 2008. We also present analysis of the data to highlight common risk factors.

Problems: We consider and discuss the particular problems that an inner city Borough experiences including mobile populations, hostels, and differing ethnic groups.

Rapid response: We set out the arrangements put in place so far and how we want to progress.

A case study: We present a brief case study regarding a twin baby that died, highlighting the rapid response, factors involved, and the care of the surviving twin.

OP03.06 The medico-legal investigation of sudden, unexpected and/or unexplained infant deaths in South Africa: where are we—and where are we going?

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Objective: There exists a paucity of published research data in South Africa (with a population of approximately 50 million people), with regard to the incidence and investigation of Sudden Unexplained Deaths in Infants (SUDI) and/or SIDS. Currently, no nationally accepted infant death investigation protocol exists. The aim of this multicenter study was to critically review the current practice of infant death investigation at large medico-legal laboratories in South Africa.

Methods: Retrospective, analytical studies were undertaken at two large medico-legal laboratories in Tygerberg (Cape Town) and Pretoria, where almost 6,000 medico-legal autopsies (combined case load) are conducted annually. The number of infant deaths in children under 1 year of age, other relevant demographic details, and the scope and nature of the medico-legal investigations were reviewed. The study extended over a five-calendar-year period.

Results: A total of 1,550 Cases of deaths in infants under 1 year of age (and which were admitted to the above medico-legal mortuaries), were reviewed. Of these, 119 had been classified as SIDS cases. The study showed marked intercase as well as interdivisional discrepancies in terms of the investigation of infant deaths at the two institutions, mainly because of the lack of a standardized national investigation protocol in such cases.

Outcome: It is envisaged that this study will: (1) stimulate structured research and publication of data at other major centers in South Africa and (2) create a platform from which a practical yet internationally accountable infant death investigation protocol could be implemented in South Africa, in order to expand our understanding of this enigmatic entity in South Africa and to facilitate comparisons with other countries.

OP03.07 The institution of a standardized SIDS investigation protocol in South Africa: feasibility study of 11 cases in the Western Cape

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No standardized national protocol existed in South Africa for Sudden Unexplained Deaths in Infancy (SUDI) and SIDS investigation under the auspices of the South African Police Service before April 2006. Prior to that date, SUDI cases were investigated by academic Forensic Pathology Departments according to internal protocols. These protocols rarely included death scene investigation (DSI). With the establishment of the National Forensic Pathology Service in April 2006, the responsibility for investigating all infant deaths was transferred to the Department of Health, and efforts were initiated to rigorously standardize protocols for the investigation of SUDI. Here, we report on 11 SUDI cases that were fully investigated according to international guidelines (with a complete autopsy, DSI, and doll reenactment) at the Division of Forensic Medicine and Pathology, University of Stellenbosch. The cases were classified by means of consensus opinion. In this feasibility study, we were able to: (1) identify unique requirements of SUDI investigation in the Western Cape based on the population demographics and available resources; (2) demonstrate feasibility in the investigation of SUDI cases in an internationally prescribed manner with available resources; and (3) demonstrate that current infrastructure and resources allow for data collection and analysis for public health and research purposes. This study not only shows the feasibility for systematic investigation of SUDI in the Western Cape, but also provides the basis for recommending a national policy for these cases.

OP03.08 A contribution to the evaluation of a New UK SUDI protocol contained within working together 2006

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This research offers a contribution to the evaluation of a new protocol for the multiagency investigation of SUDI introduced by the UK Government in April 2006. The research utilizes primarily qualitative interviews with a sample of police, health, and other professionals but also includes observational fieldwork at seminars and professionals' meetings. There has been no previous evaluation to date and this paper suggests some areas where further early research would be useful. The research reveals a marked improvement in infant death investigation,

and in particular the fact that the proportion of all infant deaths classified as SIDS has now reduced considerably. This is a tangible measure of success because there will be less chance that homicides remain undetected, and where there is no maltreatment of the child (which is the majority of cases), the parents are able to understand why their child died. The research did, however, also reveal some concerns around the implementation of the new protocol, and the conclusions offer to policy-makers areas where further guidance and training are needed. The paper provides some discussion on the concept of the police investigation of infant deaths and offers some thoughts on the main differences between an adult sudden death investigation and that of a child. Although the research is exploratory and care is taken not to “over-claim” the findings, it does provide a basis for future research into specific areas of multiagency working.

OP04.01 Parent attitudes to the reduce the risk of cot death messages

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Objective: To explore parents’ attitudes to reduce the risk of cot death messages to help explain failure to follow the messages and to inform future health education strategies. The messages were: do not expose the baby to tobacco smoke, sleep the baby supine, and the safest place for the baby to sleep is in a separate cot in a room with the parents.

Methods: A total of 506 Mothers of children aged 6 months to 3 years were interviewed in their homes in November 2007 using ad hoc quote sampling to achieve at least 1/3 disadvantaged.

Results: Substantial minorities of mothers failed to follow recommended infant care practices. 14% Sometimes slept the baby prone, and 26% on the side. The most disadvantaged were least likely to follow recommended practice. 43% Said the baby usually slept in the same room as them for the first 6 months, with the disadvantaged less likely to have the baby in the room. 6% said the baby was sometimes exposed to smoking for more than 1 h per day.

Over half had unprompted awareness of advice on smoking risk, and 3/4 had prompted awareness. For awareness of prone sleeping risk, the figures were 42 and 69%; for bedsharing, 24 and 68% and for side sleeping, 7 and 28%.

Substantial minorities did not believe the messages that they were aware of: 19% were not persuaded of the risks of smoking, 25% that bedsharing carries risks, 29% that prone sleeping is risky, and 47% that side sleeping is risky. Those that failed to believe the risk tended not to follow the recommended advice.

About 71% slept the baby prone because the baby seemed to like it better. The main reason for exposing babies to smoke was perceived lack of choice. Almost half who bedshared said they did so because it was easier or nicer to care for the baby. Implications for future health education strategies will be discussed.

OP04.02 Who doesn’t get the message?: evidence from the Queensland infant care practices study

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Objective: To determine factors associated with non-compliance of reduce the risk messages for sudden infant death in a cohort of Queensland infants aged approximately 3 months.

Methods: A target population of all infants born in Queensland during April 2002 was identified using the Queensland perinatal database as a sampling frame. A cross-sectional survey was performed using a postal questionnaire at approximately 3 months of age. Survey questions included infant and maternal demographics and practices related to the Reduce the Risk (RTR) recommendations. Perinatal data was also obtained. Analyses were conducted using logistic regression.

Results: Completed surveys were returned from 2,534 (64%) primary caregivers. Uptake of RTR recommendations in the care of infants remains relatively poor in Queensland. The prevalence of risk factors was 38.5% for non-supine sleep positions (usual practice in the last 2 weeks); 60.6% of infants were not placed feet to foot if placed to sleep in a cot; 21.8% of mothers reported smoking currently, while 40.1% were no longer giving the infant any breast milk. Only 23.3% of the sample practiced the RTR messages, while only 14.9% practiced the RTR recommendations and breastfeeding. Factors commonly associated with not complying with RTR messages in multivariable analyses were young maternal age, living in rural or remote areas, single mothers, being a public patient, and an increasing number of previous pregnancies.

Conclusions: Despite continued public campaigns promoting reducing the risk factors associated with sudden infant death, the “hard to get to” population remains the most under-exposed to these public health messages. New methodologies need to be developed in the public health system to educate parents, present and future, of the risks associated with sudden infant death.

OP04.03 Why parents bedshare with their infants: surveys and interviews with African-American parents

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Background: The AAP, in their October 2005 policy statement, recommended a “separate but proximate sleeping environment” for all infants as a strategy to further decrease the rates of SIDS and other causes of sudden unexpected infant death. African-American parents bedshare more frequently than their Caucasian counterparts.

Objective: To investigate, using both quantitative and qualitative methods, factors influencing African-American parents’ decisions to bedshare with their infants.

Methods: We interviewed low-SES and middle-high SES African-American parents about infant sleep environment, infant care practices, and influences on decision-making. A subset of parents then participated in either focus group or individual interviews to discuss these topics in more detail.

Results: A total of 206 Parents completed the survey. 197 (95.6%) infants slept in the same room with one or both parents, and 68 (33%) routinely bedshared with one or both parents. In focus group or individual interviews with 45 parents, reasons for bed sharing centered around several themes: (1) convenience, (2) desire to bond with infant, and (3) protection of the infant. Protection was a central theme among low-SES parents, who were concerned about the possibilities of kidnapping and stray gunfire. Reasons for room sharing centered around the following themes: (1) space—lack of a separate room for the infant, (2) convenience, and (3) need to be within sight and sound of the infant.

Conclusions: African-American parents view room sharing and bedsharing as providing a protective environment for their infant. Efforts to encourage room sharing without bedsharing must address parental concerns about safety.

OP04.04 Recommendations for real life: the nature of shared sleep environments in Queensland and implications for effective safe infant sleeping messages

Young, J¹; Thompson, JMD²

¹Royal Children's Hospital & Health Service District, Australia;

²University of Auckland, New Zealand

Objective: To describe shared infant sleeping environments in a cohort of Queensland infants.

Methods: A cross-sectional survey design was used to benchmark infant care practices and factors associated with sudden infant death in a cohort of Queensland infants aged approximately 3 months ($n = 4,000$). Parent–infant sleeping environments, including bed-sharing practices, were described for last night and usual practice conditions and analyzed using logistic regression.

Results: Completed surveys were returned from 2,534 (64%) caregivers. Bedsharing was reported as usual practice by 46%. Although 582 (51%) infants were usually brought into bed for short periods (1–3 h/night), almost a third bedshared ≥ 6 h/night (359, 31%). While 647 (56%) infants usually bedshared with both parents, 431 (37%) slept with their mother only. A notable 61 (5.3%) infants shared a bed with one or both parents and other children <14 years of age. Placing an infant between one person and the edge of the bed was the preferred sleeping arrangement (522, 63%).

Multivariable analysis showed that mothers who were younger, indigenous, single, smoked during pregnancy, and delivered preterm infants were significantly more likely to bedshare. Bedsharing was also significantly associated with childcare practices including supine infant sleep position, breastfeeding, and not using a pacifier.

Conclusions: Bedsharing was common in this Australian cohort. While bedsharing is associated with some infant and maternal factors that increase risk of sudden infant death, it also appears to be associated with several practices known to reduce risk. Compliance with safe sleeping recommendations is reliant on the ability of health professionals to engage parents, identify individual sleeping environments, and provide evidence-based advice to low and high risk parents that aims to reduce risk associated with all sleeping environments, particularly in circumstances where parent–infant bedsharing occurs.

OP04.05 Smoking prevalence before, during, and after pregnancy among parents in Israel

Shatz, A

ATID-Israeli Foundation for the Study and Prevention of SID, Israel

Objectives: Evaluate smoking prevalence before, during, and after pregnancy among women and their spouses, the perception of SIDS risk linked to smoking, and the impact of pre-pregnancy education, ethnicity, religion, maternal age, and level of education on smoking cessation.

Materials and methods: Questionnaire-based survey of parents bringing their infants aged 1–6 months to an ENT clinic for examination. Demographic data, awareness to SIDS risk factors, and smoking habits before, during, and after pregnancy were recorded.

Results: About 21.14% of 331 women, and 32.9% of their spouses, self-reported smoking before pregnancy. During pregnancy, 10.8% of the mothers and 19% of the spouses reported smoking. Smoking cessation was significantly correlated with level of education, maternal age, and ethnicity and usually continued after giving birth. Low number of cigarettes per day for both women and spouses were also significant contributors to smoking cessation. 80% of women who were unable to stop smoking reported a 50% reduction in cigarette consumption. The mean number of cigarettes smoked per day

was reduced from 14.5 before pregnancy to 6.6 during pregnancy ($P < 0.001$). Smoking spouses reported avoiding smoking at home but no significant reduction in consumption.

Conclusion: 49% of women who smoked before pregnancy stopped smoking. Others significantly reduced consumption. Level of education and awareness of SIDS risks were found to be best predictors for smoking cessation. Continued efforts to educate the public on the hazards of smoking will further reduce smoking rates before, during, and after pregnancy, thus further reducing the risk of SIDS.

OP04.06 Factors influencing African-American parents' decisions about sleep position

Moon, R; Oden, R; Joyner, B

Children's National Medical Center, USA

Background: African-Americans continue to be at 2–3 \times the risk for SIDS than Caucasian-Americans. In addition, African-Americans are twice as likely to place their infants prone for sleep.

Objective: To investigate, through both quantitative and qualitative methods, factors influencing African-American parents' decisions regarding infant sleep position.

Methods: We interviewed low-SES and middle-high SES African-American parents about infant sleep environment, infant care practices, and influences on decision-making. A subset of parents then participated in either focus group or individual interviews to discuss these topics in more detail.

Results: A total of 206 parents completed the survey. 78.6% recognized supine as the AAP-recommended position; 7.8% thought that side/supine was recommended, and 13.6% did not know. No parents thought that prone was recommended. However, only 51.5% believed that supine was the best sleep position for infants, and only 39.3% believed that prone definitely places infants at increased risk for SIDS. 59.2% routinely placed their infant supine, 25.2% side, and 15.5% prone. Infants were placed prone almost universally because they sleep longer and better. In the focus group and individual interviews, the following themes emerged as influencing sleep position decisions: (1) if nobody knows what causes SIDS and if babies can die on their backs, sleep position cannot be a risk factor, (2) it is safe to place the infant prone if she/he can turn his/her head while prone, and (3) even if parents have trust in their pediatrician, they are comfortable making decisions counter to their pediatrician's recommendations if they feel that it is in the best interests of their infant.

Conclusions: African-American parents are aware of the Back to Sleep recommendation. However, many do not believe that the supine position reduces the risk of SIDS. Trust in the pediatrician may not be sufficient reason for parents to use the supine position.

OP04.07 Positioning the baby to sleep on her back: do mothers follow this orientation? A randomized clinical trial in Porto Alegre, Brazil

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Departamento de Pediatria e Puericultura, Faculdade de Medicina, Universidade Federal do Rio Grande, Brazil

Objective: Test if an educational intervention with mothers at Maternity Ward would promote modification on baby sleeping practices.

Methods: Randomized clinical trial; the intervention consisted in an individual orientation to mothers before discharge and a pamphlet

stressing the recommendation for baby sleep positioning. The control group received just routine orientation of the health team. The outcome was baby sleep positioning at the third month evaluated during a home visit.

Results: Mothers ($n = 228$) were selected at the Maternity Ward; from the allocated sample, 191 were localized for a home visit performed during the baby's third month (intervention: $n = 91$; control: $n = 100$). Only 20% of all mothers received routine orientation during their stay at the hospital concerning baby sleep positioning. Among them, 6.7% were informed about the correct position (supine). Considering the mothers of intervention group, 42.9% put their babies to sleep on their backs at third month, comparing with 24.0% of mothers of control group ($P = 0.009$; Prevalence Risk 1.786; CI 1.171–2.723). In a logistic regression model, the intervention was the only variable that influenced maternal practices concerning baby sleep positioning ($P = 0.014$; OR 2.219; CI 1.175–4.103).

Conclusion: Mothers who received the intervention had more than twice the chance to put their babies to sleep supine at third month when compared with those who received just the hospital routine orientation.

OP04.08 Pacifier use: What makes mothers change their mind?

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Objective: The American Academy of Pediatrics (AAP) has recently recommended the use of a pacifier to reduce the risk of SIDS. The objective of this study was to find out the reasons for mothers to either use or not use a pacifier and to find out the mother's reasons for changing their mind.

Method: We analyzed the data of 174 mother–infant pairs by means of a semi-structured questionnaire performed shortly after birth, and at the age of 7 weeks and 5 months, respectively.

Results: The main reason for mothers primarily refusing a pacifier was their concern about malformation of the teeth or jaw. Until the end of the fifth month, 31% of the mothers changed their mind about pacifier use. Mothers primarily refusing a pacifier introduced a pacifier due to the need of soothing the infant. Mothers, who initially intended to use a pacifier, changed their mind due to rejection by the infant. The prevalence of pacifier use at the age of 5 months was 78%. The majority of mothers (69%) introduced the pacifier during the first week of life.

Conclusion: By the end of the fifth month, about one-third of mothers had changed their mind about pacifier use, either because of rejection by the infant or the need of settling. Mothers require more and better information concerning the appropriate time of pacifier onset.

OP05.02 Too young to grieve? The private world of siblings following a sudden infant death in their family

Stokes, J

UK

- One of the most difficult problems for parents is helping a very young child through the crisis of a family death
- One of the most difficult problems for a couple is the emotional turmoil that naturally follows a sudden infant death

- One of the most rewarding experiences is supporting a family to find ways to complete their grief journey together. This presentation will look at recent research which shows that 'parental warmth' is a significant factor in determining outcome for bereaved children. A series of short film clips featuring very young children will illuminate the developmental and communication issues that often result in pre-school-aged children being excluded from support. Winston's Wish, a national charity for bereaved children in the UK, has developed a 6-week program specifically for pre-school-aged children and their parent(s). Finally, the longer-term implications of sibling bereavement from a sudden infant death will also be considered.

OP05.03 An accident waiting to happen? An exploration of culpability in determining whether sudden unexpected death to a child is an accident or possible child neglect

Horwath, J

University of Sheffield, UK

It goes without saying that the sudden, unexpected death of a child is tragic. Yet, how much harder is it to bear if parents or professionals question whether the death could have been avoided? In circumstances where children die unexpectedly, professionals usually assess whether lack of reasonable care on the part of parents or caregivers contributed to the death of the child. Indeed, in a number of countries and states in the USA, what distinguishes an accident from child neglect is that the latter is perceived of as an act of omission or failure to care on the part of the parent. Yet, how do professionals agree on an act of omission or failure to care on the part of the parent? Moreover, if parents are considered to have failed to provide reasonable care, to what extent are they culpable and what mitigating circumstances should be taken into account? This presentation considers these questions. Establishing culpability is complex and multifaceted, not least because legislatures, the media, and society interpret differently the extent to which parents should be held responsible for the death or injury of a child in a particular situation. The problems of using actuarial methods for establishing risk of harm and culpability will be discussed. The presentation concludes with consideration of a framework for assessing reasonable parental care. Ways in which this framework can be used to inform understanding of culpability and mitigating circumstances will be discussed.

OP06.01 Use of soothers among Irish infants: prevalence and association with sudden infant death syndrome

McGarvey, C

Ireland

Background: Consistent reports of a protective effect of soothers/pacifiers has led to recommendations that babies are provided with soothers as a means of reducing the risk of SIDS although the nature of this protective effect is unknown.

Objective: To examine prevalence of soother use among Irish infants and establish the association, if any, with SIDS.

Methods: A 10-year (1994–2003) population-based study of 430 SUDI (401 SIDS, 29 undetermined), and 1,308 controls matched for date and place of birth. Odds ratios and 95% CIs were calculated by conditional logistic regression. The variable 'duration of soother use' was adjusted for age of death of the index case.

Results: Overall, more SIDS infants than controls had ever used a soother (74 vs. 66%). Use of a soother during the last/reference sleep was strongly associated with a reduced risk of SIDS (AOR 0.23 95%CI 0.120–0.46), with fewer infants than usual having a soother for this period (28 vs. 48% SIDS and 49 vs. 58% controls). Routine soother use (every sleep) did not significantly affect the SIDS risk (AOR 0.91 95%CI 0.65–1.10) but infants that ‘occasionally’ used a soother were at increased risk (OR 4.46; 95%CI 1.8–10.54). Median duration of soother use did not differ significantly between cases and controls, and there was no evidence of a dose–response effect with increasing duration in weeks. Introduction of soothers occurred significantly earlier for SIDS infants than controls (0.5 vs. 2.5 weeks, $P < 0.001$), and was associated with increased risk of SIDS (AOR 3.92, 95%CI 1.82–8.40). Introduction of a soother after the age of 1 week carried a reduced SIDS risk (AOR 0.16, 95%CI 0.05–0.58). **Conclusion:** Recommendations to provide soothers must specify that they are to be used regularly and should not be introduced before the age of 1 week. Further investigation is required to establish the factors that influence soother use, particularly why SIDS infants who routinely used soothers did not do so for the last sleep.

OP06.02 Does the recommendation to use a pacifier influence the prevalence of breastfeeding? Results of a multicenter randomized controlled trial

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Background: Observational studies have shown a correlation between pacifiers (P) use and reduced breastfeeding (BF) duration. Avoidance of P constitutes step 9 of the Baby-Friendly Hospital Initiative.

Objective: To perform a clinical trial to determine whether the recommendation to offer a P once BF is well established reduces the prevalence or duration of BF.

Methods: From 11/05 to 5/07 1,023 mothers in 2 public and 3 private hospitals who had the intention to breastfeed for at least 3 months and whose normal newborns regained their birth weight by 15 days agreed to participate in the study and were randomized to 2 groups: offering P (OfferP) and not OfferP. Telephone interviews were conducted by an interviewer blind to the assigned group at 1, 2, 3, 4, 5, and 6 months and every 60 days thereafter until BF had ended. The primary outcome was the prevalence of exclusive BF at 3 months. Secondary outcomes were prevalence of exclusive and partial BF at different ages and compliance with group assignment.

Results: For 970 mother–infant dyads available for follow-up, there was no significant difference in the prevalence of exclusive BF at 3 months between the OfferP and not OfferP groups (85.2 and 85.3%, RR 0.99; CI 95% 0.94–1.05). 66% of the infants assigned to the OfferP used a P, whereas 40% of the infants assigned to the not OfferP also used it. Nevertheless, no significant differences in BF prevalence were observed when only infants who complied with group assignment were analyzed (per protocol). There were no significant differences between groups in the prevalence of exclusive and partial BF in any of the monthly time points or in the sub-populations of public, private, or baby-friendly hospitals.

Conclusions: In mother–infant pairs with well-established BF, the recommendation to offer a P at 15 days does not modify the prevalence of BF. Sponsored by International Children’s Medical Research Association, Switzerland.

OP06.03 Cold stress amongst traditionally swaddled infants and those using sleeping bags in a Mongolian winter

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Traditional childcare for Mongolian infants includes tight swaddling in multiple layers throughout the winter during which temperatures commonly fall below -40°C . In Ulaanbaatar, almost half of the residents occupy traditional dwellings where the indoor temperature can fall below zero.

We investigate the thermal balance (particularly cold stress) of infants in sleeping bags or traditional swaddling. Temperature recordings of infants’TM core, peripheral, environmental, and micro-environmental temperatures infants were made from 40 swaddled infants and 40 infants in sleeping bags over 24-h periods at 30-s intervals at ages 1 and 3 months. Instances where individual abdominal skin temperature fell below 35°C were investigated to determine the specific circumstances when the low core temperatures were recorded.

A core temperature of less than 35°C was recorded for 9 infants at 1 month of age. Of these 7 infants lived in a traditional Ger (2 were swaddled and 5 in sleeping bags) and 2 swaddled infants lived in apartments. At 3 months, the abdominal temperature fell below 35.0°C for 26 infants. The median low core temperature was the same at 34.6°C for both swaddled and non-swaddled 1-month old infant in Gers and 34.8°C for infants in apartments; the median low core temperature was slightly higher (34.6 vs. 34.8°C) for non-swaddled infants at 3-month old living in a Gers ($P = 0.06$) but was the same (34.6°C) for those living in apartments at this age.

The circumstances when low core temperatures were recorded were found to be activity-related rather than from physiologically induced cold stress. Each activity state was either related to the change of baby or feeding. Almost all low core recordings occurred during the daytime, the warmest part of a day, but also at a time when mother-infant activities were at their most frequent—for example when the baby was undressed for changing, or when unwrapped prior to feeding.

OP06.04 Airway protective and behavioral responses to asphyxia in sleeping infants and adults

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Washington University School of Medicine, USA

Objective: Infants unlike adults are at risk for asphyxiation when their faces are covered by bedding. Three factors might explain this disparity. First, infants could require higher levels of inspired CO_2 ($\text{CO}_2\text{ I}$) to cause awakening. Thus the degree of asphyxia might be increased compared to adults. Second, infants could have less effective airway protective responses. Third, infants might rely on a different behavioral strategy to survive asphyxia.

Methods: We studied 12 infants (1/2–6 months old) and 22 young adults during sleep while recording $\text{CO}_2\text{ I}$. Subjects slept prone. Asphyxia was induced by draping clothes over the face until protective movements caused access to room air ($\text{CO}_2\text{ I} < 0.4\%$). Subjects were videotaped.

Results: $\text{CO}_2\text{ I}$ at arousal was similar for infants ($3.6 \pm 0.20\% X \pm \text{SEM}$) and adults ($3.4 \pm 0.46\%$; $P > .05$). Adult AW protective movements consisted of immediately grasping the cloth covering the

face with one or both hands. In contrast, the infant's were stereotyped (startles, then thrashing movements). In only 10% of trials did infants gain access to fresh air compared to 78% of adult trials. Unlike adults who occasionally murmured, 83% of infants cried loudly.

Conclusions: Sensitivity to CO₂I was the same in infants and adults and does not explain an infant's susceptibility to suffocation. Compared to adults, infant responses to asphyxia are markedly less effective in gaining access to air. However, unlike adults most infants cried loudly. Our findings explain why supine sleeping infants are much more susceptible to fatal suffocation than adults. When exposed to mild asphyxia, infants use a different strategy for survival by crying loudly. Their cries for assistance potentially explain the decreased SIDS/suffocation risk when they share the same room with adults.

OP06.05 Comparison of risk factors for sudden infant death syndrome and other sudden unexpected deaths in infancy

Hauck, F; Siadaty, MS

University of Virginia, USA

Objective: Compared with SIDS, less is known about risk factors for other causes of sudden unexpected deaths in infancy (SUDI). The objective of this study is to identify risk factors for SUDI, and risk factors that are common and differ between SIDS and SUDI.

Methods: Participants consisted of 260 infants who died from SIDS and 209 from SUDI, and matched controls in Chicago, 1993–1996. 75% of the infants were African-American. Standardized scene investigations and questionnaires to assess environmental, social, behavioral, pregnancy, and other factors were completed. Conditional logistic regression models estimated odds ratios (OR) and 95% confidence intervals (CI) for a given risk factor for SIDS or SUDI cases vs. controls. Conditional logistic regression with interaction terms was then used to compare the OR of SIDS versus SUDI for that factor.

Results: 49% of SIDS mothers smoked during pregnancy compared with 19% of control mothers (OR 4.85, 95% CI 3.00–7.85; aOR 4.29, CI 2.40–7.68). For SUDI cases, 39% of mothers smoked compared with 30% of controls (OR 1.70, CI 1.08–2.67; aOR 1.51, CI 0.85–2.71). The adjusted SIDS/SUDI odds ratio is 1.70, CI 1.21–2.40. Younger maternal age and single status are risk factors for SIDS but not for SUDI; the differences in odds ratios do not achieve statistical significance. Lower maternal education and inadequate prenatal care are risk factors for both SIDS and SUDI. Alcohol use in pregnancy was not shown to be a risk factor for SIDS or SUDI. Binge drinking (>4 drinks on any occasion) in pregnancy is associated with increased risk of SIDS, but does not achieve significance due to small numbers. It was not found to be a risk factor for SUDI.

Conclusions: Smoking is a more important risk factor for SIDS than SUDI supporting the unique role of this exposure in the causal pathway of SIDS. Results and implications for additional factors will be described.

OP06.06 Dangerous co-sleeping practices amongst deaths categorized as SIDS

Blair, PS¹; Sidebotham, P²; Edmond, M¹; Evason-Coombe, C¹; Heckstall-Smith, E¹; Fleming, PJ¹

¹University of Bristol, UK; ²University of Warwick, UK

Objective: To investigate the specific circumstances in which co-sleeping SIDS deaths occur.

Methods: A population-based case-control SUDI study conducted in the South-West of England (population ~ 5 million) from January 2003 to December 2006 inclusive. Both age-matched random controls (weighted to occupational census data) and 'high risk' controls chosen using prenatal predictive factors (smoking during pregnancy, young maternal age, low socio-economic status, higher parity) were used. A detailed sleep scene investigation of the control reference sleep was conducted to the same standard as the cases.

Results: Of the 79 SIDS deaths, 43 occurred while co-sleeping with an adult (55%) compared to 20% amongst both the random (17/87) and 'high-risk' (16/82) controls. The median age of the co-sleeping SIDS infants was 50 days compared to 104 days amongst the SIDS infants who slept alone. However, 29 of the co-sleeping SIDS deaths (37%) occurred in what would be considered a dangerous environment (co-sleeping on a sofa and/or with an adult who had consumed more than 2 units of alcohol or taken sleep-inducing drugs) and uncommon amongst both the random (3%) and 'high-risk' (5%) controls. The univariate risk associated with this environment was highly significant even when compared to the more socioeconomically matched 'high-risk' control families (OR = 13.3 [95% CI:4.1–55.1]). The risk associated with co-sleeping outside this dangerous environment was almost significant if parents smoked (OR = 3.50 [95% CI:0.97–14.17] but approached unity amongst non-smokers (OR = 1.08 [95% CI:0.26–3.91]).

Conclusion: The risk related to bedsharing is predominantly from hazardous circumstances (sofas, alcohol, drugs, smoking), and parents must be made aware of how potentially dangerous such circumstances may be, even when they do not intend to fall asleep.

OP07.01 Sudden infant death: targeting those hardest to reach

Daniels, J

UK

Communicating the strategies to avoid sudden infant death remains one of the most significant challenges we face. This is especially true when working in deprived and multiethnic populations. This descriptive work looks at unexpected infant deaths in a highly diverse and deprived part of London and shows that a large proportion of babies spent their last sleep in a place other than a cot. Over a 5-year period there were a total of 18 unexpected deaths, for which no cause was found, in babies below the age of 1 year presenting to a district general hospital. 72% of these children did not spend their last sleeping period in a cot. Of these babies, 2 out of 8 spent their last sleeping period on a sofa and 6 slept in the parental bed. Many of these children lived in families where there were multiple risk factors for a sudden unexpected death.

OP07.03 Diversity of response to a diversity of need

Carlin, K

Sids and Kids Victoria, Australia

Sids and Kids Victoria, Australia, provides support to families whose children die from 20 weeks gestation to 6 years of age. A child's death maybe a Sids, a stillbirth, a neonatal death, a sudden onset illness, a preexisting medical condition, homicide, an accident, or as a result of a genetic abnormality.

The agency supports over 300 new families a year from very diverse backgrounds, some of whom are experiencing concurrent

life crises, in addition to their bereavement. It is important that a thorough psycho-social assessment be completed by the trained staff, most of whom are Social Workers. These assessments enable identification of complex cases with challenging issues including mental illness, domestic violence, drug and alcohol addiction, child abuse, suspicion of homicide, social isolation, poverty, and homelessness.

A diverse program is offered to families. It includes counseling, a 7-day/24-h telephone support line, outreach, support from parents bereaved in the past, groups, creative activities, ritual, children's programs, fathers' fishing days, residential weekends, family days, and financial assistance for funerals.

The Social Workers require the skills to work with bereaved families in these challenging and complex cases. In addition, it is essential to refer appropriately and liaise with other agencies. It is imperative that the Social Workers receive good supervision. This encourages reflection on work practices, provides an awareness of appropriate boundaries and gives them the support they need to work with these families.

Through case presentation, this paper will illustrate how the agency effectively responds to the diverse needs and grieving styles of families.

OP07.04 If my infant slept on his back would he be alive now: challenges in providing SIDS support in the era of modifiable risk factors

Mitchell, I¹; Morrison, L²; Regan, C²

¹University of Calgary, Canada; ²SIDS Calgary Society, Canada

Background: Provision of support to SIDS parents is essential. In Calgary, support has been provided since 1982 by a bereaved parent and a professional.

Objective: To describe changes in approach to parents support after acceptance of the importance of modifiable risk factors.

Methods: Parents attend monthly support meetings and share their experience of loss. The professional provides information as requested. In the past, parents expressed guilt, but were told that "SIDS can neither be predicted nor prevented." After 1992, there was increasing recognition of modifiable risk factors by professionals, and wide availability of this information to families. In Alberta, from 1997 to 2005, 95.28% of SIDS had at least one identified risk factor. 98 parents have attended meetings from 2002 to 2005 and a common question is: "if my infant had been put down to sleep on his back would he be alive now?" Similar questions are asked about sharing sleeping surfaces and exposure to tobacco smoke. While modifiable risk factors are not precisely the same as causes, the two concepts are not readily distinguished. Parents are still supported, but without hiding the conclusions in the scientific literature. To the question about the consequences of sleeping prone, a truthful answer is given, that sleep position likely played a role in the death. Parents are upset but not surprised. A truthful answer about the role of child care practice in the death of the child is essential if a positive relationship is to develop between supporters and bereaved parents.

Conclusion: Fully informed parents can make different child care decisions if they decide to have another child. Informed parents can be advocates for further societal acceptance of the importance of infants sleeping on their back, not being exposed to tobacco smoke, not sharing a sleeping surface with parents, and not sleeping in an adult bed.

OP07.05 Burying our babies: cross-cultural perspectives on parental bereavement, coping, and the experience of child loss

Lang, S

University of Redlands/Guild for Infant Survival, USA

Objective: The objective of this presentation is to explore and gain insight into the cross-cultural diversity of experiences of SIDS parents. By analyzing a variety of perspectives, I aim to offer a nuanced, culturally informed portrayal of bereavement.

Methods: As an anthropologist and SIDS mother, my methods for exploring the diversity of bereavement experiences are both emic and etic, that is, from an insider's perspective and as an ethnographer or cultural analyst. I reflect on literature and personal stories of SIDS parents from the US, Japan, Israel, and Europe and highlight significant factors of cultural diversity that shape our experiences of grief.

Results: The results of this study indicate that not all bereavement is the same. In particular, factors of religious/spiritual beliefs, ideologies on death and afterlife, public rituals or lack thereof, social networks, and the prevalence of infant death in a society, all play significant roles in how a person experiences and endures child loss. The "reality" of experience is subjective; even emotions such as grief are embedded within a cultural context, and hence, culturally constructed.

Conclusions: A parent's understanding of their child's death, their sense of loss, experience of bereavement, and means of coping vary depending not only on their individual personalities and personal circumstances but also on the cultural context in which they suffer this loss, and the social norms and values that they internalize as members of a particular society. While SIDS parents share a common bond, there are significant cross-cultural differences among us too.

OP07.06 A helping hand: how we support families when a child dies suddenly and unexpectedly

Kjaerbeck, J

Queen Silvias Children Hospital, Sweden

One of the largest pediatric emergency units in Scandinavia is the one at Queen Silvia Children's Hospital in Gothenburg, the second largest city in Sweden with 500,000 inhabitants. All children who live in the area of Gothenburg and die suddenly and unexpectedly will be brought to this emergency clinic. At the Children's Hospital, a special program to take care of families who has suffered the loss of an infant due to SIDS was started in 1989 by a bereaved nurse (J. K.). This program has gradually developed to include all children who die suddenly and unexpectedly. Today, the team at the hospital has close cooperation with the SOS Alarm service, the ambulance service, the police, and the forensic department. Everyone deserves a helping hand. The basis of the program is a continuous contact with the parents and the whole family including siblings, grandparents, and other family members and friends. How can we provide the best help? It is essential to support the families. Most important is to "be there," to stay with the families, and not leave them alone. We help the family to take farewell of their dead child and give them all the time they need. We encourage them to come and visit the child several times and prepare the child for the funeral themselves. In a second part of the presentation, the story of Filip will be told: Filip's father (B. T.) will tell what happened from the moment of the accident and afterward. After the funeral, we offer the family an appointment with the ambulance crew that took the child to the hospital. In another

presentation, Peter Johansson from the ambulance service will tell about the meeting with the families. A moment of difference, from 1 s to the next—and nothing will ever be the same again.

OP08.01 Changes in factors other than prone sleeping may also help reduce SIDS rates

Blair, PS¹; Sidebotham, P²; Edmond, M¹; Evason-Coombe, C¹; Heckstall-Smith, E¹; Fleming, PJ¹

¹University of Bristol, UK; ²University of Warwick, UK

Objective: To investigate whether specific advice given since the ‘Back to Sleep’ campaign (1991) has affected the prevalence of these factors or SIDS rates.

Methods: Comparing two population-based case–control studies conducted in England 10 years apart from 1993 to 1996 (the CESDI study) and from 2003 to 2006 (the SWISS study).

Results: The proportion of infants placed prone was similar between the two studies but the proportion placed on the side had more than halved (cases and controls). The proportion of infants placed with their feet at the foot of the cot had dramatically risen while head covering had become much less common. Pacifier use has fallen while the breast-feeding rates have increased.

Comparing the prevalence of risk factors between studies:

Risk factor	CESDI Study		SWISS Study		SIDS controls		SIDS controls	
	<i>N</i> =	%	<i>N</i> =	%	<i>N</i> =	%	<i>N</i> =	%
Sleeping position	317		1,295		77		87	
Put down supine	141	45	895	69	52	68	73	84
Put down on side	129	41	361	28	14	18	9	10
Put down prone	47	15	39	3	11	14	5	6
Position in cot ^a	<i>N</i> = 205 %		<i>N</i> = 982 %		<i>N</i> = 32 %		<i>N</i> = 67 %	
Placed at the bottom	7		3	40	4	16	50	44
Head covering	<i>N</i> = 303 %		<i>N</i> = 1,289 %		<i>N</i> = 78 %		<i>N</i> = 87 %	
Found covered	49	16	38	3	4	5	0	0
Dummy (Pacifier)	<i>N</i> = 313 %		<i>N</i> = 1,296 %		<i>N</i> = 70 %		<i>N</i> = 87 %	
Used for last sleep	124	40	664	51	11	16	18	21
Breastfeeding	<i>N</i> = 323 %		<i>N</i> = 1,298 %		<i>N</i> = 79 %		<i>N</i> = 87 %	
Ever attempted	141	44	774	60	55	70	69	79

^a Calculated just for those infants placed in a cot-type bed for the last sleep

With no change in definition, the SIDS rate has significantly decreased ($P < 0.0001$) over the 10 years, from 0.77 [95%CI:0.69–0.85] to 0.45 per 1,000 live births [95%CI:0.40–0.60]

Conclusion: Two UK studies with similar methodology show a significant fall in SIDS rate over the past decade, associated with a

reduction in side sleeping and head covering and an increase in breastfeeding, but a fall in pacifier use. These data show that changes in factors in addition to prone sleeping may contribute to further reduction in SIDS rates.

OP08.02 A device that promotes supine infant positioning

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Objectives: Evaluate the efficacy and safety of an infant mattress specifically designed to maintain babies supine during sleep and assist parents to follow SIDS risk reduction guidelines. The mattress was also evaluated for its ability to maintain open air passages in the event babies do roll over.

Methods: A comparative prospective clinical study of healthy infants. Enrolled infants were admitted for mild dehydration but presented no breathing disorders. Each infant was put to sleep on both a standard hospital mattress and the tested mattress for the same time period. Hourly position and oxygen saturation data as well as overall parent and physician satisfaction evaluation questionnaires were analyzed.

Results: 13 Infants (9 males, 4 females with a mean age of 4 months) used each mattress (range 1–5 days) for a minimum of 5 h. Mean O₂ saturation was 96% with the tested mattress and 94.19% with the regular mattress ($P < 0.0004$). Prone position shift episode occurred once with the tested mattress and 63 times with the standard mattress. Most parents (84.6%) reported high satisfaction rates with the tested mattress. Physicians reported significantly reduced reflux rates and improved infant comfort.

Conclusions: Preliminary results show the tested mattress’ efficacy and safety in maintaining a supine infant position with improved O₂ saturation and reduced reflux. Results indicate the specially designed mattress may help parents comply with a key guideline in reducing the risk of SIDS.

OP08.03 Non-nutritive sucking habits in sleeping infants

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Objective: Pacifier use has been reported to decrease the risk of SIDS but the responsible mechanisms are unclear. Since little is known about infants’ non-nutritive sucking (NNS) habits during sleep, we investigated NNS patterns and changes of physiological parameters during NNS in sleeping infants.

Methods: Polysomnography was performed in 12 healthy infants with an age of 55 ± 6.2 days (median \pm SEM) who regularly used a pacifier during sleep. Video recordings were used to differentiate episodes of active suckling (bursts) and rest periods. We evaluated the median time of suckling in relation to the total time of pacifier use, the median number of bursts per minute, the median duration of single bursts, and the median interval between two sequent bursts. In 48 randomly selected bursts, we additionally analyzed changes in heart rate (HR), respiratory frequency (RF), and oxygen saturation compared to the 10-s period preceding the burst.

Results: Recorded sleep time with a pacifier held in mouth was 31.3 ± 8.6 min, of which $15.5 \pm 2.6\%$ were spent with active suckling. The median number of bursts per minute was 2.2 ± 0.3 , the median duration of a single burst was 3 ± 0.1 s, and the median interval between two sequent bursts was 10 ± 2.1 s. HR, RF, and oxygen saturation did not change significantly during bursts.

Conclusions: This study presents “normal values” for NNS habits in pacifier users and may thus provide a basis for further investigations concerning the efficacy of pacifiers in SIDS prophylaxis.

OP08.04 To swaddle or not to swaddle: effects on infant arousability from sleep

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Objective: It has been proposed that an impaired ability to arouse from sleep may be involved in the pathophysiology of Sudden Infant Death Syndrome (SIDS). Currently, swaddling is promoted by some Australian SIDS organizations as a method for settling infants in the supine position, aiming to reduce the incidence of infants being placed prone to improve sleep. The aim of this study was to evaluate the effects of swaddling on infant arousability as a test of its safety.

Methods: 10 Healthy term infants were studied with daytime polysomnography at 3–4 weeks and 3 months after birth, in swaddled and non-swaddled conditions. Arousal from sleep was induced using a pulsatile jet of air to the nostrils at increasing pressures. Arousal responses were scored with standard criteria; sub-cortical activations and cortical arousals were combined for this analysis. Arousals observed during uninterrupted sleep between tests were classified as spontaneous and were also examined, expressed per hour spent in each condition. Two-way RM ANOVA was used to assess effects of sleep state/swaddling and postnatal age on arousal thresholds and spontaneous arousals.

Results: Regardless of sleep state and age, swaddling had no significant effects on baseline physiological variables (heart rate, oxygen saturation, abdominal skin temperature), or on arousal thresholds to air-jet stimuli. During active sleep (AS), at 3 months of age, infants exhibited fewer spontaneous arousals when swaddled ($9 \pm 2/h$) compared with unswaddled ($17 \pm 3/h$, $P < 0.05$). No effects of swaddling were observed on the number of spontaneous arousals during AS at 3–4 weeks or in quiet sleep at either age studied.

Conclusion: This study showed that swaddling infants reduced spontaneous arousals from sleep, while arousal responses to external stimuli remained unchanged. This provides important new evidence to support the promotion of infant swaddling as a safe means to settle infants and improve sleep in the supine position.

OP08.05 Gestational age at birth and SIDS: which infants are at highest risk?

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Background: In previous studies, preterm birth has been found to be a risk factor for SIDS. Recently questions have been raised regarding the relative contributions of mild to moderate versus extreme prematurity to a variety of outcome states.

Objective: To determine whether infants born with mild to moderate prematurity are at increased risk of SIDS in comparison to infants born at term and infants with extreme prematurity.

Methods: Between 1977 and 2005, all infants who died due to SIDS in the province of Alberta were part of case investigations at the Medical Examiners office that oversaw autopsies, site investigations, and background data collection on all cases. The infant populations in each of the gestational age categories were determined and SIDS rates were compared using risk ratios and CI95 to allow for determination of population attributable risks.

Results: Between 1977 and 2005, 1,752 infants died due to SIDS. In Canada, during that interval, approximately 92% of all infants were born at term, 6–7% were born at 33–36 weeks, and 1% were born at 24–32 weeks. The relative percentages of SIDS in each of the three groups were term 82.5%, mild-moderate preterm 11.5%, and extremely preterm 6.0%. The risk ratio for the extremely preterm versus term groups was 6.643 (CI95 5.298–8.328), and for mild to moderate preterm versus term groups it was 1.827 (CI95 1.544–2.162); the population attributable fractions of cases of SIDS associated with prematurity were similar in both preterm groups.

Conclusions: SIDS rates are higher in preterm infants than term infants. Extremely preterm infants are at higher risk of SIDS than mild-moderate preterm infants.

OP08.06 Origins of death

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The debate over whether SIDS is an entity is influenced by semantics, hidden agendas, and by prejudices arising from personal experience. However, the concept of “the cause of death” is confused by failing to separate the registered cause of death from the answer to the question “Why did this child die?”. Registered causes of death are clearly important for legal and epidemiological reasons, and have allowed the formulation of research and effective prevention campaigns. Why an individual child died is important for their family, for efforts by society to prevent further deaths, and for the dead child who has a right to a proper appraisal of his/her death. There are three areas of origin:

1. Vulnerability
2. A precipitating event and its final mechanism
3. Care before and at the time of death.

Although these are interlinked, they can be separated out. Traditionally “cause of death” is equated mainly with the final mechanism and its precipitating event; in SIDS, this remains unclear. However, the same set of triple origins apply to any death even when there is no doubt about the registerable cause. This will be illustrated. These distinctions will become important for Child Death Reviews. They also are fundamental to the considerations of carer’s responsibilities, and the speculation in the media on when responsibility becomes culpability.

OP09.01 Preventing cot death: Dutch strategies to get the message across

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The 2006 Dutch incidence of SIDS was 0.06/1,000 live births. This is due to two important factors. Firstly, the Dutch Youth Health Care system ensures that parents receive recommendations consistently and repetitively. Secondly, the efforts of the Cot Death Foundation and

the National Cot Death Committee are responsible. In 1987, prone sleeping was discouraged and the incidence dropped sharply. In 1996, the Dutch Cot Death Foundation was established. Its leaflet "Safe Sleeping" was first distributed by well-baby clinics in 1998. Versions in Turkish, Moroccan, English, German, and French followed. In 1996, the National Cot Death Committee of the Dutch Paediatric Society was formed. This group is available by telephone 24/7 and offers support to parents and professionals. Through its efforts, there is data available on cot deaths and regular surveys on known risk factors are carried out. In 2001, the Foundation's website was launched: www.wiegendood.nl (cotdeath.nl). This site is the leading source of information for professionals and parents. Unique is its separate section on safe and unsafe baby products. Individual queries are promptly answered. Because the information is on a professional level and the emphasis on cot death can be too confrontational, a second website was launched specifically for parents in 2005: www.veiligslapen.info (SafeSleeping.info). On this site, the emphasis is on safety, not cot death. In 2003, the Foundation worked closely with the Dutch Consumer Safety Institute on a nationwide multimedia campaign concerning safe sleeping which ran from 2004 to 2005. The effect of the campaign was fully evaluated. As the Foundation and Committee are all run on a voluntary basis, their continued existence is uncertain. We are in the process of seeking new ways to safeguard their expertise and role in Dutch cot death prevention.

OP09.02 Sleeping babies safely: a multiagency approach to positively impact health professional and public knowledge about safe sleeping recommendations

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Background: Queensland has consistently experienced one of the highest rates of sudden unexpected deaths in infancy (SUDI) death in Australia.

Objective: To outline multiagency policy developments and key collaborations contributing to the successful implementation of a research program and resultant statewide educational intervention aimed at reducing Queensland's sudden unexpected infant deaths.

Methods: Investigations included (a) nursing and midwifery knowledge, attitudes, and practices relating to SUDI and safe sleeping messages; (b) infant care practices used by parents; and (c) effectiveness of a wrapping intervention to promote supine sleep positioning. Key reports highlighting sudden infant death risk factors and areas for improving awareness of public health recommendations, including previous study results, have been used to (a) develop statewide policy to reduce infant mortality; and (b) implement an educational intervention specifically designed to positively impact identified deficits in health professional and parental practice relating to Safe Sleeping messages.

Results: Collaborations between clinicians, researchers, Queensland Health, SIDSandKids locally and nationally, and the Commission for Children and Young People Child Guardian have been achieved. A Queensland Health statewide policy for safe sleeping is now available and information sheets relating to many Safe Sleeping issues are available on the SIDSandKids website for public access. An evidence-based educational resource designed to support health professionals in conveying public health messages to parents has been developed and implemented statewide.

Conclusions: Emerging from a search for evidence and promotion of best practice, these studies will demonstrate how nurses and midwives can lead the way as advocates for infants and children for better

services, education and family support, and how the results of such programs can impact government and public health agendas.

OP09.03 Manchester's vulnerable baby project

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Objective: To introduce early multiagency case planning for vulnerable antenatal families and children under 12 months, in order to reduce sudden and unexplained deaths in infants (SUDI).

Methods: A baby is said to be vulnerable using criteria identified by a working party who examined a cohort of SUDI in Manchester and recognized common characteristics (Manchester's indices of vulnerability); these are used to precipitate referral into the project.

Case planning for families referred into the project started in March 2004. Examining new cases and literature to inform practice and enable staff to respond to local need in line with government recommendations is integral to dynamic service delivery. The project field is across the whole city and involves the child and adult services.

Results: Between March 2004 and December 2007, an average of 128 families per year were referred into the project. The project identified the increasing trend in Manchester of SUDI while co-sleeping. Local staff requested a Manchester Safe Sleeping Policy in order to address the mixed messages clients were receiving. The incidence of SUDI in Manchester has reduced in 2006 and 2007. A database provides information on the characteristics of families referred and agency attendance and involvement.

Conclusions: The project has been well received by clients and staff across the city and is now a mainstreamed service. The results to date demonstrate a reduction in sudden and unexplained deaths in infants in Manchester.

OP09.04 Head covering: a major modifiable risk factor for sudden infant death syndrome

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Objective: Some victims of sudden infant death syndrome (SIDS) are found with their heads covered with bedclothes but the significance is uncertain. The aim of this review is to describe the prevalence of head covering, the magnitude of the risk, and how the suggested causal mechanisms fit with current epidemiological evidence.

Methods: Systematic review and meta-analysis of population-based age-matched controlled studies.

Results: Controlled observations of head covering were found in 10 studies. The pooled prevalence in SIDS victims was 24.6% [95% CI: 22.3–27.1%] compared to 3.2% [95% CI: 2.7–3.8%] amongst the controls. The pooled univariate odds ratio (OR) was 9.6 [95% CI: 7.9–11.7] and the pooled adjusted OR from studies mainly conducted after the fall in SIDS rate was 16.9 [95% CI: 12.6–22.7]. The risk varied in strength but was significant across all studies. Previous instances of head covering were similar between the two groups (pooled adjusted OR = 1.1 [95% CI: 0.9–1.4]). The epidemiological evidence does not fully support postulated causal mechanisms such as hypoxia, hypercapnea, and thermal stress, but neither does it support the idea that head covering is part of some terminal struggle. The population attributable risk (27.1% [95% CI: 24.7–29.4%]) suggests avoiding head covering might reduce SIDS deaths by more than a quarter.

Conclusions: We conclude that head covering is still a major modifiable risk factor associated with SIDS deaths and parental advice to avoid these circumstances should be emphasized.

OP09.05 Research and current advice: an overview

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In the 17 years since the UK “Back to Sleep” campaign, unexpected infant deaths have decreased by almost 80%—an initial rapid fall in 1991–1992, followed by a slower but progressive fall over the next 15 years. Two large, population-based studies of sudden unexpected infant deaths have been conducted in England during this time period—the CESDI study (1993–1996) and the SWISS study a decade later (2003–2006). Over the intervening 10 years, the SIDS rate has fallen from 0.77 to 0.45 per 1,000 live births, equivalent to almost 200 fewer deaths a year in the UK alone. Many of the background characteristics of these infants remain the same although the infants who now die are younger (median 9–10 weeks instead of 13 weeks) and come predominantly from an even more deprived, excluded social grouping. Despite an overall fall in the proportion of women smoking during pregnancy, from 27% in the CESDI study to 14% in the SWISS study, in utero smoke exposure has changed little amongst the infants who died (66% in CESDI and 59% in the SWISS study). Postnatal smoke exposure in the home seems to have fallen, however, from 23 to 6% amongst controls, and from 54 to 16% amongst SIDS victims. This suggests that, although amongst these deprived families smoking remains rife, many are taking pains to try to avoid postnatal smoke exposure – by creating a “smoke free zone” around their baby. The advice following the CESDI study to avoid placing infants to sleep on their side seems to have been followed; only 10% of the SWISS controls and 18% of the SIDS were put on their side compared to 28% of the CESDI controls and 41% SIDS a decade earlier. The proportion of controls placed prone was relatively small in both studies but as some SIDS victims are still being placed prone (CESDI study 15%, SWISS study 14%) we still need to emphasize this message. Fewer infants, either SIDS victims or controls, now sleep alone, but more infants now share the parental bed—amongst both controls (20 vs. 15%) and SIDS victims (38 vs. 26%). A worrying finding is that a much higher proportion of SIDS victims (17 vs. 6%) shared a sofa or armchair with a carer for the final/reference sleep. The apparent protective effect of using a pacifier, noted in several previous studies, was no longer present in the recent study, due partly to a marked reduction in pacifier use amongst both SIDS victims (15 vs. 39%), and controls (20 vs. 51%). This reduction in pacifier use was accompanied by a proportional increase in breastfeeding in both controls (79 vs. 59%) and SIDS victims (70 vs. 44%). These observations raise questions about the possible mechanism of the apparent protection from pacifier use. While the difference between SIDS victims and controls in terms of environmental temperature and bedding is no longer significant, the levels of thermal insulation (“tog value”) of bedding and clothing have fallen for both SIDS victims (median 3 from 5 tog) and controls (median 2.4 from 4.2 tog). Our preliminary analysis of data from the ALSPAC longitudinal cohort study shows a very strong two-way relationship between bedsharing and successful breastfeeding, further emphasizing the importance of understanding the ways in which factors interact rather than considering them in isolation. Awareness of the changing prevalence and apparent contributions from various risk factors for SIDS over the past decade will allow more focused, directed educational and intervention approaches to the prevention of unexpected infant deaths.

OP10.01 The consistent 50% male excess of SIDS and other respiratory infant deaths imply a common X-linked mechanism involving terminal cerebral anoxia

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The sudden infant death syndrome (SIDS) in autopsied postneonatal infants is characterized by an approximately 50% male excess per equal number of male and female live births. No known SIDS risk factor (e.g., prone sleep position or maternal smoking) can explain this 50% male excess risk of SIDS that remained constant after the campaign to change the preferred sleep position from prone to supine. Sudden respiratory death certified by coroner in England and Wales, 1969–1976, had a male excess of 45.7% at home, and 44.6% in hospital. A statistically similar 50% male excess is observed in infant deaths caused by respiratory distress syndrome (9ICD 769), suffocation from inhalation of food or other foreign object (9ICD 911–912), and drowning (9ICD 910) shown below, allowing for a 5% male excess birth rate. Because risk factors for inhaling food morsels or tiny objects are the same for male and female infants, some unknown factor allows more females than males to survive their crises.

Cause of infant death	Male infants	Female infants	Male excess (M/F)/1.05 (%)
Global SIDS (9ICD 798.0)	41,238	26,140	50.25
U.S. IRDS (9ICD 769)	36,373	23,135	49.73
U.S. inhalation of food or foreign object (9ICD 911–912)	1,477	946	48.70
U.S. drowning (autopsied)	513	350	39.59
England & Wales sudden respiratory deaths	9,506	6,225	45.43

This 50% male excess is predicted by a hypothesized X-linked gene with an unknown dominant allele occurring with probability 1/3 that expresses protection against neuronal death during a transient cerebral anoxia. An XY male is at risk of death with probability 2/3 and an XX female with probability 4/9, resulting in a 50% excess male risk. Examples are given of other respiratory causes of death in infancy and childhood with a similar 50% male excess mortality, such as congenital anomalies of the respiratory system, and bronchitis and bronchiolitis. We suggest that SIDS and the other causes of death cited have a common terminal mechanism. In the case of SIDS, the same cerebral anoxia is reached by a set of risk factors each too small to be considered a cause of death such as a low-grade infection. We propose a scan of the X-chromosome for an allele present in 1/3 of live male infants and missing in autopsied SIDS. If found, it could become a target for a molecular autopsy of SIDS.

OP10.02 Lethal hypoxia and hyperthermia produce different gene expression patterns

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Objective: Hyperthermia and hypoxia have been suggested as possible causes of SIDS. Neither of these insults produces changes on

a postmortem examination. Our hypothesis is that lethal hyperthermia, lethal hypoxia, and sudden death produce unique gene expression patterns that may serve to distinguish between these causes of death.

Methods: Four groups of eight infant mice (P10), weighing approximately 5 g, were subjected to different experimental conditions including lethal hyperthermia (41°C) or lethal hypoxia (8% oxygen). There were two groups of control mice, which were euthanized without any premortem stress. In the first group of control mice (control 1) and in mice subjected to lethal hyperthermia and lethal hypoxia, liver tissue was collected immediately after death. To mimic the gradual cooling that occurs after an unwitnessed death, mice in the second control group (control 2) were cooled from 37 to 21° over 4 h before liver tissue was collected. The Agilent 2100 Bioanalyser was used to measure RNA integrity. Gene expression was analyzed on Affymetrix GeneChip Mouse Genome 430 2.0 gene chips (>39,000 transcripts). Gene expression from the hyperthermia, hypoxia, and control 2 groups were compared to the control 1 group. We considered genes to be differentially regulated if there was >2-fold difference in expression compared to the control 1 group ($P < 0.05$). The false discovery rate method was used to correct for multiple comparisons.

Results: RNA quality was very good or excellent in all groups. Gene expression patterns in the control 1 and control 2 groups were very similar. We identified 1,473 differentially regulated genes that were unique to the hyperthermia group and 486 differentially regulated genes that were unique to the hypoxia group.

Conclusions: Premortem stresses cause recognizable alterations in gene expression patterns. These data suggest that gene expression patterns may provide valuable clues about conditions preceding sudden infant death.

OP10.03 Genes regulating serotonin and dopamine pathway in the brainstem may be involved in the etiopathogenesis of the Sudden Infant Death Syndrome

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Objective: Among genes involved in SIDS, several studies have identified polymorphisms of serotonin transporter as a predisposing factor. In this work, genes regulating serotonin and dopamine metabolism were investigated in an Italian SIDS cohort to verify their combined role in the neurotransmission pathway of missed infants.

Methods: Genotypes and allelic frequencies of TPH-2, 5-HTTLPR, Stin2 VNTR, MAOA VNTR, and DAT VNTR were determined in 20 genuine SIDS and compared with 150 controls, according to the functional role (synthesis, neuronal re-uptake, catabolism) of different polymorphisms.

Results: The G1463A mutation responsible of 80% functionality loss of TPH-2 was not detected in SIDS infants while a strict relation was found between 5-HTTLPR polymorphisms and SIDS cases. The L/L genotype and the long allele (L) of promoter region of 5-HT transporter were significantly associated ($P < 0.001$) with the syndrome (L/L: 60% SIDS vs. 14.3% controls; L: 80% SIDS vs. 42.8% controls). Interestingly, no SIDS infant with S/S genotype was found. Polymorphisms of intron 2 of the same gene showed a trend for significant differences between genotypes 10/10 and 12/12 ($P = 0.068$). The haplotype analysis of the two 5-HTT regions demonstrated that the L-12 haplotype was almost twice in SIDS (42.80%) with respect to controls (24.70%). Range of variation was higher considering genotype combination L/L-12/12 (20% SIDS vs.

2.80%). With respect to serotonin and dopamine degradation, differences in the frequency of MAOA VNTR genotype 3R/3R between SIDS (13.33%) and controls (25.71%) were observed.

Conclusion: Among investigated genes, a clear association between 5-HTT genotypes and allelic frequencies and SIDS was found. As already observed in Japanese and American populations, the frequency of L/L genotype and L allele was higher in Italian SIDS infants than in controls. On the contrary, our results did not support the existence of an association between DAT polymorphisms and SIDS.

OP10.04 Anaphylaxis as a cause of death in infants: elevated concentrations of mast cell proteases in the serum

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Objective: Reports of high serum concentrations of mast cell tryptase (an established marker for anaphylaxis) have provided evidence for anaphylaxis as a cause of death in infants. We have determined the serum levels in SIDS cases of mast cell carboxypeptidase and chymase, recently identified as new markers for anaphylaxis.

Methods: Sandwich ELISA procedures with specific monoclonal antibodies were developed and validated for the measurement of carboxypeptidase and chymase in serum. These were applied to measure levels of these mast cell proteases in serum from 35 infants whose death was classified as SIDS, from 25 infants of similar age for whom the cause of death was established, and from 22 healthy living infants.

Results: Concentrations of carboxypeptidase and chymase were significantly greater in serum collected from SIDS cases than in that from the postmortem and living comparison cases. Levels of these new markers were not correlated with each other or with concentrations of tryptase, suggesting different rates of release, differences in the subpopulations of mast cells involved or different rates of clearance. There was no association between serum levels of carboxypeptidase or chymase and postmortem interval, age, or body weight of infants, though in the SIDS group, carboxypeptidase concentrations were correlated with total IgE levels ($P < 0.0007$).

Conclusions: High levels of mast cell carboxypeptidase and chymase in the serum of SIDS victims call for investigation of anaphylaxis as a cause of death in infants.

OP10.05 The role of the serotonin system in breathing and body temperature control: insights from genetically modified mice

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The serotonin (5-HT) system has been the focus of intense study after it was recently shown that the majority of SIDS cases had have multiple 5-HT abnormalities. In order to understand how 5-HT abnormalities may lead to SIDS, we are studying a genetically modified mouse, which lacks the 5-HT-producing cells in the brain. As adults, the mice lacking 5-HT cells breathe almost normally at rest, but do not increase their lung ventilation normally (50% reduction) in response to high levels of carbon dioxide compared to

normal mice. In addition, these mice have trouble maintaining their body temperature in cold environments, despite normal body temperatures in warmer environments. We believe that the defects in breathing and temperature control observed in these mice provide insights into the normal function of the serotonin system, and suggest that proper function of the 5-HT system is important for the response of the respiratory and temperature control systems to external stress.

OP10.06 Interleukin polymorphism and SIDS

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Objective: The mucosal immune system is stimulated in SIDS, and our hypothesis is that this immune reaction is due to an unfavorable combination of functional polymorphisms in the interleukin genes.

Methods: The subjects investigated consisted of 148 SIDS cases, 56 borderline SIDS cases, 41 cases of infectious death, and 131 controls. The following interleukin SNPs were selected: IL1 +4845G/T, IL1 511C/T, IL6-572G/C, IL8-781C/T, IL8-251A/T, IL12 + 1188A/C, IL13 + 4464A/G, IL16-295T/C, IL18-137G/C, and IFN +874A/T.

Results: No differences were found in genotype distribution between any of the groups investigated. However, several associations between genotype and risk factors were observed. In the cases of infectious death without fever prior to death, the following genotypes were found:

- IL-8-251AT in 65% ($P = 0.05$)
- IL-1a-511CT in 60% ($P = 0.01$)
- IFN +874AA in 57.1% of the infants that were co-sleeping prior to death ($P = 0.001$)
- Among the children with a smoking mother, 50% had the genotype IL16-295CT ($P = 0.047$)

In the borderline SIDS group, 63% of the infants with upper airway infection prior to death had the IFN +874AA genotype ($P = 0.002$).

Conclusion: This study indicates that specific interleukin genotypes in combination with certain risk factors may be involved in SIDS.

OP11.01 Play and conversation box for bereaved children

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The Unexpected Child Death Society of Norway (the Society) has 40–50 volunteers who have experienced the loss of a child and who are ready to provide bereavement support to other bereaved families. Our aim is to support the whole family, but often the volunteers find it difficult to approach the bereaved children. Parents are often concerned about their other children and feel guilty because they do not have the capacity to take care of the children's needs. Ullev University Hospital has experienced that toys, drawing, plays, exercises, and children books about illness and loss are useful tools when communicating with children in grief.

The goal of this project is to provide better volunteer bereavement support to the children. 20 play-and-conversation boxes have been created. The box is supposed to be a tool for approaching children's grief. It consists of toys, books, pencils, and other things which may be used when playing and talking with bereaved children (2–12 years old). A guide for the volunteers on how to use the boxes has been made. 16 volunteers have participated in a 2-day course on

communication with bereaved children and how to use the play-and-conversation box. These volunteers are the participants in this project and may use the boxes in their bereavement support during the 1½-year project period. Professional counseling is available to the volunteers during this period.

After 1 year, the project will be evaluated. If the experience is good, the play-and-conversation box will be a permanent tool for the Society's volunteers. All the volunteers will then be trained in using the box. The presentation will describe the project and the experiences so far.

OP11.02 A baby's sudden death: siblings and grief

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Bereaved children arouse strong feelings in all of us. We are reminded of ourselves as children, of our own children, or the children we hope for. Working with families where children experience the sudden death of a baby brother or sister involves witnessing adults and children in considerable pain. Part of our anguish results from our knowledge that we cannot make it better for these families and children. We cannot prevent children from experiencing sadness, but our help can mean that parents and children are supported, rather than being alone, as they experience that sadness. It is important for us all, whether professionals or families, to remember that children do survive the trauma of loss and discover that life will continue and can be good again.

The way in which we help children to deal with loss will have a profound impact both on their future development and on their ability to cope with all sorts of crises.

Children who experience the death of someone close to them need support from the adults around them. Children have an amazing capacity to deal with the truth: offered with love they can grow and respond creatively to the challenge of bereavement.

OP12.01 Sudden infant death: the effect on staff

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As professionals we need to begin with ourselves. We need to learn more about our own feelings and how and when we learnt about life and the judgments we make and the things that worry us. This self-examination is particularly important because the very essence of our dealings/interactions with families is the therapeutic use of ourselves.

The more we learn the more we realize we can never know enough about bereaved families or understand the pain and reactions in someone else. But we can help. We are there in a crisis as a nurse, doctor, midwife, chaplain, social worker, counselor. We can offer ourselves, our skills to truly listen, our sensitivity and concern and human loving care. To do this work over time, we need to take into account our own needs and personal fears and to be willing to accept and ask for support.

As professional carers we choose, for many reasons, a career that is about taking pain away. Yet in grief we need to help the bereaved to have and express their painful feelings and this can be very difficult without adequate support for ourselves.

We need to notice when we become overly involved and lose a personal sense of ourselves and become part of the grieving family. To be aware of boundaries that help separate us and keep a healthy individual identity. Becoming dependent without limits, whether it is the professional carer or the family is not therapeutic—nor is being distant and unable to relate as a caring human being.

Just as families search for meaning so do we as professionals. We can find meaning through our shared humanity and by building connections between people.

OP12.02 Alleviating compassion fatigue in support networks after traumatic deaths

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This study was funded by the Unexpected Child Death Society of Norway. The objective was to study the experiences of social networks supporting families who had lost a child suddenly and unexpectedly. A mixed method design combined questionnaires and qualitative focus groups interviews. The participants (family members, friends, neighbors, and work colleagues) were recruited through peer organizations for SIDS and suicide bereaved. A total of 101 persons filled in questionnaire, whereas 70 interviewees, 55 women and 15 men, participated in 21 focus groups. Half of the groups comprised networks that had supported SIDS families, and the other half had supported suicide bereaved. The results showed many similarities in both groups. The networks described the support processes as: "Painful, difficult, but incredibly rewarding!" The positive aspects were about valuable life knowledge, development as a human being, and friendships that acquired greater depth. On the other hand, many described "compassion fatigue," connected to the strong powerful visual or auditory impressions that could not always be processed. They encountered large human challenges, impossible to solve or cure, resulting in a sense of powerlessness and helplessness. They asked for a possibility to share impressions, reflect upon own initiatives through others' experiences, vent uncertainty, discuss the need for breaks, allocate tasks immediately following the death as a form of relief for one another, and acquire inspiration with regard to providing support over time. This, as the networks suggested, could be facilitated by professionals through network meetings.

OP13.01 Risk-related intervention in relation to prevention of SIDS: a tribute to John Emery

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Adjusting care to risk, i.e., Risk-Related Intervention, RRI, is intuitively appealing. We all take great care when crossing a busy road. However, disease prevention is most effective when population average risk is reduced. This may be best achieved by disseminating health care messages.

The distribution of SIDS risks is very skew, with most infants at low risk and a few at very high risk. Parents of low risk infants respond to reduce the risk messages like "back to sleep," "don't smoke," "always use a dummy," etc., but may become unduly anxious as the number of messages increases. Parents of very high risk infants tend to be slower to respond. RRI is needed to reach these families.

The concept of RRI to prevent unexpected infant death developed in Sheffield under the direction of John Emery from a controlled attempt to gather prospective Cot Death data. The intervention program involved scoring all infants at birth, and giving extra health care to the high risk babies. Before and after the program, death rates in Sheffield were generally above the national average. During the

20 years of the program, the mortality rate in Sheffield was below the national average of 19, $P < 0.01$.

Theory shows that when preventive resources are limited, they are best allocated when resulting risks are as uniform as possible. When a risk score, like the Sheffield score, is used to allocate infants to high and low risk groups, the effectiveness of the program can be validly estimated by regression discontinuity analysis. Simulation studies show that a risk score can be effectively updated while intervention is in operation. Thus a risk predictor can track changes in the population profile.

Where high risk infants have received extra care, mortality in the high risk group has been substantially reduced. John Emery's approach of targeting high risk infants with extra care is needed if unexpected infant deaths rates are to be reduced much further.

OP13.02 Changing policies toward bed sharing in maternity units in England and Wales 2004–2007

Ward, J

Foundation for the Study of Infant Deaths, UK

Since 2000 the Departments of Health (DOH) in England and in Wales have advised that parents who smoke should not share a bed with their baby. The Foundation for the Study of Infant Deaths has a team of eight Regional Development Officers (RDOs) who have been visiting Maternity Units across England and Wales to update staff on reduce the risk messages. At these visits, information about the policies and practices of the Units is collected which has led to this analysis of practices in light of changing advice from the DOH.

Over the four calendar years 2004–2007, 176 visits were made to Maternity Units in England and Wales where a series of questions were asked about bed sharing policies on the Unit. If it was allowed, details were taken on how it took place and if there were restrictions for high risk mothers. The results were collated and analyzed to allow a comparison across the years while taking into account the advice from the DOH during this period.

The percentage of Units allowing bed sharing has remained high across the years, with the highest figure of 68% in 2007. More significantly, the number of hospitals stating that smokers are allowed to bed share has decreased but remains a substantial figure directly contradicting current DOH advice. In 2007, 18% of hospitals that allowed bed sharing allowed smokers to bed share, and the majority of these also allowed bed sharing for prolonged periods. The reasons why current advice is apparently not being followed immediately following birth, by health professionals, will be discussed while also considering the implications of this on the attitudes of parents toward reduce the risk advice.

OP13.03 Consistent and collaborative approaches to reduce preventable deaths: a safe infant sleeping educational resource designed for health professionals

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Objective: To improve health professional knowledge, attitude, and practice deficits relating to sudden unexpected deaths in infancy (SUDI) and Safe Sleeping messages.

Methods: A pre-test/post-test intervention design evaluated knowledge, attitudes, and practices relating to SUDI and Safe Sleeping (SS) in a sample of nurses and midwives caring for families with infants ($n = 393$): (a) pre-test survey and audit (observational and chart); (b) educational intervention including evidence relating to SUDI and SS recommendations; and (c) post-test survey and audit to evaluate intervention effectiveness.

Results: Pre-test results identified knowledge, attitude, and practice deficits. Of the 230 respondents, only 166 (72%) provided parent education about SS in care and discharge planning, despite working with infants and families. Most (196, 85%) nurses advised parents to use supine positioning for healthy babies, but only 147 (64%) advised parents to place babies with reflux supine to sleep. Two-thirds of staff (152, 66%) indicated that they would recommend wrapping in the supine position as an alternative settling/sleep strategy for a 2-month infant placed prone. Documentation of SS education was poor prior to the intervention. The intervention achieved significant positive changes in knowledge of risk factors; recommended infant sleep position, effective infant wrapping, and plagiocephaly prevention.

Conclusions: The Safe Sleeping resource was implemented throughout Queensland in a variety of clinical and community settings in 2008. Resource sharing, consistency, key stakeholder collaboration, and effective change management were integral to the educational resource being evidence-based, user-friendly, accessible, and a sustainable mode of health professional support. Collaborative approaches involving consistent information and resource sharing between all key stakeholder groups, supported at a national level, will facilitate Safe Sleeping initiatives being sustained long term.

OP13.04 Educating the educators: ensuring parents are given a consistent message about safe sleep factors

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Background: The role of modifiable risk factors in reducing the incidence of SIDS is now fully recognized and the message to parents must be consistent and clear. In our area, there was inconsistency in the advice offered on SIDS, particularly about bed sharing. The percentage of SIDS where parent(s) and child shared a sleeping surface rose from 15.5% in 1987–1991 to 51.02% in 2002–2005.

Objective: To develop best practice guidelines for infant sleep practice that would be used by all professionals with contact with parents.

Methods: Within the Calgary Health Region, the birth rate is 14,000/year in a variety of settings. Parents receive advice on infant care from a wide range of professionals in many settings. We formed a multidisciplinary committee with professionals from a variety of professions in many services. Over 4 years we reviewed the evidence, consulted experts, and drafted guidelines. The guidelines were further reviewed by a larger group of professionals, administrators, and parents. We emphasized safe sleeping in infancy, particularly the risks of bed sharing. We focused on four areas: the safest position and place for the baby to sleep; the risks of bed sharing; reducing the risks of bed sharing for breast feeding; and circumstances when bed sharing should absolutely be avoided. The current version of the guidelines was supported by six key administrators, and then circulated widely and made available on the web site.

Conclusions: Guidelines on sensitive and controversial topics can be developed. Development cannot be rushed and must be based on wide consultation and the scientific evidence. There must be buy in by frontline professionals, managers, and senior administrators. Guidelines contribute to the safety of infants and enhance the credibility of the organization and of the professionals.

OP13.05 Brochure: safe sleeping environment for the infant child

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Unexpected Child Death Society of Norway, Norway

Background: Conditions in an infant's sleeping environment can potentially increase the risk of sudden infant death. Co-sleeping with parents may be dangerous for the infant when combined with other risk factors. The question of whether co-sleeping is to be recommended has been heavily debated among parents, health professionals, and researchers. Some advise parents to co-sleep because it stimulates breastfeeding, while others claim co-sleeping is safe after a child is 4 months of age. Finally, some say you should never co-sleep—especially when the mother is a smoker. Due to this debate, the necessity of a clear, unified message has arisen.

Goal: To reduce confusion about co-sleeping and the risk of infant death by inviting the main actors in the debate to cooperate and define a unified message about safe sleeping and co-sleeping for infants.

Process: The Unexpected Child Death Society of Norway invited the National Medical Resource Centre for Breast-feeding, the Norwegian Directorate for Health and Social Affairs, and the Institute of Forensic Medicine to a collaboration. After discussing the situation, we agreed on the urgent need of making an information brochure communicating a simple and unified message concerning safe sleeping and co-sleeping. In this process, we discussed research findings and challenges. Finally, we agreed on what were the main messages and how to best communicate these to parents.

Results: A small and neat brochure, consisting of big and colorful drawings and short sentences, was distributed by the Norwegian Directorate for Health and Social Affairs. The presentation will focus on the background, challenges, and agreements in the working process, as well as the final product: the safe sleeping brochure. Main questions that arose in the process will be discussed.

OP13.06 Infant wrapping as an evidence-based strategy to encourage settling and the utilization of the supine sleep position

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Objective: To identify knowledge, attitudes, and practices of child health nurses relating to infant wrapping as an effective settling/sleep strategy.

Methods: A pre-test/post-test intervention design was used to explore knowledge, attitudes, and practices relating to wrapping in a sample of child health nurses ($n = 182$): (a) pre-test survey; (b) educational intervention incorporating evidence relating to infant wrapping; SIDS&KIDS endorsed infant wrapping pamphlet; Safe Sleeping recommendations. Emphasis was placed on infant wrapping as an effective settling strategy for parents to use as an alternative to prone positioning; and (c) post-test survey to evaluate intervention effectiveness.

Results: Pre-test results identified wide variation in nurses' knowledge, attitudes, and practices of infant wrapping as a settling/sleep strategy. The intervention increased awareness of wrapping guidelines and self-reported practices relating to parent advice. Significant positive changes in nurses' awareness of wrapping guidelines ($P < 0.001$), to wrap in supine position only ($P < 0.001$), and parental advice to use wrapping as an alternative strategy to prone positioning to assist settling/sleep ($P < 0.01$) were achieved post-test.

Conclusions: Managing unsettled infants and promoting safe sleeping practices are issues routinely addressed by child health nurses working with parents of young infants. Queensland has a high incidence of prone sleeping. Infant wrapping is an evidence-based strategy to improve settling and promote supine sleep consistent with public health recommendations.

Infant wrapping guidelines are now included in Queensland Health's state policy and Australian SIDSandKids information relating to safe infant sleeping. In communicating complex health messages to parents, health professionals have a key role in reinforcing safe sleeping recommendations and offering safe, effective settling/sleep strategies to address the non-recommended use of prone positioning for unsettled infants.

OP14.01 Genetic risk factors for SUDI and SIDS

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Recent studies in SIDS infants have identified polymorphisms in 21 genes with disparate regulatory functions having increased frequency compared to control infants. Polymorphisms have been identified in six cardiac channelopathy genes: sodium channel (SCN5A), potassium channel (KCNQ1, KCNH2, KCNE2), RyR2-encoded cardiac ryanodine receptor, CAV3-encoded caveolin-3, sodium channel beta-4 subunit (SCN4B), and glycerol-3-phosphate dehydrogenase 1-like gene (GPD1-L). Polymorphisms have been identified in three serotonin (5-HT) genes: 5-HT transporter protein (5-HTT), intron 2 VNTR copy number, and 5-HT FEV. Polymorphisms have been identified in six autonomic nervous system (ANS) development genes: PHOX2A, PHOX2B, RET, ECE 1, TLX 3, and EN 1. Polymorphisms have been identified in five infection and inflammation-related genes: complement C4A and C4B, interleukin (IL)-6, IL-10, and vascular endothelial growth factor (VEGF). Finally, polymorphisms have been identified in the mitochondrial DNA (mtDNA) gene, an energy production-related gene. At present, we know very little about clinical phenotypes and the perturbations that may be required to unmask antemortem phenotypes in infants destined to die suddenly and unexpectedly. It is not known to what extent antemortem baseline electrocardiograms in cardiac channelopathies will be abnormal or if perturbation by a stressor such as hypoxia, acidosis, or epinephrine infusion will be necessary. No definable antemortem phenotypes for polymorphisms affecting infection/inflammation have been established. The functional consequences of altered ANS developmental genotypes can be inferred from pathophysiologic data in SIDS infants, but no antemortem clinical phenotypes have been established. Even less is known regarding antemortem clinical phenotypes in any 5-HT-related polymorphisms. The identification of genetic risk factors, gene-environment, and gene-gene interactions are the new frontier of research in SUDI and SIDS.

OP14.02 Sudden infant death syndrome (SIDS) and unexplained stillbirth

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There are extensive epidemiological literatures on the associations with both SIDS and stillbirth. These demonstrate a series of common risk factors and a series of divergent risk factors. Common risk factors include elevated maternal serum levels of alpha-fetoprotein during

pregnancy, poor intra-uterine growth, maternal cigarette smoking during pregnancy, and socio-economic deprivation. Divergent risk factors include maternal age, parity, and gestational age. Stillbirth is associated with advanced maternal age, nulliparity, and post-term pregnancy, whereas SIDS is associated with young maternal age, high parity, and preterm delivery. We have hypothesized that SIDS and stillbirth have a common dependence of an adverse intra-uterine environment. However, in the case of stillbirth, the compromised fetus remains in utero, whereas in the case of SIDS intra-uterine stress leads to premature birth. Hence, maternal characteristics may determine the likelihood that a given degree of intra-uterine stress leads to labor, and, therefore, whether the outcome is stillbirth or SIDS. This model provides a framework for considering how genetic or other biological determinants of intra-uterine stress may be modified by environmental or physiological cofactors to determine associations with perinatal and infant death.

OP14.03 Deleterious genetic mutations and bacterial toxin induced sudden infant death

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It is possible to estimate the mean number of deleterious mutations in the human genome from data on the frequency of recessive disease in the offspring of cousin marriages. Let Q be the mean number of deleterious mutations in the germ line and P the mean number of new mutations per human generation. Deleterious mutations are distributed at random to gametes during meiosis and the gametes then combine at random to form zygotes. The result is a Poisson distribution of deleterious mutations in zygotes with mean $P + Q$. Theoretical models indicate that deleterious mutations will interact synergistically to impair development and function. Thus zygotes at the upper end of the Poisson distribution are less likely to survive. The zygotes that do survive and develop into infants will have a skewed Poisson distribution with mean less than $P + Q$. In this way the population can come into long-term balance. Infants at the upper end of the skewed Poisson distribution will have less robust physiological systems, and it is suggested that they will be at increased risk of bacterial toxin induced disease particularly at 2–3 months of age when protective IgG reaches its nadir. The age incidence of SIDS is consistent with a bacterial cause. There is increased carriage of bacteria, including *Staphylococcus aureus*, in the upper airways of SIDS cases. Toxins from *S. aureus* and *Escherichia coli* interact synergistically with each other and with nicotine to cause rapid death in animal models. Respiratory carriage of *S. aureus* is common in early infancy and increases with viral respiratory tract infections and with prone sleeping. Staphylococcal pyrogenic toxins have been identified in autopsy tissue in SIDS. Death in SIDS can be rapid with transition from well to found dead in less than 1 h. This is consistent with direct toxin action on cardiorespiratory function or neural control.

OP14.04 SIDS and cardiac arrhythmias

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Several arrhythmic diseases show no morphological changes in the heart and have increased risk of sudden death, sometimes without pre-existing symptoms. Such arrhythmias, especially long QT syndrome

(LQTS), have been suggested as a cause of some cases of SIDS. The genetic basis for several such arrhythmic diseases has been described in the last decade, making them candidates for investigation in SIDS. Several single cases of SIDS with mutations in LQTS genes have been described. And, in the last few years, large data sets of DNA samples from SIDS victims have provided evidence that a relatively high proportion of SIDS cases can be caused by cardiac arrhythmia due to mutations in LQTS genes (5–15%). Other arrhythmias have also been found to be involved, such as Brugada syndrome, short QT syndrome (SQTS), and catecholaminergic polymorphic ventricular tachycardia (CPVT). This suggests that many of these arrhythmic diseases of genetic origin also contribute to SIDS. We have shown that nothing in the clinical history or autopsy findings can indicate which cases could be LQTS. Others however have indicated that SIDS cases with such mutations are older than the classical age peak for SIDS. There is also the question if such mutations act alone or are dependent on environmental triggers. It is however certain that molecular autopsies are a thing of the future. Testing sudden unexpected deaths for mutations in LQTS and possibly other arrhythmogenic diseases of genetic origin can provide an explanation of the death for the benefit of both physician and parents. Also, family members can be offered genetic counseling and investigation to identify possible carriers within the family, thereby instigating treatment.

OP15.01 The care of next infant (CONI) program

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The Care of Next Infant (CONI) program provides support to parents with babies born following a cot death. Trained local coordinators offer a range of measures including: weekly contacts with a qualified public health nurse—in UK a Health Visitor (HV); access to pediatrician; symptom diary; weight chart; apnea monitor, and room thermometer. The program is widely available in the UK with uptake generally over 90%. 10,000 babies have been enrolled.

Objectives: To review the use of the program and families involved. **Method:** Data about CONI families extracted from CONI registration forms, symptom diaries, HV CONI records, and parent questionnaires have been compared over time and where appropriate against national data.

Results: Use of the monitor has increased from 86% families in 1990 to 93% in 2006, use of the symptom diary has declined from 91 to 75%, and use of the weight chart is constant at 85%.

The mean frequency of home visits by the HV has declined from every 8 days in 1990 to every 10 days in 2006. However, contact at the clinic has remained constant, thus overall contacts average one per week. These were rated helpful or very helpful by 89% parents. Over the same time, contacts with the family doctor and pediatrician have halved.

The proportion of parents rating the overall support from CONI helpful or very helpful is constant over time at 93%. Compared with national data, the CONI families have characteristics indicating increased vulnerability: mothers are younger at birth of first child; double the rate of multiple births; double the proportion babies with birth weight <2,500 g; breastfeeding incidence lower; twice as many parents smoke; unemployment 5 times higher. 5% babies were still placed prone for sleep at 1–3 months and 5% still on side.

Conclusions: While the use of the program has changed over time, a very high level of HV contacts has been maintained. The CONI program is reaching highly vulnerable infants, and is highly rated.

OP15.02 Unexpected infant deaths on the care of next infant, CONI, program since 2000: confirmation of previous findings

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Population: The CONI program supports families with the care of infants born after a Cot Death and is widely available in UK, excluding Scotland. Where operating, uptake exceeds 90%. We report data on the first 10,000 babies recruited by autumn 2006.

Objective: To report the recurrence rate of unexpected infant death and the proportion apparently due to infanticide.

Methods: Deaths of CONI infants were subject to detailed enquires and review whenever possible.

Results: Among 6,373 infants on CONI before 2000, 57 died under 1 year; of these, 9 died from disorders with poor prognosis, and 48 (7.5/1,000 live births) were unexpected infant deaths; 5 were overt or confessed homicides, and 2 were probable covert homicides, i.e., 14.6% were probably homicides.

Among 3,265 babies enrolled on CONI from 2000, there have been 14 infant deaths of which 13 were unexpected (4.0/1,000 live births). There have been no overt homicides and 1 confessed homicide, and no covert homicides have so far come to light.

In the last 7 years, the unexpected infant death rate among CONI babies has declined 47%, $P = 0.04$. Also, as far as is known to date, probable homicides have declined from 1.1/1,000 to 0.3/1,000 live births, a drop of 70%, $P = 0.291$. Due to the small numbers, this reduction is not statistically significant.

Conclusion: Since 2000, only 7.7% of unexpected deaths on CONI were probable homicides, in close agreement with our earlier report.

OP15.03 Outcome of 4,000 babies on CONI PLUS program

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The CONI PLUS program was developed in response to professionals' requests to extend the CONI (Care of Next Infant) program to a wider group of anxious parents. It is intended for families with essentially well babies. From 1995 to Feb 2007, 4,000 babies have been enrolled.

Objectives: To review the use of the program and outcome.

Method: Data about CONI PLUS was analyzed, and the 3 largest groups by enrolment compared to each other.

Results: Reasons babies enrolled: "Close family history of SIDS" 1,301 (32%); "Apparent life threatening event (ALTE)" 1,277 (32%); "Previous explained sib death" 382 (10%); the remainder includes preterm apnea, ALTE in sib, and multiple reasons for enrolment 1,040

(26%). 93% families found CONI PLUS helpful. For “Close family history of SIDS”: 189 families (16%) had history of more than 1 previous SUDI (range 2–7). 5 infants died (3.8/1,000), all presenting suddenly and 4 are unexplained (3.1/1,000). “ALTE” group: 68% presented by age 2 months; 89% were admitted to hospital following the event and an underlying diagnosis was identified in 666 (52%). 11 infants died (8.6/1,000), 5 suddenly and unexpectedly, 4 are unexplained (3.1/1,000) and 1 is pending an inquest. “Previous explained sib death”: 3 infants died (7.8/1,000), 1 suddenly and unexplained (2.6/1,000). Significant differences between the families in the different groups are shown below:

Close family ALTE Explained sib history of SIDS death

Mean birth weight (g)	3,177	2,857	3,047	$P < 0.0001$
Mean gestational age (week)	39	36.9	37.8	$P < 0.0001$
Singleton birth	96%	94%	93%	$P < 0.05$
Mother age <20 years	27%	11%	1%	$P < 0.0001$
Mother smokes	44%	36%	29%	$P < 0.01$

Conclusions: All the groups show high rates for SUDI. The “ALTE” group also includes those with poor prognosis. The “Close family history of SIDS” group is notable for young maternal age and maternal smoking; the “ALTE” group for low birth weight and prematurity. Families enrolled on CONI PLUS contain a population of high risk babies.

OP15.04 Update: Cribs for kids®: a national safe-sleep program

Bannon, J

SIDS of PA/Cribs for Kids, USA Cribs for Kids® was created in 1998 in Pittsburgh, Pennsylvania (PA), when SIDS of PA and local Child Death Review Team members discovered that 90% of the infant deaths diagnosed as SIDS had occurred in places other than a properly assembled and maintained crib. Thanks to the growth of the Child Death Review System in the United States and increased use nationwide of the Centers for Disease Control and Prevention (CDC) protocol for infant death scene investigation, there is now widespread recognition of the risk factors infants face when they are placed in unsafe sleeping environments.

The mission of Cribs for Kids® is to provide infant safe-sleep education and the gift of a crib to families in need. Through partnerships with Graco Children’s Products and Pitt-Ohio Express, Cribs for Kids® partners can take advantage of discounted pricing and free shipping from our Pittsburgh warehouse.

At no charge, partners receive a tool kit which contains everything needed to begin a program, including our safe-sleep guidelines, which mirror those of the American Academy of Pediatrics, standardized forms, educational brochures, and grant writing materials. To date, over 50,000 families have benefited from this program.

Since the last International SIDS Conference in Yokohama, Japan, the number of Cribs for Kids® programs has increased from 16 to 152 including one in Juarez, Mexico, where an American company, North American Mailing Services, has established a Cribs for Kids® program for its employees.

In Pittsburgh, Pennsylvania, all 6,500 participants have lived to celebrate their first birthdays. These same positive results are being reported nationwide. Those attending the International SIDS Conference will have a clear understanding of how to begin this life-saving intervention and will be introduced to a newly produced Safe Sleep Public Service Announcement.

OP15.05 Bedtime basics for babies: a multifaceted campaign to prevent SIDS and sleep-related infant deaths in the United States

Reno, L

First Candle/SIDS Alliance, USA

Objective: To demonstrate the ability to influence infant sleep practices and save infant lives with a multifaceted safe sleep campaign. The campaign will ensure that every parent is aware of and prepared to adopt safe sleep practices before leaving the hospital and every baby has a safe place to sleep, especially if the family cannot afford one. An \$11 million grant from the Gates Foundation will be used to pilot the campaign in Washington, Indiana, and the District of Columbia.

Methods: Crib Distribution—Eligible families will receive safe sleep education, a crib, and a safe sleep kit. Approximately 200,000 cribs will be distributed. Education—Widespread distribution of safe sleep materials to new/expectant parents, education/training for health professionals, and multimedia outreach to the general public will be used. Evaluation—An internationally recognized research team will track at least 100,000 families and infant mortality statistics during the 7-year campaign. Process and outcome data will be studied, evaluated, and published.

Results: Researchers anticipate that a significant decrease in infant mortality rates will be realized across the regions by the end of the campaign.

Conclusions: Of the more than 4,500 sudden, unexpected infant deaths occurring each year in the United States, experts estimate that at least 50% could be prevented by placing babies to sleep in a safe environment. With proof that campaigns such as this can save babies lives, the potential exists to change childcare practices nationwide, saving thousands of lives for generations to come.

OP16.01 Interagency working in responding to unexpected child deaths: a UK perspective

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From April 1, 2008, the UK government has required all Local Safeguarding Children Boards (LSCBs) in England to have in place procedures for responding to and reviewing childhood deaths. This presentation will describe the processes involved and how they are being implemented across England, with reference to similar processes being implemented in Scotland, Wales, and Northern Ireland. The rapid response is a coordinated multiagency approach to investigating the unexpected death of a child and supporting the bereaved family. Across the country, local multiagency teams have developed and implemented rapid response processes with varying success; data on their implementation will be drawn from a recent national survey in England. In most parts of the country, there are now clear protocols for responding to SUDI and many places are exploring how to appropriately extend these processes to deaths of older children in the community. Experience in the Southwest of England has shown that, with appropriate support, local teams can achieve a rapid response to SUDI in at least 90% of cases. In addition to the rapid response to unexpected deaths, there is a parallel requirement to review all childhood deaths. Two recent UK studies have shown the potential of child death reviews to identify lessons that can lead to preventive action to improve services for children, and ultimately to prevent future deaths. The studies have also demonstrated how these processes could run at a local and regional level. Some of the key lessons learnt will be shared, including the need for strong multiagency representation; a clear focus on outcomes that feeds into preventive action; robust administrative support; and ongoing evaluation of these processes to continue to develop them and to ensure positive outcomes from the process.

OP16.04 Interagency working in responding to unexpected child deaths: a European perspective

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The investigation of childhood deaths is complex and complicated, in particular, if the death occurred suddenly and unexpectedly. A professional investigation requires special knowledge and impact from different fields of medicine, psychology, and criminology. Although scientists agree with this important point, in most of the European countries the investigation of SUDI cases is not standardized and follows different guidelines if they exist. To demonstrate this fact, the situation in Austria, the Czech Republic, France, Germany, Italy, the Netherlands, Norway, Sweden, and Turkey was analyzed in more detail: A death scene investigation is usually done by police officers except for scientific studies or pilot studies which have been performed in Germany (1998–2001), in Norway, and at present in France. Autopsies are usually performed by forensic pathologists (in Norway, Sweden, and in some centers in other countries with special pediatric knowledge) only if the police is involved in the investigation, or by pathologists without special experiences in infants, or in a small number by paediatric pathologists. The autopsy frequency differs from about 50% in Germany to 100% in Sweden, Austria, and the Czech Republic. In some countries information on the autopsy frequency is not available. An interdisciplinary reviewing of these deaths is mainly done as part of scientific studies (Norway, Germany), except for Austria and the Netherlands, where it is a routine in each SUDI case. In France, it is done if pathologists or pediatric pathologists performed the autopsy. In Germany, the results of these case conferences were not included in the mortality statistics. In all countries, parents are informed on the autopsy results, by either police officers, by the physician who performed the autopsy, a pediatrician, or a general practitioner. In most countries, the parents can get psychological support on special request or by parental organizations. Preventive actions are the result of scientific studies and led to a decrease of the SUDI incidence in most of the countries although it is obvious that not all groups of the population could be reached in the past. To summarize, a European recommendation on how not only SUDI cases but also all childhood deaths should be investigated would be a great success, but is at present far from reality.

OP17.01 Sudden infant death syndrome: underlying cause versus text reporting on U.S. death certificates, 2003–2004

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Cause of death ICD-10 codes from death certificates are the primary source for assessing trends and characterizing Sudden Infant Death Syndrome (SIDS) deaths in the United States. While providing useful data for surveillance, these limited data restrict the ability to identify potential risk factors. We examined relevant text recorded on death certificates of infants who died of SIDS to better understand these “unexplained” deaths.

Using 2003–2004 U.S. mortality files, the authors selected all infant deaths with SIDS coded as the underlying cause of death (ICD-10 code R95) and manually examined any text written, including diseases, injuries, complications, and other significant conditions. Text was grouped into primary classifications (SIDS, probable SIDS, consistent with SIDS, sudden unexplained/unexpected infant death

[SUID], sudden infant death, near or atypical SIDS, pending, unknown, and miscellaneous) and secondary factors (other conditions and factors) using exact text phrases.

Of the 4,408 deaths with SIDS coded as the underlying cause of death in 2003–2004, most were classified by their text into “SIDS” (67.2%). “Probable SIDS” (2.6%) and “consistent with SIDS” (4.6%) occurred less frequently as primary classifications. “SUID” was listed as the primary classification on 11.0% of the certificates. The most common secondary factor listed was “bedsharing or unsafe sleep environment.”

Differences in reporting may have an important effect on the number of “true” SIDS cases. A national SUID case registry with scene investigation and pathology data could lead to more consistent classification and ultimate prevention of SIDS.

OP17.02 Sudden infant death syndrome (SIDS), in mortality statistics: problems in data quality and international comparability

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Any data on the incidence of SIDS hold a substantial degree of uncertainty; because SIDS (ICD-10: R 95) is a diagnosis that can only be made after any underlying cause of death has been excluded, it is internationally agreed that an autopsy has to be performed. However, autopsy rates differ between nations and even regions. Additionally, it remains unclear whether the autopsy report was taken into account for national mortality statistics. The current ICD-10 categories do not allow differentiating between ‘confirmed’ SIDS cases and cases without autopsy.

In an ongoing study, the Robert Koch Institute (RKI) in Berlin, Germany, is investigating SIDS cases and cases with R 98–99 causes of death. Objectives of the study are to identify unknown risk factors in sudden deaths. On the basis of the information on autopsy results gathered during the study, we estimated the proportion of cases that would be misclassified in the official mortality register if autopsy results were not considered.

About one-third of the initial R 95 codes in the death certificates (external postmortem investigation only) turned out to be not true after an autopsy was done: the estimated prevalence of misclassification in SIDS cases was 30.2% (95% Confidence Interval 22.2–38.2).

Coding of R 95 without taking into account the internal post-mortem examination leads to a substantial degree of misclassification and consequently to over- and under-reporting of SIDS. This preliminary evaluation of our study data on diagnosis reliability was presented at the annual meeting of the WHO-FIC-Network (Mortality Reference Group). WHO agreed that the ICD-10 code R95 will be split into two categories: those where SIDS was determined by autopsy and those where no autopsy results were present. After implementation of this change into the ICD-10 classification system, improvements in consistency and comparability of SIDS rates in mortality statistics can be expected.

OP17.03 Feasibility of “less invasive autopsy” by whole body MRI in SUDI: implications for prospective research in SUDI

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Less invasive autopsy by magnetic resonance imaging (MRI) offers a promising alternative to invasive autopsy. However, changes in the Coroner's (Amendment) Rules 2005, lack of direct access to parents, and short window period for consenting pose several difficulties for performing such research in SUDI (Sudden Unexpected Death of Infant)

Aims: (1) To examine feasibility of whole body MRI before autopsy with prospective informed parental consenting SUDI autopsies. (2) To examine the attitude of parents and HMC officers toward such research.

Methods: Prior to the start of study (and again following each referral), all HM Coroners (HMCs) referring cases to Great Ormond Street hospital were approached explaining the study and requesting assistance with recruiting and permission to contact parents. In cases where permission was obtained, a family liaison sister with experience in dealing with bereaved families contacted parents by telephone, explained the study, and obtained verbal, followed by written, consent for MRI. The study was approved by the local REC and funded by Dept of Health.

Results: 20 HMCs were approached of which 2 offered to assist, 2 declined, 1 asked for additional funding, and 15 did not reply. During the study period (February 2008) 13 cases were referred by 10 different HMCs. In 2, the HMC refused MRI. 1 changed to a forensic 'special' case. In 3, the Coroners officer felt the parents were too distressed to be contacted. In seven, the bereavement nurse contacted the parents, and verbal consent was obtained from all 7 (100%) cases. All parents and HMC officers felt that participation in this project was a positive experience.

Conclusions: Prospective research in SUDI is feasible by using informed prospective parental consenting via telephone contact. However, close co-ordination of the mortuary staff, HM Coroners officer, research staff, and medical staff is required. The diagnostic value of "less invasive autopsy" by whole body MRI remains to be determined.

OP17.04 Improving practice in discussing consent for the retention of tissues and organs following a child death

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In England it is necessary to get consent from parents before there can be any retention of their babies' tissues or organs for research, teaching, or audit purposes. The Foundation for the Study of Infant Deaths (FSID) was commissioned by the Department of Health to provide seminars for coroners' officers and for pediatricians between 2003 and 2006 to encourage and enable key professionals to discuss consent with bereaved parents whose children died suddenly and unexpectedly. 30 seminars were held for coroners' officers and 129 for pediatricians.

A training package was produced and delivered by 8 FSID regional staff at the series of seminars. The project was evaluated through a delegate's evaluation form and a report form completed by the staff running the seminars.

Many coroners' officers felt it was the medical professionals' role to discuss these issues with parents. The results showed that only 57% of coroners' officers thought it was their role to discuss tissue retention. There was no conclusive agreement on who should discuss the issues with parents, but the project did have the effect of raising the importance of the issue with professionals, with 62% of coroners' officers and 77% of pediatricians saying they would discuss consent with parents in the future. The ongoing implications of these results

for multiagency working and the importance of discussing tissue retention will also be covered.

OP17.05 Assessment of the consent obtained in Coronial autopsies between January 2006 and December 2007

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Objective: In UK, cases of SUDI are under the jurisdiction of the Coroner. Consent is required with regard to what can be retained or should be disposed of regarding blocks and slides and retained frozen tissue after the coroners' purposes have been fulfilled. We analyzed and compared the consent by three different groups: Sheffield Children's Hospital NHS Foundation Trust, Coroner's Officers, and Police Family Liaison Officers.

Methods: 119 Coroner's postmortems covering the years 2006 and 2007 were identified. The new consent form introduced in 2007 specifically asks for blocks and slides (B&S) to be retained as part of the medical record (or to be disposed of) and for the consent (or not) for the tissue and blocks and slides to be used for education, audit, quality control (EAQC), and medical research (Med Res).

Results consent results: SCH gained consent for B&S in more than 90% cases; >70% of these also consented for EAQC and Med Res; 3 cases from 2006 gave no consent. CO gained 85% of consent for B&S in 2006 and 48% in 2007; 50% of these also consented for EAQC and Med Res; 15% of 2006 cases gave no consent and 44% of their 2007 cases are pending. PFLO obtained a 100% consent for B&S; 70% cases also consented for EAQC and Med Res.

Conclusion: Results obtained by SCH staff indicates that if consent was obtained by trained personnel who explained the value of keeping B&S and tissue, their agreement was more forthcoming. When consent was taken by CO there was a reduction in the agreement to retain tissue for EAQC and Med Res and 44% of cases were outstanding. CO are not trained in seeking consent and in some cases this is taken by them over the telephone. This would appear to reduce the amount and quality of consent obtained. The PFLO have received training by the SCH staff which clearly reflects the improvement in their ability to obtain consent. Families have the right to always be approached and INFORMED consent obtained by trained staff.

OP17.06 Diagnostic contribution of bacteriology and virology in 119 cases of SUDI: an appraisal of the South Yorkshire Inter-agency Protocol

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Background: Sudden Unexpected Death in Infancy (SUDI) applies to any death that occurs "suddenly" and "unexpectedly" in children.

Objectives: Assessment of the bacteriology and microbiology results in SUDI cases performed in our institution between January 2004 and December 2007. **Methods:** Retrospective investigation of postmortem findings to record demographic information, postmortem interval, bacteriology, and virology results and clinico-pathological relevance of each case.

Results: 119 cases were identified. The mean age of the patients was 6.6 months (mode: 3 months). Bacteriology and virology were performed in 115 cases (96.6%). The most frequent samples were from blood, cerebrospinal fluid, faeces and middle ears. Significant results were obtained in 46/115 (40%). A blood culture (BC) was done in 105/119 cases. This showed a positive result in 57 (55%) but was found to be significant in 13 cases (22.8%). The average postmortem interval was 1.9 (mode: 1) days with no effect on the BC result. The cerebrospinal fluid was cultured in 79/119 (66.3%). This produced a positive result in 10 (13%) cases but was relevant only in 5 and presumed to be postmortem flora in 5 cases. Samples from the middle ears were taken in 31 (26%) children, with 14 (60.8%) obtaining a significant result. 114 samples were taken from other sites of the body. 22 (19%) significant positive results were obtained of which 9 would not have been detected by the above methods alone.

Conclusion: The finding of a clinically significant result in 46/115 (40%) of our cases confirms the relevance of performing multisite microbiology and virology investigations in all cases of SUDI.

OP17.07 Reported sleeping position and SIDS: pathological observations

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Objective: To compare autopsy findings with described infant positions when found.

Method: SIDS files in South Australia were reviewed over a 7-year period from 2000 to 2006. The position of the bodies when found and the distribution of lividity on skin surfaces were recorded. Autopsy photographs were reviewed.

Results: Out of 35 cases, carers were able to reliably specify the position of the body when found in 32.

Infants were found on their sides in 4 cases, supine in 14 (44%), and prone in 14. Thirty infants had documented posterior dependent lividity, and 10 had additional anterior lividity. One case each had only lateral and anterior lividity, respectively. In 6 of the cases with fixed anterior lividity, the position of the bodies when found was reported as 'side' ($N = 1$) and 'back' ($N = 5$). This was not supported by the autopsy findings.

Conclusions: Given the possibility of inaccurate reporting of infant positions, it appears that descriptions of terminal sleeping position cannot always be accepted as completely reliable. This trend may have increased in recent years with the wide publicizing of the negative associations of prone sleeping. One result of this may be that deaths in the prone position may now be reported as supine. If this is so, then epidemiological studies relating reported infant positions to other factors may be faced with a significant confounding factor that may make subsequent interpretation of results difficult.

OP17.08 Patterns of diagnostic shifting in Michigan (MI), USA: urban versus rural differences in assigned causes of death

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Objectives: Post-neonatal mortality in MI has remained between 2.56 and 2.61 deaths per 1,000 births since 1998, despite a dramatic fall in SIDS rates (from 1.11 to 0.37 per 1,000 births). Our objective was to quantify the extent of diagnostic shifting from SIDS to related diagnoses, and to establish whether this shifting was more common in more urban vs. less populated counties in MI.

Methods: All death certificates for infants 29–365 days of age from 1998–1999 to 2003–2004 were abstracted. Deaths likely to be sudden and unexpected (SUID) were analyzed. Included among SUID were deaths whose manner was: natural (SIDS), accidental, or undetermined, and whose cause was SIDS, positional asphyxia, and unclear. The physician assigning manner and cause and the county of certification were tabulated.

Results: In 1998–1999 there were 311 SUID, while there were 199 in 2003–2004. (SIDS in earlier years 256, later 63.) In 1998–1999, whether SIDS was the diagnosis was not significantly affected by whether ≥ 5 SUIDs were certified in a county over the 2 years (chi-squared, $P = 0.203$). In contrast, for 2003–2004, counties certifying manner and cause of death for ≥ 5 SUID were less likely to use the diagnosis of SIDS than those certifying fewer SUIDs (chi-squared, $P < 0.001$). In 2003–2004, less busy counties certified 17.6% of SUID.

Conclusions: Diagnostic shifting from SIDS to positional asphyxia or undetermined occurred in MI and shifting was more significant in busier medical examiners' and coroners' offices between 1998–1999 and 2003–2004. This is presumably due to more experience with investigation of the circumstances of death. To develop safe sleep initiatives to reduce infant mortality, states should understand local heterogeneity in diagnostic approach to sudden death during sleep.

OP18.01 Influence of prenatal smoking exposure on a triple risk hypothesis of sudden infant death syndrome

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A triple risk hypothesis of sudden infant death syndrome (SIDS) results from an altered chemical response to breathing or blood pressure challenges when thermoregulatory and sleep processes interact. Prenatal smoking exposure is a major risk factor associated with SIDS. The aim of the study was to investigate the effects of prenatal smoking exposure on the interaction between peripheral chemoreceptor activity and thermal stress during sleep in neonates.

Peripheral chemoreceptor activity was assessed at thermoneutrality and in a mild-warm environment in 37 premature neonates (postconceptional age: 36.1 ± 1.2 week, study weight: 2.1 ± 0.3 kg) by performing a 30 s hyperoxic test (HT, 100% O₂) during active (AS) and quiet (QS) sleeps. The drop in ventilation (VE) measured in response to the HT reflects the strength of the chemoreceptors drive during resting ventilation. The exposed group consisted of 16 infants whose mothers reported smoking during pregnancy (S+); 21 non-exposed neonates formed the control group (S-).

At thermoneutrality, the fall in VE in response to the HT was significantly lower in the S+ than in the S- group in AS (-25.8 ± 6.2 vs. $-33.8 \pm 12.0\%$, respectively; $P = 0.031$) but not in QS. The same results were obtained in the mild-warm condition (AS: -27.6 ± 10.2 vs. $-36.0 \pm 9.8\%$ for S+ and S-, respectively; $P = 0.017$). The response time to the HT was longer in the S+ group but the difference was only significant during QS at thermoneutrality (11.8 ± 1.9 vs. 8.8 ± 3.1 s in S-; $P = 0.005$) and during AS in the mild-warm condition (10.7 ± 3.2 vs. 8.5 ± 2.5 s in S-; $P = 0.030$).

The influence of prenatal smoking exposure on chemoreceptor activity is sleep state dependent but not thermal dependent. In smoking-exposed premature neonates, ventilatory drive is decreased in AS and the HT response time is delayed, whatever the environmental condition. This situation could subject a vulnerable population to an increased risk of cardiorespiratory disorders during sleep, thus leading to SIDS.

OP18.02 Are events in pregnancy associated with an increased risk of SIDS?

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Aim: To review pregnancy and the risk of SIDS.

Method: All variables were examined prior to adjustment for potential confounding factors in a subsequent multivariate analysis. Each SIDS ($n = 287$) was compared with control infants ($n = 832$) over an 8-year period (1994–2001).

Table 1—Pregnancy details	Univariate analysis		Multivariate analysis	
	OR	95% CI	OR	95% CI
Social deprivation	7.08	1.70–10.66	2.77*	1.03–7.46
Maternal age <25 years	3.48	2.38–5.10	0.88	0.28–2.76
Maternal education <18 years	2.19	1.49–3.31	0.7	0.29–1.68
Lone parent	7.06	4.69–10.64	2.03	0.72–5.73
Number of previous live births ≥ 3	2.07	1.37–3.15	3.93*	1.19–12.92
Miscarriages (at least one)	1.11	0.77–1.61		
Stillbirths (at least one)	3.07	0.79–11.77		
Anemia	2.07	1.30–3.27		
UTI	4.41	2.75–7.06	4.69***	1.39–15.77
Alcohol consumption	1.92	1.38–2.67	1.8	0.85–3.79
Mother smoking during pregnancy	7.88	5.37–11.56	2.90***	1.21–6.97
Medication taken during pregnancy	1.47	1.04–2.06	0.75	0.31–1.76
Mothers well being during pregnancy (had health problems)	1.4	1.01–1.93	1.27	0.55–2.90

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Social deprivation was significant with the OR reduced to 2.77 when smoking was introduced (Table 1). Mothers who had 3 or more live births were 3 times more likely to have a SIDS. No differences was found between Cases and Controls for miscarriages and stillbirths. Anemia, although significant in the univariate analysis, was difficult to measure. UTI remained significant (OR 4.69). Pregnant women should seek professional advice if they suspect a UTI. About 46.6% of case mothers consumed alcohol during all three trimesters as opposed to 25.5% of Controls. It remained significant until mother smoking was added. Mothers who

smoke are almost 3 times more likely to have a SIDS with a dose-response effect apparent proportionally to the amount. If smoking was eliminated, 49.3% of SIDS could be prevented. Significantly more Case mothers used illegal substance. Mothers need to be informed of the potential risk.

Conclusion: Health professionals need to disseminate the evidence from the above to all pregnant women in a culturally acceptable way. Those modifiable risks may help to decrease SIDS.

OP18.03 Maternal substance use during pregnancy and increased risk of SIDS among African-Americans

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Objective: African-American infants are twice as likely to die from SIDS as White infants. We sought to determine if maternal prenatal drug use contributes to the excess risk of SIDS among African-Americans and if this is independent of smoking.

Methods: 260 infants who died from SIDS in Chicago, November 1993–April 1996, were matched to 260 living controls on race-ethnicity, age, and birth weight. Standardized death scene investigation and parental interviews were conducted to collect information about the circumstances preceding the infant's death including sleep environment; medical history; mother's prenatal tobacco, alcohol, and drug use; and social factors. Conditional logistic regression analysis measured the associations between the independent factors (maternal smoking and drug use) and SIDS. Unadjusted and adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated.

Results: 75% of the cases and controls were Black. Maternal smoking during pregnancy was more common among SIDS infants than control infants (49 vs. 19%, $P < .001$), and more common among Black SIDS infants than among Whites (54 vs. 32%, $P = .003$). Maternal drug use was also more common among Black SIDS infants (40 vs. 3%, $P < .001$), as was cocaine use, the most commonly reported drug (32 vs. 3%, $P < .001$). Smoking was associated with increased risk of SIDS (OR 4.4, 95% CI 2.7–7.4) among Blacks. Similar results were found in multivariable analysis. Cocaine use in pregnancy among Blacks, adjusted for smoking, sleep environment, and other potential confounders, was associated with increased risk (OR 3.5, 1.3–9.3).

Conclusions: The higher prevalence of smoking and cocaine use among mothers of African-American infants who died from SIDS may account in part for the racial disparity in SIDS. Providers need to identify at-risk patients and offer interventions that will benefit their health as well reduce the risk of SIDS among their newborn infants.

OP18.04 Changing prevalence of modifiable risk factor for SIDS in Hamburg, Germany, 1996–2006: effects of a prevention campaign

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Objective: To develop the most effective strategies for further prevention, it is of importance to monitor the prevalence and distribution of modifiable risk factors in the population of a given community.

Method: In 1996, 1998, 2001, and 2006, parents of healthy infants were interviewed about their smoking, feeding, and bedding habits ($n = 2,001, 2,027, 1,752,$ and $1,704,$ respectively) in Hamburg. The standardized interviews were carried out in pediatric practices and offices of mothers' health care consultants. Socioeconomic status was determined by the average socio-economic standard of the district of each participating practice. Various preventional activities have been stimulated and carried out during the study period.

Results: In Hamburg, which has about 16,000 births per year, the SIDS rate was 0.90 per 1,000 life births in 1996 (15 cases), 0.92 in 1998, 0.63 in 2001, and 0.22 in 2006 (3 cases). The proportion of parents who preferred to put their baby in the prone sleeping position decreased from 8.1% in 1996 and 5.6% in 1998 to 3.2% in 2001 and 3.5% in 2006. The side sleeping position decreased substantially within the same time frame (50.6, 55.3, 41.5, and 10.6%). Smoking during pregnancy decreased from 22.2% in 1996 to 11.0% in 2006. However, the proportion of mothers who refused to answer this question increased from 11.4 to 27.7% in the same period. More results from this study will be presented, including the socioeconomic factors, prevalence of the use of sleeping bags, and co-sleeping habits.

Conclusions: The major drop of the SIDS rate in the nineties has been followed by another drop between 2001 and 2006, which seems to be a robust trend. In part, this might be attributable to the declining proportion of the side sleeping position since 2001. The decreasing prevalence of maternal smoking might have its share as well, but the data are difficult to interpret. However, local prevention campaigns seem to have been successful.

OP18.05 What can we expect from a service to support pregnant smokers to stop?

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Smoking during pregnancy may cause up to 50% of Sudden Unexpected Deaths in Infancy and Stillbirths. The Department of Health has provided funding for specialist smoking cessation services for pregnant women throughout the UK. In Scotland, a survey of these services was carried in 2007. 13,000/53,000 (25%) pregnant women reported that they were current smokers when asked at maternity booking. 2,900/13,000 (22%) were referred to specialist smoking cessation services. 900/13,000 (7%) set a quit date and 290 (2%) had quit 4 weeks later. Glasgow has a policy to refer all pregnant smokers and 2,085/3,381 (62%) were referred in 2007 with 397/3,381 (12%) setting a quit date. 134 (4.5%) had quit 4 weeks later. This is double the all Scotland cessation rate among pregnant smokers. Smoking cessation research focuses on the minute detail of the intervention to be applied. It is however vital to research ways to identify pregnant smokers, refer them to specialist smoking cessation services, and engage them with those services. It is also important to make medications such as Nicotine Replacement Therapy easily available when appropriately prescribed for women who have set a quit date. It is not enough to know that an intervention works. This knowledge needs to be translated into effective service provision.

OP18.06 Mother–baby sleep interactions

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Introduction: Infant sleep depends on age, environment and child-care practices. Maternal influences are physiologically significant

because of proximity and mother's ability to alter the baby's environment. Biorhythms, absent at birth in babies, but develop at varying rates postnatally, will control sleep and night-time activities. Most cot deaths occur at night.

This study relates developing biorhythms with gene expression, infant and maternal sleep activity, and endocrine output.

Method: Prospective monitoring of 25 newborns and mothers to the point of biorhythm maturity; maternal and baby sleep activity measured by acti-watches; and urine output of melatonin, cortisol, and growth hormone were assessed.

Results: Initial *t*-test comparison suggests that sleep patterns and night-time activity of mothers are in tandem with those of baby. As babies get older sleep duration is longer, sleep is more efficient, and night-time awakenings are reduced in unison with that of mother. This occurs in conjunction with physiological maturation and physical growth. It is yet to be determined whether parents are inducing or following night-time routine of their babies.

We will determine how infant care practices such as place of sleep, bed type, feeding methods, and socio-economic factors influence and affect sleep patterns in newborns. There are indications of a robust clock gene output in human infants to coincide with circadian maturity.

OP18.08 Head covering and the risk of SIDS: findings from the New Zealand and German SIDS case–control studies

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Objective: The aim of this study was to identify the risks for SIDS associated with being found dead with the head covered compared with those infants that died with their heads not covered.

Methods: Two case–control studies: (1) the New Zealand (NZ) Cot Death Study (1987–1990, SIDS cases = 393) and (2) German SIDS case–control study (GeSID, 1998–2001, cases = 333).

Results: The proportion of infants found dead with their head covered was 15.6% in the NZ study and 28.1% in the German study. Found with head covered was associated with older infant age (in NZ study, covered: 19.4 weeks (Interquartile range = 12.9–27.4), not covered: 11.3 (IQR = 8.0–16.1), $P < 0.0001$; in German study, covered: 30.5 weeks (IQR = 18.5–39.0), not covered 14.0 (IQR = 9.0–22.0), $P < 0.001$). In both studies, being found with the head covered was associated with being very sweaty when found. Head covering was also associated with the incidence and severity of thymic petechiae in both studies. Both position placed to sleep and position found were not associated with head covering.

Conclusions: The finding that dead infants found with their heads covered are often very sweaty suggests head covering is not an agonal event and that it precedes the death, and may be causally related to the death. Infants found with their heads covered are older, which probably reflects motor development.

OP19.01 Practical writing seminar: putting words to the experience

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The Unexpected Child Death Society of Norway provides care and support for families who experience sudden and unexpected loss of a child. One of our main functions is to provide and develop bereavement-support initiatives to families that have lost a child.

Many members create poems and texts about their loss as part of their bereavement process. In 2007, we offered a new bereavement support initiative to our members: a writing seminar. The seminar focused mainly on the process of writing and how to use language as a tool to express grief and pain. The main goal was to help those who have lost a child to facilitate their bereavement process.

A well-known Norwegian writer and poet with extensive experience leading similar courses was responsible for the seminar. Eight members signed up for the course. They came together one weekend and took part in two working sessions of 6 h each. The group worked intensively, learning about various writing techniques and how to use the written word to express their feelings. The eight participants produced many poems and texts during the weekend and took advantage of the opportunity to share their experiences with each other. Participants evaluated the course afterward. Feedback was positive. All reported learning a lot and that taking part in the course had helped them to express feelings “impossible to express.” There will be a new evaluation after 6 months to get more information about the long-term benefits. Participants also underlined the social value of spending time with others that had gone through similar painful experiences.

The presentation will describe the contents and organization of the course, give examples of poems and texts that were produced, and describe the results by reporting participants’ perceptions of how the seminar affected their grief processes.

OP19.02 Surviving the first two years after your baby’s death

Horchler, JN

Co-Author, SIDS & Infant Death Survival Guide, USA

Shock, horror, denial, despair, guilt, anger, exhaustion, piercing sorrow—these are just a few of the often overwhelming feelings that may confront family members as they try to survive the first 2 years after a baby’s death. What moms and dads and other family members need in the throes of the first 2 years’ grief roller coaster is for someone to softly say, “I survived my baby’s death, and I have some practical suggestions that can help you cope, too.” During this “round table” workshop, grief-stricken family and friends will feel free to cry and share their intense emotions, and will receive validation from others who have been through a similar loss and survived. Ample opportunity will be provided for family members to tell their personal stories and to ask questions. Veteran bereaved moms, dads, and siblings will be there to offer comfort, gentle advice, and—most importantly—hope. A discussion of how writing, visual art, and music can help people through grief will be initiated. A free, personally autographed copy of the book the “SIDS & Infant Death Survival Guide” will be given to each participant, in addition to several helpful handouts on how to cope with the various aspects of grief and available resources. Peer contact email addresses and phone numbers will be provided in case participants wish to continue a relationship after the conference.

OP19.03 Internet bereavement support forum

Harrison, L; Harrison, LJ; McSpedden, M

SIDS & Kids, NSW, Australia

SIDS & Kids NSW Bereavement Support Services are coordinated by the Health Promotion Team. The team oversees and implements the parent-based, self-help model through which support services are provided.

It was recognized by SIDS & Kids, NSW Health Promotion Team, that there was a need for this type of contemporary method (Internet Support) for providing parent-based self-help. Research has indicated that this type of service usage is expected to increase by 20–30% per year.

(APS 2007) A literature search on Internet Support Services was conducted by the Health Promotion Team, and other models of Internet Support were examined. It was determined that the Bereavement Support Services provided by SIDS & Kids could be expanded to incorporate individual support and “virtual” group support. This process was conducted over a 6-month period.

As a result, this Forum was set up and launched in March 2007 at a fund-raising breakfast. Internet support does not replace other support services, like face-to-face groups or counseling, but is complementary to other services. Many members are from rural areas of NSW, and Australia, but also from metropolitan areas where they also use face-to-face services. We also have provided an area for Health Professionals to access support when appropriate. Positive feedback has been received from members. The advantages and disadvantages of internet support will be discussed. At present, there are approximately 160 members registered, with 20 who use the forum regularly. The majority of our members have experienced death of a baby as a result of Miscarriage or Perinatal death. Members regularly comment about the support they have received from this self-help group.

OP19.04 Experimental use of discussion boards to run a ‘virtual’ focus group

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¹Children’s Hospital, UK; ²Royal Holloway, University of London, UK; ³University of Sheffield, UK

Objectives: A support program (CONI), for parents with babies born following a SUDI is widely available in the UK. To supplement feedback from user questionnaires and to encourage parents to present new ideas, we invited parents to participate in a confidential discussion on an internet discussion board. We aimed to explore: parents’ perceptions of the emotional and practical difficulties in caring for a subsequent baby; advantages and disadvantages of CONI program; alternative forms of support; and the viability of using a discussion board to run a ‘virtual’ support group for CONI parents.

Method: Over a 12-month period, parents were sent study details by post. Participants were given a username, password, and information on how to log on and post comments. The researchers posted questions following themes identified in advance and responded to points raised by parents. The discussion was analyzed thematically and conceptually.

Results: A total of 43 parents participated from 32 (9.4%) families. 233 comments were posted by 24 parents. Themes were identified and grouped into 5 categories: processes of bereavement, fears for the new baby, managing family relationships, interacting with health care professionals, and presentation of ‘self’ as a parent. Conceptual analysis identified issues surrounding the similarity between the CONI and SUDI baby; how the child that died continues to develop in their mind’s view; and gender differences in ‘self-presentation’ by mothers and fathers. Criticisms of CONI concerned delivery rather than content and parents did not identify any new strategies for support.

Conclusions: Uptake and participation was low but the discussion provided a rich source of material giving insight into the ongoing impact of the parents' bereavement. A discussion board is low cost and enables meaningful contact between widely scattered parents.

OP19.05 Family weekends organized by The Association for SIDS and child death families in Finland (KÄPY ry) supporting grieving families

Kivikko, M¹; Aho, AL²

¹SIDS Finland, Finland; ²SIDS Finland, University of Tampere, Department of Nursing Science, Finland

In Finland, the Association for SIDS and child death families (KÄPY ry) has been operational at national level for 16 years. The Society gives peer support, and its designated task is to support families who have lost a child regardless of the age of the child or the nature of the death. The society's actions consist of activities in support, publicity, finance, and research. The most important task of the Society is to support families who have lost a child; this consists of individual and group support. Individual support is given by a crisis hotline and by personal contact. The Society also disseminates support packages of printed matter and has its own publication. Group support is given nationally in peer support groups, men's weekends, sibling support groups, and family weekends.

The Society organizes 3 family weekends every year. These can be applied by all families who have lost a child. There may be some 30 families participating in each of these weekends. The weekend is free of charge for those families participating for the first time. For adults, there are small group discussions with a mediator and also discussions in theme groups. Themes include mothers' grief, fathers' grief, loss of a firstborn child, lost of a sick child, and the pair relationship. Parents themselves can select their theme groups. There are trained peer supporters leading these groups. For children, there are therapy groups for different ages. Children's groups are led by trained therapists. Child care is available for small children. At family weekends, there are also memorial occasions for the whole family and memorials at night for parents and other shared activities for families.

The presentation gives closer view of family weekends organized by KÄPY ry and experiences of parents who have participated in them.

OP19.06 Taking care of yourself: a creative arts group for bereaved parents

Same, D¹; Grynberg, C²

¹SIDSandKIDS Melbourne, Australia; ²Creative Arts Therapist, Australia

Over the past 2 years, SIDS and Kids in Melbourne, Australia, has run three Creative Arts groups, cofacilitated by a professional counselor and a Creative Arts therapist. On average, eight bereaved parents attended each 2-h session over six consecutive weeks.

The rationale for these groups is based on the understanding that there are some human experiences that are so complex and intensely emotional that they defy words. For many people, the loss of a child is one of these experiences. Participation in the creative arts process allows bereaved parents to explore and express strong feelings and to gain insight into their inner selves.

Throughout the sessions a variety of media is used including traditional materials such as paint and pastels as well as clay, found objects, and poetry, short stories, and rhythm instruments. These are incorporated into the sessions as ways of connecting each individual

to their creativity. For many people, the creative aspect of the self can become lost during periods of grief, bereavement, and stress. Rediscovering this part of one's identity is experienced as a positive and important part of the sessions.

This paper will focus on the unfolding of one of the Creative Arts groups, including some case studies, and will highlight the theory that supports the healing nature of the creative process.

OP19.07 The FSID helpline: challenges in the evaluation of a quality service

Simons, J

Foundation for the Study of Infant Deaths, UK

The Helpline offers advice, information, and support during office hours, and also every evening, when it is staffed by bereaved parent befrienders.

Since 1991, the successful 'reduce the risks' message has caused numbers of cot deaths to plummet. The greatly changed demographic picture of who now experiences bereavement by Sudden Infant Death Syndrome (SIDS), who contacts the Helpline service, and for what sort of support requires that recruitment and training of befrienders is reviewed and re-evaluated.

Since the befriending service's inception, 30 years ago, befrienders have received a brief, information-based preparation, initially designed to enable face-to-face support of newly bereaved parents, using and sharing the befriender's own experience of bereavement, in a uniquely empathic relationship.

Currently, face-to-face befriending is rarely possible or appropriate; almost all befriender contact is via the telephone or email, and the multifaceted psycho-socio-economic problems often experienced by those now most vulnerable to SIDS requires that a Helpline skills training, as opposed to a more generic 'support' training, be implemented, with a program of regular re-validation.

A baseline skills assessment was undertaken with the 28 Helpline befrienders, by means of audiotaped, simulated phone calls, rated by an independent professional, against a pre-agreed proforma. Bereaved parent simulators delivered an identical opening to each phone call, leading to individual discussion of an identical 'backstory.'

Issues arising from the evaluative plan and process, results of the skills' evaluation, the revised training program, and current strategic and operational issues for the FSID Helpline service will be discussed.

OP19.08 A commemorative space. The Foundation for the Study of Infant Deaths (FSID) launches an In memory microsite for bereaved parents and their communities

Peckett, N; Kenyon, S

UK

On March 25, 2008, the Foundation for the Study of Infant Deaths (FSID) launched a new "In memory" microsite using a webdesign agency. This development builds on the pages created in-house in 2001 to offer bereaved parents, their families, and communities the opportunity to pay tribute to their baby who died suddenly and unexpectedly. The objective was to allow parents the opportunity to create and maintain a page in memory of their baby who died. This page would belong to the parent and be a permanent place to visit to remember their baby. Facilities for bereaved parents within the microsite:

- Create their own personal page with their own words, pictures, and poems
- Email their friends and family to let them know about their new memorial page
- Choose to publicize their fundraising in memory of their baby
- Encourage donations in memory of their baby

Family, friends and colleagues can light a virtual candle in memory of babies. These appear as tributes on the memorial page of each baby. One month into the launch there were 59 tributes and 126 candles. In previous years, FSID received a yearly average of 69 tributes. Future plans are to promote the “In memory” microsite further to all bereaved parents known to FSID and promote this service to relevant professionals. We will develop the “In memory” microsite further by offering parents a choice of images to choose to add to their memorial page should they not have photos of their baby. We will also develop a discussion forum for bereaved parents and their families which will sit well alongside this microsite. At the conference presentation, images will be shown to show the facilities to parents, how the site works, and how parents are using the site.

OP20.01 Combined antagonism of adrenergic and serotonergic receptors impairs the maintenance of gasping and restoration of eupnea after hypoxic apnea

St. John, WM; Leiter, JC

Dartmouth Medical School, USA

Serotonergic receptor defects in the brainstem are associated with the occurrence of Sudden Infant Death Syndrome (SIDS). However, the physiological effects of blocking serotonergic receptors or reducing serotonergic neuronal function on cardiorespiratory function have been modest in neonatal animals. Therefore, we tested the hypothesis that serotonergic activity altered autoresuscitation in juvenile rats. We examined gasping and the restoration of eupnea after hypoxic apnea using the isolated perfused brainstem preparation before and after blocking serotonergic receptors, adrenergic receptors, or simultaneously blocking both types of receptors. Perfusion of the isolated brainstem preparation with hypoxic-hypercapnic solutions induced apnea after a short delay. Once apnea occurred, the perfusate was changed back to the hyperoxic control solution. In the absence of receptor antagonists, gasping occurred shortly after apnea developed, and after a variable number of gasps, eupnea was re-established. Neither serotonergic antagonists (ketanserin or methysergide) nor an adrenergic antagonist (WB 4101) changed the pattern of apnea or gasping, although the number of gasps was reduced. The restoration of eupnea was slightly delayed in some preparations. When antagonists of both receptor types were combined, the number of gasps was greatly reduced, and the restoration of eupnea was consistently delayed. The delay in the restoration of eupnea exceeded 100 s in all preparations that received both WB 4101 and methysergide. We conclude that activation of adrenergic and serotonergic receptors enhances autoresuscitation and the restoration of normal respiratory activity after hypoxia-induced apnea, and failure of these mechanisms may contribute to the pathogenesis of SIDS.

OP20.02 Prone sleeping impairs circulatory control in healthy term infants: implications for SIDS

Yiallourou, SR; Walker, AM; Horne, RSC

Monash University, Australia

Objective: Sudden Infant Death Syndrome (SIDS) is associated with prone sleeping and circulatory failure has been hypothesized as a factor in the fatal event. We aimed to determine the effect of prone sleeping on heart rate (HR) and blood pressure (BP) control over the first 6 months of life.

Methods: Term infants ($N = 20$) were studied longitudinally at 2–4 week, 2–3, and 5–6 months with daytime polysomnography. A photoplethysmographic cuff (FinometerTM) on the infant’s wrist measured (MAP), systolic (SAP), diastolic (DAP) arterial pressure and HR during quiet sleep (QS) and active sleep (AS) in both the supine and prone positions during baseline measurements and head-up tilts (HUT).

Results: At 2–3 months in QS a change from supine to prone induced a fall in baseline SAP (6 mmHg, $P < 0.05$) and a rise in HR (4 bpm, $P < 0.05$). In addition, there was a significant BP fall in the initial phase of the HUT that was greater in prone than in supine with the mean difference between supine and prone being 6% ($P < 0.01$). Baseline MAP and DAP were consistently less (by 1–9 mmHg) at 2–3 months in both sleep states and sleeping positions compared with both other ages.

Conclusions: In healthy term infants, both baseline BP and BP control are altered in the prone position and this is most marked at 2–3 months of age. An uncompensated fall in BP in the prone position at 2–3 months (when SIDS risk is greatest) could increase the possibility of circulatory failure and SIDS in vulnerable infants.

OP20.03 Spontaneous arousals in pacifier users versus non-users

Kerbl, R

Hospital of Leoben, Austria

Objective: Pacifier use has been postulated to decrease the risk of SIDS by favoring infant’s arousability from sleep. We evaluated the influence of a pacifier on the frequency and duration of spontaneous arousals in healthy infants.

Methods: Daytime polysomnography was performed in 14 infants with an age of 51.7 ± 19.9 days (mean \pm SD) who regularly used a pacifier during sleep. Cortical arousals (CA) and subcortical arousals (SCA) were scored according to the recommendations of the “International Paediatric Work Group on Arousals.” The number of arousals per 10-min period and the duration of arousals were determined for periods of pacifier use as well as for periods after pacifier dislodgement and were compared with the data of 10 control infants (age 49.8 ± 16.5 days) who never used a pacifier.

Results: Altogether, 211 arousals in pacifier users and 225 arousals in non-users were scored. In pacifier users, 2.0 ± 1.6 arousals per 10-min period with a duration of 12.2 ± 3.0 s occurred during pacifier use, and 1.7 ± 1.6 arousals per 10-min period with a duration of 12.2 ± 3.1 s occurred during periods without pacifier. In pacifier non-users, 2.3 ± 1.2 arousals per 10-min period (duration 13.9 ± 2.9 s) were scored. No significant differences between the different groups could be shown. However, when comparing CA and SCA separately, pacifier non-users had significantly more CA per 10-min period than pacifier users during periods without pacifier ($P < 0.05$).

Conclusions: Our findings suggest that other than arousal mechanisms might be responsible for the efficacy of pacifiers in SIDS prophylaxis.

OP20.04 SIDS: organ weights and pathophysiology

Goldwater, PN¹; Little, BB²

¹Children, Youth & Women’s Health Service and The University of Adelaide, Australia; ²Tarleton State University, USA

Background: Sudden infant death syndrome has been defined on the diagnosis based upon exclusion. An objective method to predict SIDS may aid the diagnosis of SIDS. Organ weights and other pathological features of cases of SIDS and non-SIDS deaths can be predictive of SIDS, perhaps increasing the certainty of diagnosis.

Objective: To derive a quantitative predictive model of group membership using autopsy organ weights in a cohort of SIDS cases and non-SIDS deaths.

Methods: Demographic, clinical, and organ weight data were extracted from autopsy reports of SIDS and non-SIDS deaths in South Australia and Victoria during 1977–2002. Autopsies were conducted by experienced pediatric pathologists; diagnosis of SIDS was based on current case definitions. Multivariate analysis of variance (MANOVA), multivariate analysis of covariance (MANCOVA), discriminant analysis, and allometric regression were used in the analyses.

Results: Organ weights were proportionately different between SIDS and non-SIDS cases from Adelaide, South Australia, and Victoria, Australia. The thymus and brain tend to be significantly heavier; the heart tends to be significantly lighter in SIDS compared with non-SIDS. A predictive model using brain, thymus, and heart weights was developed to assist in making a diagnosis of SIDS or non-SIDS. Though the three organ weights (brain, heart, thymus), body weight, and age, it was possible to correctly classify 83.9% of cases in the present study, with 83.2% sensitivity and 57.0% specificity.

Conclusion: The co-occurrence of heavier brain and thymus but lower heart and kidney weights suggests disrupted patterns of growth of vital organs may contribute to death in SIDS victims.

OP21.01 Meaning reconstruction following a SIDS loss

Krueger, G

Simon Fraser University, Canada

The reconstruction of meaning following a death due to sudden infant death syndrome (SIDS) is part of the grieving process for those involved in the loss. The trajectory and resolution of a SIDS loss is different in a number of ways from the usual grief progression when someone dies after a natural life course. Traditional stage theories and models regarding grief only partially explain the complexities of the problem faced by these parents, something that needs to be better understood not only by health professionals, but also by society at large. In the past few decades, researchers, using qualitative techniques, have provided more nuanced information about grief in general. These views enhance our understanding to a point, but there are still themes around the concepts of memory, support, restoration activities, and even grief itself that are unique to SIDS, unexamined in the past and underreported in the literature. This presentation will report on my 3-year grounded theory study examining narratives obtained from in-depth interviews with 21 parents in Canada who have lost an infant to SIDS. Thirty hours of transcripts were analyzed using a qualitative research software program and the resulting data reviewed with current literature to identify those areas that fit theory and those that are novel. Comprehending how parents cope and reconstruct their lives is an important element in understanding their needs in order to provide timely and appropriate interventions when necessary.

OP21.02 Dream babies

Wilson, R

UK

During pregnancy, a fetus grows and develops in the womb, unseen except in scans; after birth, the infant is developing into an individual

but despite intense observation by parents much of his or her future personality and skills and areas of difficulty remain unknown. When death brings an end to the life of the physical child, there is also the death of the alter ego—the child who has developed in the mind of each parent. That “dream baby” often has clearly defined individual characteristics which are not constrained by reality or time. Their whole future may be mapped out. Listening to parents in a weekly bereavement clinic over 30 years revealed the importance of the dream baby, the consequences of their death, and some of the effects on the future of the family. Some of our difficulty in understanding parents’ feelings and reactions may arise from not recognizing the existence and the death of the dream baby.

OP21.03 Sexuality and intimacy in parents following the loss of a child

Dyregrov, A

Center for Crisis Psychology, Norway

To broaden our knowledge about sexuality and intimacy following the loss of a child, a multimethod study was conducted. A questionnaire on intimacy and sexuality was sent to 1,027 members of the two major bereavement support organizations for parents who have lost children in Norway. A total of 321 (33%) were returned. In addition, 10 couples were interviewed in depth about their experiences. The results showed that around two-thirds of the parents had resumed sexual contact within the first 3 months after their child’s death. Around a third had their activity reduced. Significantly fewer mothers than fathers experienced sexual pleasure and close to 30% of the mothers experienced that this had been reduced since the death. Only 10% had experienced that sexuality as an issue was raised in follow-up conversations. There were clear gender differences in reactions and perceptions, often agreed upon by the two genders. Men were ready to resume usual activity in the sexual area much earlier than women. Women suffered much more from grief that in different ways intruded on the sexual act, and they perceived that sex somehow was wrong. Their need for closeness was also easily misunderstood by men as a wish for sex. Although the challenges in the sexual area demanded good communication and respect within the couple, there was a lack of support, counseling, and information. The provision of verbal and written information would help families through the post-loss period and may lower parental conflict and better relational coping.

OP21.04 Remembering, reflecting, never forgetting

A. Deri-Bowen, foundation for the study of infant deaths, UK

Deri-Bowen, A

FSID, UK

This abstract will reflect on my observations of bereaved family members during my 30-year involvement with FSID, both as a volunteer and as an employee for 21 years. This covers a period when the number of sudden unexplained deaths in the UK was approx 1,500 in the late 1970s and mid 1980s, to the greatly reduced number of 300 deaths a year at the present time.

The focus of this presentation will highlight:

- Ways in which family members move through the multitude of emotions which arise when a baby dies suddenly and how these emotions change and re-emerge over many years after the death.
- That there is a need for the bereaved to have the opportunity to talk about their baby and continue to ask questions in a

comfortable 'safe' environment without it being organized as a 'support' event.

- Some of the occasions when people have shared their thoughts and experiences even 50 years after the death. The content of the presentations comes from being involved with face-to-face befriending, group support, training volunteers, fund-raising events, family fun days, and while organizing the 10th SIDS International Conference.

PP01.01 Infant asphyxia, soft mattresses, and the 'trough effect'

Byard, R¹; Combrinck, M²

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Death scene examinations of sleeping environments have increasingly identified fatalities caused by accidental asphyxia from so-called sleeping accidents. *Case report:* A 5-month-old boy was found face down and unresponsive in a portable cot. At autopsy, there were no unusual features present, with no injuries or organic diseases present that could have caused or contributed to death. Radiologic, microbiologic, and metabolic testing were normal and neuropathologic evaluation was unremarkable.

However, the cot was old with a collapsible wooden frame and a base that consisted of a sheet of canvas with no supporting slats. Placing the infant back into the position when found demonstrated complete covering of the mouth and nose by a pillow with entrapment within a trough formed by the canvas base and bedding. Removal of the mattress and bedding revealed marked concavity in the stretched canvas base, which measured 60 mm in depth from the horizontal when unstretched, and 90 mm when pressure was applied. Based on the features at the scene, the cot examination, death scene reconstruction, and negative autopsy findings, death was attributed to accidental suffocation. In addition to again demonstrating the potential dangers of using old cots, this case clearly shows the problems that may exist when soft and sagging bedding forms a central trough that may entrap an infant. Death scene investigators should specifically comment on the presence of such troughs and measure the depth of the trough from the cot base to provide some quantification of the degree of concavity present.

PP01.02 A practical infant death classification schema

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¹University of South Dakota School of Medicine, USA; ²USA

In April of 2006, the National Forensic Pathology Service assumed responsibility for the medico-legal investigation of all sudden unexpected deaths in infancy (SUDI) in the Cape Town region of South Africa from the South African Police Service. As part of the process of initiating this Service, the Division of Forensic Medicine and Pathology, University of Stellenbosch, analyzed 11 SUDI cases using standardized autopsy and death scene investigation protocols. Six of the 11 deaths were due to established causes of death (e.g., infection, neoplasia). Using the 1991 SIDS definition (NICHD consensus), however, the classification of the remaining 5 deaths was problematic due to scene sleep safety issues, such as bed sharing and possible overlying, all suggesting possible asphyxia. We propose the following SUDI classification schema: (A) SIDS; (B) Unclassified-possible asphyxial-related (e.g., bed sharing, possible overlying); (C)

Unclassified-non-asphyxial-related (e.g., hyperthermia); and (D) Established cause of death. Using this schema, we classified the 5 problematic cases as four SIDS and one Unclassified-possible asphyxial-related. This schema is a workable method of infant death classification that is directly applicable to the type of infant death cases seen by forensic death investigators throughout the world. The future correlation of brainstem neurochemical findings with each of these 4 groups should help clarify relationships between environmental exposures to factors such as alcohol and smoking, brainstem abnormalities, and subsequent vulnerability to asphyxial stress.

PP01.03 Prevention of sudden infant death syndrome (SIDS): results of an information campaign in Bavaria

Gernhold, U; Ehrensperge-Reeh, P; Wildner, M; Nennstiel-Ratzel, U
Bavarian Health and Food Safety Authority, Germany

Objective: To spread knowledge about prevention measures for SIDS to parents and to active health and child care professionals, an information campaign was launched in 2005.

Methods: All maternal units and 500 randomly selected parents of 4-month-old infants were interviewed by questionnaires concerning knowledge and implementation of SIDS prevention measures. Subsequently information materials were developed and spread. Publicity was started. The simple and evidence-based main messages were: using a sleeping bag for the infant, back sleeping position, sleeping room temperature 1,618°C, the cot placed in the parents' room, no smoking, breastfeeding. Different occupational groups were involved to improve implementation of recommendations. To evaluate the campaign, maternal units and another random sample of parents were interviewed in 2007.

Results: The demand for information materials increased impressively after public relations work. In 2005 and 2006, 90 and 96%, respectively, of the maternal units indicated to give information to parents about prevention of SIDS. In 2005, 58% of the maternal units used back sleeping position with no further improvement in 2007. The use of sleeping bags has doubled. In 2007, 10% more parents indicated to have received information and exclusively used sleeping bags. Back sleeping position was chosen by 78% of the parents in 2005.

As in the maternal units this proportion did not improve. A subgroup analysis of parents with >2 children showed that they get less information and follow the recommendations not as well.

Conclusions: A questionnaire-based survey showed shortfalls concerning information and implementation of the recommendations. The information campaign had good acceptance. Nevertheless, implementation has to be improved on the professional and parental side. Maternal units appear to function as a role model. Parents of >2 children follow the recommendations less well and are less informed. Further intensification of the campaign is necessary.

PP01.04 Sterile site infection at autopsy in sudden unexpected deaths in infancy

Goldwater, PN¹; Highet, A²

¹Children Youth & Women's Health Service and The University of Adelaide, Australia; ²University of Adelaide Department of Paediatrics, Australia

Objective: To examine and compare bacteriological findings at autopsy of cases of SUDI and deaths of other cause.

Method: Autopsy review of normally sterile site (NSS) (heart blood, spleen, or cerebrospinal fluid) bacteriology of 130 SIDS cases, 32 cases of SUDI due to infection, and 33 cases of non-infectious sudden deaths.

Results: Sterile site infection was uncommon in cases of sudden accidental death; however, finding true pathogens such as *Staphylococcus aureus* in NSS in SIDS and deaths associated with infection was relatively common. 10.76% of SIDS had NSS *S. aureus*, compared with 18.75% of infection-related deaths. *S. aureus* was not found in accidental deaths. Incidence of coliform bacteria in NSS in SIDS was not significantly different from deaths of other cause. NSS bacteriology yielded no growth in 45.4% of sudden accidental death, 43% of SIDS, and 28.1% of infectious causes.

Conclusions: *S. aureus* in NSS in a large proportion of SIDS would indicate that a proportion died of staphylococcal disease. Although the differences in NSS isolation of *S. aureus* in the 3 infant groups did not quite achieve significance, nevertheless, on the basis of these findings and the characteristic virulence of *S. aureus*, it is recommended that SUDI from which *S. aureus* is isolated from sterile sites be considered for reclassification. From this study (and unfortunate mistakes not picked up by coroners or the judicial system), it is recommended that the opinion of a consultant microbiologist be sought to interpret microbiological findings prior to finalizing autopsy reports on SUDI.

PP01.05 The most important modeling job of your life: continuing education for nurses on SIDS risk reduction

Graham, K; Kallash, H

First Candle/SIDS Alliance, USA

Objective: To ensure that every parent leaving a hospital has heard about and seen nurses model safe infant sleep practices.

Methods: First Candle and the National Institute of Child Health and Human Development developed an educational initiative to increase the capacity of nurses to educate families about SIDS risk factors. Research on parent decision-making indicates that some parents place their infants to sleep on their stomachs because nurses did so in the hospital. Research confirmed that many nurses were not back sleeping infants in hospitals. However, if back sleeping is modeled in the hospital, the proportion of parents following SIDS risk reduction practices increases. The educational initiative consists of: (1) A CEU that shares the latest risk-reduction information on SIDS and methods to communicate this information to parents in a culturally competent manner; (2) Provision of sample safe sleep policies and procedures for maternity units to create their own safe sleep policies; and (3) In-person trainings conducted at multiple venues (national/regional nursing conferences, hospital in-services, and public health staff trainings).

Results: To date, 22 national/regional trainings were conducted; 751 nurses completed the CE and more than 10,000 nurses have been exposed to the curriculum at more than 37 regional/national conferences nationwide. Program evaluations scored an average participant satisfaction of 4.92 on a 5-point scale. Nurses were able to increase their knowledge in the post-test when compared with the pre-test by 35%, and 70% achieved 90% or above on the post-test.

Conclusions: The combination of venues provided an opportunity for nurses to come into contact with the curriculum on multiple levels,

fostering sustainability through institutionalization of the curriculum recommendations.

Training venue	Benefits	Challenges
National Conferences	<ul style="list-style-type: none"> • Less logistical details to organize • More cost effective • CEUs are included in the registration fee • Networking in exhibit hall • Marketing handled by the conference planners 	<ul style="list-style-type: none"> • Significant lead time required to meet abstract deadlines • Difficult to complete required paperwork for CEUs and program evaluations • Shorter presentation time periods—45 min • Competing concurrent sessions
Regional Conferences	<ul style="list-style-type: none"> • Less logistical details to organize • More cost effective • Marketing handled by the conference planners • Longer presentation times—90 min 	<ul style="list-style-type: none"> • Competing concurrent sessions • Smaller venues and less participants • Less opportunity to exhibit and exhibit hall traffic
Public Health Organization	<ul style="list-style-type: none"> • Excellent opportunity to support local program efforts • Opportunity to sustain the effort on a local level • Greater control over program and collection of evaluations 	<ul style="list-style-type: none"> • Greater time and effort to organize logistically • Greater cost associated with the planning and registration
Hospital In-service	<ul style="list-style-type: none"> • Ability to institutionalize the curriculum • An opportunity to directly address issues related to the recommendation • Difficult to schedule trainings • Shorter sessions—30 min 	<ul style="list-style-type: none"> • Disjointed environment, less conducive to learning • Number of participants reflects commitment of hospital administration

PP01.06 SUDI and stillbirth: public health messages for prospective parents

Richardson, R; Harrison, LJ

SIDS & Kids, NSW, Australia

SIDS and Kids NSW supports those who experience the death of their baby or child during pregnancy, birth and infancy, including the experiences of miscarriage and early pregnancy loss, stillbirth, neonatal and infant death and the death of a child up to 6 years. Our role includes the provision of support services for bereaved parents and community education for those who are or plan to be pregnant. New South Wales is Australia's highest populated state, with approximately 88,000 births annually. More than 1,000 families experience the death of their baby or young child within our brief each year.

SIDS and Kids NSW receives an average of 20 inquiries weekly, requesting information about reducing the risks of SUDI. Many callers are beyond the 20th week of pregnancy and contact us as they make preparations for their baby. We provide evidence based public health information to callers about reducing the risks of SUDI. However, in the absence of a public health campaign about the risks of stillbirth, we give no information about the importance of being vigilant about the well-being of mother and baby as pregnancy progresses. In recent times, several callers have re-contacted us thanking us for the information we gave about SUDI, but informing that their baby was stillborn. Many anecdotally report that they delayed seeking medical attention despite a prolonged period of lack of fetal movements, in the belief that this is to be expected or with a sense of not wanting to trouble their health care provider.

This paper will explore this dilemma for health professionals, highlighting the lack of awareness of stillbirth and the current gap that exists between the known risk factors for stillbirth and the lack of public health campaigns through which professionals can be equipped and inform prospective parents informed.

PP01.07 International trends in sudden infant death syndrome

Hauck, F

University of Virginia, USA

Objective: To compare international trends in SIDS and postneonatal infant mortality rates following implementation of SIDS risk reduction campaigns. This presentation will update and expand information presented at the 2004 SIDS International Conference.

Methods: National SIDS and postneonatal mortality rates were collected from a number of sources: websites from vital statistics centers; published reports; and correspondence with leading SIDS researchers, who collected the data from their respective national registries or vital statistics offices. Updated SIDS data were obtained for 12 countries: Argentina, Australia, Canada, England/Wales, Germany, Ireland, Japan, the Netherlands, Norway, Scotland, and US.

Results: There has been a striking decrease in SIDS rates in all the countries, following risk reduction campaigns. However, since 2000, rates in several countries have remained stagnant, and there is considerable inter-country variability. Trend data for both SIDS and postneonatal mortality in the 12 countries will be described and compared.

Conclusions: Campaigns have been successful in reducing the incidence of SIDS, but recently, stabilization of rates is cause for concern.

Several factors contribute to the variability in rates across countries, including differences in definition, diagnostic methods and classification, and risk factor profiles. Standardizing diagnostic methods and classification of SUDI will help make international comparisons more meaningful. SIDS risk reduction education must also be continued, with emphasis on high-risk communities and settings. In addition, the process of data collection across countries is arduous. A streamlined and accessible system for international surveillance needs to be established.

PP01.08 Evidence-based transitioning of newborn intensive care unit (NICU) patients to American Academy of Pediatrics (AAP) guidelines

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Objective: The AAP has published clear guidelines for sleep position and the sleeping environments for all infants. Many practices in NICUs directly contradict AAP guidelines. Clearly a transition needs to occur so that NICU nurses can model correct sleep position and environment significantly prior to discharge. Studies have shown that in many NICUs, transitioning is delayed until almost discharge due to perceived contraindications. Several NICUs requested a "Transitioning Policy."

Methods: For each needed transition we created a list of commonly felt contraindications. We then did a literature search to assess whether any of these were indeed contraindications.

Results: As seen in the table below for sleep position, only continued need for oxygen might be a reason to continue prone sleep. Similar review of other factors such as soft bedding, boundaries, and bundling suggested that these could be transitioned by 32–34 weeks gestation.

Conclusion: Most NICU patients should be able to be transitioned early, once NG feeding is established and respiratory support stopped, and AAP recommendations modeled for a significant portion of their NICU stay.

Supine sleep	Research finding	References	Valid
GE reflux	Will handle reflux better supine	Jeffrey (1999)	No
Infant comfort	Prone prolongs QT interval, reduces HR variability, not worth risk	Ariagno (2003)	No
Apnea, Bradycardia	No increase in A + B when supine	Keene (2000)	No
Temp.	Temp. regulation, autonomic	Franco (2002), Home (2001)	No
Regulation	Control better supine		
NG feeding	Once on full feeds tolerate supine NG or PO	Hillman (unpublished)	No
Need for oxygen	No O ₂ prone does not improve, on O ₂ prone improves	Bhat (2003), Aris (2006)	Yes

PP01.09 Prenatal and postnatal risk factors of ALTEWasilewska, J; Kaczmarski, M; Sawaicka-Zukowska, M

Medical University of Bialystok, Poland

Objective: The aim of the study was to search for risk factors of ALTE from conception to the prenatal life.**Methods:** The study included 400 children hospitalized in III Department of Pediatrics, Medical University of Bialystok. We investigated the courses of pregnancy and neonatal period based on medical surveys of 27 ALTE patients and 373 with other diseases (GER, bronchial asthma, allergic rhinitis). Detailed medical history of pregnancy, delivery, perinatal period, and infant care practices were analyzed. Statistical analysis was performed using GraphPad Prism 4 Software.

ALTE (%) (n = 27)		Non-ALTE (%) (n = 373)	P
Normal gestational age (38–42 hbd)	92.3	89.5	ns
Birth weight (g)	3,437 ± 504.9	3,395 ± 513.8	ns
First pregnancy	57.69	50.4	<0.05
Pathology of pregnancy	55.55	22.25	<0.05

Results: The groups did not differ in: gestational age, birth weight, APGAR score, delivery mode, body sleep position. In more than 55% of mothers of ALTE infants, gestation was complicated by infection (18.52 vs. 4.83%, $P < 0.05$), contractions (33.3 vs. 6.97%, $P < 0.05$), hypertension (7.40 vs. 0.8% $P < 0.05$), gynecological bleeding (11.1 vs. 5.36%, $P < 0.05$), and anemia (22.22 vs. 3.75%, $P < 0.05$).

Over 37% of ALTE patients showed pathological course of the neonatal period versus 21.08% of children from the non-ALTE group. During infancy, most children with ALTE (44.4%) slept side, whereas in the non-ALTE group supine position was predominant during sleep (38%). During the infantile period, in over 51% of houses of ALTE children, the ambient temperature exceeded 21°C versus over 43% in the second group.

Conclusion: First pregnancy, diseases during pregnancy, history of apnea episodes in neonatal period, and the use of a pacifier should be considered as risk factors for ALTE.**PP01.11 Behavioral features during sleep in the infants born with low birth weight and modifying effect of kinesthetic stimulation**Kelmanson, I

Raoul Wallenberg International University for Family and Child, Russian Federation

The study aimed at evaluating behavioral features during sleep in infants born with low birth weight (LBW) and at evaluating modifying effect of kinesthetic stimulation.

Compared with healthy matched control infants born at term with normal weight, 100 infants born with LBW presented at the age of 2 months with longer average total sleep duration, principally due to longer night sleep. More often parents rated LBW infants as sleeping too long and falling asleep in the transport; by the bed time, they

were more often ready to fall asleep, but more frequently needed parents in the room and were put into parental bed before. LBW infants were more frequently brought to parental bed, if they wake up at night.

Fifty LBW infants were assigned to kinesthetic stimulation at the age of 2 months. This included massage (rubbing, stroking), passive movements of the limbs and other maneuvers performed by professionals until the infant is 8 months old. At the age of 8 months, the infants from intervention group less often snored during sleep, less frequently required extra feeding on waking up at night, and were apparently more alert at the daytime compared with matched LBW infants who did not receive any special kinesthetic stimulation.

The findings were similar for the babies who were either born preterm or LBW, but at term. Associations remained significant after adjustment was made for major potential confounding factors. Kinesthetic stimulation may be undertaken to improve quality of sleep and to reduce the risk of sleep-disordered breathing in the infants born with LBW.

PP01.12 Side sleeping position: hardly modifiable risk factor for sudden infant death syndrome (SIDS)?Kiechl-Kohlendorfer, U; Pupp, U; Riemer, B

Innsbruck Medical University, Department of Pediatrics, Division of Neonatology, Neuropediatrics and Metabolic Diseases, Austria

Objective: To investigate whether there was a significant decline in side sleeping position in Tyrol over the last 5 years due to a prevention campaign, and to assess factors associated with side sleeping.**Methods:** In an ongoing cohort study, data on child care practices including sleeping position, smoking during and after pregnancy, and breastfeeding have been collected by questionnaire for all infants born in the Tyrol (study period January 2002–September 2007; $n = 27,521$, response rate 69%).**Results:** Prevalence of side sleeping decreased from 50.4% in 2002 to 25.3% in 2006 ($P < 0.001$). In 2007, still 21.9% of all parents place their infant on the side position for sleep. Parents who laid their infant side were more likely to have a low educational level, to be single parents, to smoke in pregnancy, and, thereafter, and to have more than one child.**Conclusion:** Although information on side sleeping position being a risk factor for SIDS became known among the population, further efforts should be made to achieve behavioral changes in those groups of parents who continue to place their infant side.**PP01.14 Infant sleep location in the United States: associated maternal and infant characteristics with this SIDS prevention recommendation**Fu, LY¹; Colson, ER²; Corwin, MJ³; Moon, RY¹¹Children's National Medical Center, USA; ²Yale University, USA; ³Boston Medical Center, USA**Background:** In 2005, the AAP recommended infant-parent room-sharing (without bedsharing) to further reduce the SIDS rate. It is yet unknown how prevalent roomsharing is in the population, and if it is more prevalent in certain demographic groups. The goal of this study is to evaluate sleep location for U.S. infants, and to identify family demographic characteristics associated with high-risk vs. low-risk infant sleeping arrangements.

Methods: Interviews were conducted with 708 mothers of infants at Women, Infants, and Children centers in four US cities in 2005. Data were analyzed to identify and quantify factors associated with the choice of infant sleep location. Multinomial logistic regression models were developed for sleeping arrangement last night as a 3-level outcome: (1) roomsharing without bedsharing; (2) bedsharing; (3) solitary sleeping.

Results: Of the 708 respondents, 48.6% reported roomsharing (without bedsharing), 32.5% reported bedsharing, and 18.9% reported solitary sleeping. In the multinomial logistic regression, roomsharing without bedsharing was more common than solitary sleeping if the mother was Hispanic (RRR 3.03, 1.337-14) and if the baby was <3 months of age (RRR 1.75, 1.02-3.03). Roomsharing without bedsharing was less common than bedsharing if the mother was a teenager (RRR 0.41, 0.26-0.67), black (0.43, 0.26-0.70), or had a high school education or less (0.45, 0.23-0.88).

Discussion: Roomsharing without bedsharing is practiced by almost half of this study population. It is more common for younger infants and Hispanic families. Bedsharing accounts for sleep location in approximately 1/3 of this study population and is more common among black families, teenage mothers, and mothers with less education. These three factors are also epidemiologic risk factors for SIDS. It is important to identify and understand the reasons that families with these demographic characteristics bedshare.

PP01.15 An examination of SIDS and first nations in Canada

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A child is a gift from the Creator, and while they are with us, it is our responsibility to look after them and as much as possible to guard them from potential dangers. A Canadian cohort-based study of live births (First Nation and non-First Nation) registered in British Columbia, 1981-2000, demonstrated that neonatal and postneonatal mortality rates for First Nation infants showed a steady decline in rural areas but a rise-and-fall pattern in urban areas. SIDS is a major cause of infant death in First Nations communities in Canada. While the cause for SIDS is unknown, the Regional Longitudinal Health Survey of First Nations in Canada states that 36.6% of First Nations children were exposed to some maternal smoking use which is a risk factor. There is very little culturally appropriate information available to inform expectant and new parents about ways to reduce risks. To address risk reduction strategies, NIICHO developed Look up to our Ancestors brochure and bookmark which provides basic information on SIDS from a Canadian Aboriginal perspective asking parents, as a reminder, to whisper "look up to our ancestors" when putting the baby down to sleep. In Canada, First Nations and Inuit have the highest smoking rates. To reduce SIDS, we need to encourage smoke-free environments. A First Nations specific sign Welcome to our Smoke-free Home! Second-Hand Smoke Kills. Please Smoke Outside with a fact sheet was developed. This is a community resource to promote a smoke-free environment, which at the same time provides information on the harmful effects of second-hand smoke to smokers, non-smokers, children, and unborn babies.

PP01.16 The historical transition and plan for diagnosis system of SIDS in Japan

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³Department of Mental Retardation and Birth Defect Research, National Institute of Neuroscience, Nati, Japan; ⁴Mie University, Graduate School of Medicine, Department of Developmental and Regenerative Medicine, Japan

The concept of SIDS was introduced to Japan for the first time in 1973. At that time, sudden death was considered suffocation. The Ministry of Health and Welfare composed a SIDS research team in 1981. The first work of the research group was to propose the definition of SIDS. This definition did not require complete autopsy to make diagnosis.

The purpose of this definition was to enlighten the concept of SIDS. After this definition was announced, the diagnosis of SIDS increased; on the other hand, the number of suffocation cases decreased. In 1995, the research group renewed the definition making a complete autopsy indispensable for SIDS diagnosis. However, as a result of considering the low autopsy rate, the renewed definition permitted the non-autopsied cases to be diagnosed as suspected SIDS.

Owing to the back to sleep campaign, the SIDS rate decreased and it became to 0.25 per 1,000 live births. But it reached the ceiling; in addition, social problems were illuminated. Finally renewed definition was proposed in 2005, which excludes non-autopsied case from SIDS. This renewed definition suggested that the role of research group has not only been enlightenment but also promotion of appropriate diagnosis and effective research. In March 2008, we started a diagnosis and research system in the Tokyo area. The next step is to expand this system throughout Japan. There is still argument about how to compose the research resource bank. In any case, this has already been started in March 2008 and is to be established by 2010.

PP01.17 Is there an interest to prolong cardiorespiratory recordings in preterm infants before discharge

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Objective: Cardiorespiratory recordings (CRR) were used to inform the clinician about maturation of the cardiorespiratory function in preterm infants. The duration of these recordings varies widely among institutions. In our hospital, the recordings last 36 h. Using these recordings, the objective of this study was to evaluate the agreement between two successive nights and between night and day.

Objective: From October 2005 to November 2007, CRR were recorded during successive 36 h in preterm infants with persistent

apnea and bradycardia (PAB) in neonatal unit or in preterm infants after an ALTE at home (one recording per infant). We evaluated the frequency of bradycardia (<80 bpm for >5 s) every 12 h (night1: 8 pm–8am, day: 8am–8 pm, night2: 8 pm–8am). It was hypothesized that a 12 h recording is altered if it contains ≥ 1 bradycardia.

Results: 54 infants (32 weeks of gestational age at birth (26–36.5)) were included in this study: 25 infants for PAB and 29 infants for ALTE. The postconceptional age was 39.5 weeks (35–46) at the recording. Two groups have similar demographic data. 39 infants exhibited bradycardia (median 3 (0–17)); the PAB group exhibited more bradycardia than the ALTE group ($P = .002$). Non-paired Wilcoxon Test was used to calculate P .

Nine infants, who did not have bradycardia for the first 12 h of the study, had at least one bradycardia for the last 24 h. The agreement value was moderate between two successive nights for the whole population ($\kappa = 0.55$), was good for the ALTE group ($\kappa = 0.64$), and was mild for the PAB group ($\kappa = 0.29$). The agreement value between night and day was moderate (night1/day = 0.52 and day/night2 = 0.44).

Conclusion: The agreement value of CRR results between two successive nights was moderate. The best duration of these recordings has to be determined as well as the value of these results for the occurrence of ALTE after discharge.

PP01.18 Enigmatic apnea and progressive encephalopathy

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A case presentation of a male infant with hypoventilation and apnea that developed slowly and then regressed neurologically with the onset of severe epilepsy at 10.5 months. He died at the age of 14 months. Multiple investigations during life failed to elicit an underlying cause. After autopsy and review of the brain pathology internationally MECP2 analysis was undertaken, and he was found to have a MECP2 808delC deletion.

PP01.20 Impact of cerebral injury on postnatal sleep maturation in a cohort of very preterm newborns

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Objective: For the very preterm newborn, little is known about the impact of neurological aggression on the maturation of sleep architecture.

Method: We have compared sleep organization between preterm newborns with normal or poor neurological outcome with the analysis of complete polysomnography at term-corrected gestational age (GA). The children were born at 27 weeks of GA or less, or weighing less than 1 kg at birth. A neuropsychiatric follow-up of these infants was organized. Two groups were constituted: a first one with children

without any neurological disorder among cerebral palsy, language or mental retardation, visual or hearing disability, and attention disorder and a second group with children with at least one of these impairments. A MIMIC (Multiple Indicator Multiple Cause) model was used to study the relationship between neurological development status and two sleep latent variables: the spontaneous arousability, described by the number of awakenings (AW) or movements (M) per hour of quiet sleep (QS) and of active sleep (AS), and the QS organization, described by the median duration of QS cycle and the percentage of QS. Other explicative data were introduced in the model: standardized GA at birth, day or night recording, SGA, and sex.

Results: 45 Neonates were included in the analysis. No demographic medical characteristics presented statistical differences between the two groups. Spontaneous arousability was found to be significantly associated with neurological development status, the number of AW or M per hour of QS was multiplied by 1.44 [1.00–2.05], and the number of AW or M per hour of AS was multiplied by 1.10 [1.00–1.27] for the 19 preterm neonates with normal development. Spontaneous arousability was also found to be significantly increased for day recording.

Conclusion: This work suggests that neurological injury could compromise the spontaneous arousability for the very preterm newborns and then contribute to the increased risk of SIDS in this population.

PP01.21 Investigating the risk factors for sudden infant death syndrome

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Objective: To investigate the risk factors for sudden infant death syndrome (SIDS) in the infants sleep environment in a population where few infants sleep prone.

Methods: A population-based SIDS case-control (GeSID) study over 3 years (1998–2001) in Germany.

Results: There were 333 SIDS cases and 998 matched controls. Although there were few infants placed prone to sleep, those that were prone were at a high risk of SIDS (adjusted OR = 7.08, 95% CI = 3.69–13.60). Those who were unaccustomed to sleeping prone were at very high risk (adjOR = 37.73, 95% CI = 5.37–265.27) as were those who turned to prone (adjOR = 18.54, 95% CI = 7.84–43.87). Bed sharing increased the risk of SIDS (adjOR = 2.73, 95% CI = 1.34–5.55). Duvets were associated with an increased risk of SIDS. Sleeping prone on a sheepskin increased the risk for SIDS (adjOR = 27.92, 95% CI = 6.45–120.91). Sleeping in the house of a friend or a relative was associated with an increased risk of SIDS (adjOR = 4.39, 95% CI = 1.11–17.38) compared with sleeping in the parental home. Pacifier use was associated with a significantly reduced risk of SIDS.

Conclusion: This study has clarified the risk factors for SIDS in a population where few infants sleep prone. This study supports the current recommendations of the American Academy of Pediatrics.

PP01.22 Infant death in ecological region of Poland

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Objective: The aim of the study is to make a comparison between infant mortality rates in the ecological region of Poland and infant mortality rates in the whole country. This region, i.e., Podlasie, also called the Green Lungs of Poland due to a number of national parks, is inhabited by approximately 1,197,000 people (3.1% of all people in Poland).

Methods: Demographical data from Central Statistical Office in Warsaw and data from Regional Office of Medical Statistics in Białystok (the capital of the region) were used to compare infant death rates.

Results: Infant mortality index in Poland in 1995 was 13.6/1,000 live births and decreased during next 10 years to 6.8/1,000 live births in 2004. In the year 2004, 55 infant deaths were noted in the Podlasie voivodship: 37/55 (67.3%) in towns and 18/55 (32.7%) in rural area; in Białystok—16 death (29.1%). The causes of death were: prematurity (23/55), inborn anatomical defects and metabolic errors (17/55), lung infections (6/55), hypoxic-ischemic encephalopathy (3/55), inborn toxoplasmosis (2/55), sepsis (2/55), and cancer (2/55). Data of infant mortality rates are summated in table.

Conclusion: Lower infant mortality rates in the ecological low-industry region of Poland pose a question: How strong does the industrial environment affect infant death?

Year	2000	2001	2002	2003	2004
Number of infant deaths	88	74	81	57	55
Number of live births	12,080	11,601	11,265	10,792	10,692
Infant mortality in ecological region of Poland	7.28	6.38	7.19	5.28	5.14
Infant mortality in Poland	8.11	7.67	7.52	7.04	6.8

PP01.23 Compromised placental morphology in Sudden Infant Death Syndrome (SIDS)

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Objective: Fetal development in utero is largely dependent upon the transfer of oxygen and nutrients between the mother and the developing fetus via the placental trophoblast. In this study detailed stereological analyses of placental villous trophoblast from SIDS infants was undertaken to determine whether alterations in trophoblast morphology may lead to placental insufficiency, resulting in compromised fetal growth and development through delayed or arrested fetal organogenesis in utero, thus contributing to the sudden and unexpected death of an infant postnatally.

Methods: SIDS placentae were retrieved from archived storage following a complete autopsy by a pediatric pathologist and further subdivided into normal birth weight (SIDS-NBW) ($n = 12$) and low birth weight (SIDS-LBW) ($n = 12$). Volumes were estimated using stereological analysis on thin FFPE sections stained with H&E for the cytotrophoblast (CT), syncytiotrophoblast (ST), and syncytial knots (SK). Comparisons were made between (i) control and SIDS-NBW and (ii) SIDS-LBW and IUGR; this separation was undertaken to distinguish whether differences observed were due to SIDS specific factors, those relating to IUGR, or both.

Results: Total trophoblast volume was increased in the SIDS-NBW placentae due to a significant increase in ST volume; CT volume was also increased but not significantly. In contrast, SIDS-LBW placentae exhibit reduced CT volumes while ST volume remained unchanged. These placentae also displayed a reduction in the volume of the syncytial knots.

Conclusion: Placentae from SIDS infants are morphologically compromised, potentially predisposing the infant to delayed and/or arrested organogenesis in utero via perturbed oxygen and nutrient

transfer between the mother and the fetus. Although IUGR placentae also show morphological changes, the degree of compromise is far more severe than in the SIDS-NBW or SIDS-LBW placentae.

PP01.24 The maturation of sighs and startles during relief from brief airway occlusions

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We have shown that relief from sleep related airway obstruction is closely related to a cardio-respiratory arousal mechanism including activation of diaphragmatic, submental, nuchal muscle groups, and heart rate increase as well (Wulbrand 1995). This arousal mechanism is characterized by a sequence of events started by an initial sigh with a startle (Lijowska 1997). It does not to occur as an "all or nothing"—event but graded (Wulbrand 1998).

Since the intensity of such a mechanism might be crucial for survival of a life resuscitating event during airway obstruction, we studied the maturation of sighs and startles during external airway occlusion in 12 normal, healthy infants aged from 34 to 134 days during a daytime nap in terms of magnitudes and timing.

Results: Arousal-related defense behavior during airway occlusion is characterized by a sequence of events beginning with an initial biphasic sigh after 4.8 ± 1.7 SD (NON REM)/ 5.5 ± 2.3 SD (REM) s. During the second phase of this biphasic sigh, a startle occurred accompanied by a neck extension after 6.1 ± 2.0 SD/ 6.5 ± 2.6 SD). It was usually paralleled by a head turn, and then followed by general body movements (after NON-REM: 7.4 ± 2.3 SD, REM: 6.7 ± 2.3 SD).

With growing age the latency of the startle, neck extension, and body movement occurrence decreased (NON-REM/REM: $P < 0.005$) while the latency of startle occurrence during a sigh also decreased (NON-REM $P < 0.01$). The intensity of a startle increased (NON-REM: $P < 0.02$) with growing age.

Thus during maturation the latencies of the arousal-related events are decreasing while the intensity of startles are increasing with age. Impairment of the maturational development of the arousal process might increase the risk of SIDS in terms of upper airway compromise during sleep.

PP01.25 Poverty, unbalanced development, and child mortality: analysis of child mortality in China

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Background: Child mortality indexes (including IMR and Under Five Mortality Rate) are the most important standard, which evaluates a country's economic situation, education, residents' health, and sanitation improvement. Poverty is a social result, which may caused by unfair incoming during the economical development. Economists and sociologists study poverty from their own academic points.

Methods: Child Mortality includes several concrete indexes, such as infant mortality, Under Five Mortality Rate. This thesis would like to investigate the relationship between child mortality problem and poverty through the demonstration of the Chinese case. This thesis uses the data which mainly come from Chinese-published statistical yearbook and various research papers. The main research method in this thesis is reference method and correlation analysis for various variables.

Conclusion: From the analysis and comparison, some conclusion can be made: The child mortality level in whole China is experiencing increasingly declining trend. However, China has broad space for its IMR and U5MR to decrease further. As to respective child mortality in every province of China, there is local gap among different provinces. The analysis indicated that child mortality involves some elementary factors that influence the daily life of people, such as clear water, sanitary washroom, basic medical service, and financial support for the poor. The most important issue for the further improvement of child mortality problem in China is to optimize the collocation of Chinese sanitation resources. Further improvement of Child mortality in China will face two main challenges: the distribution of limited sanitation resource and the birth defect problem.

PP02.01 Progress toward a national sudden unexpected infant death case registry in the United States

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The United States Centers for Disease Control and Prevention (CDC), as part of their Sudden Unexpected Infant Death (SUID) Initiative, has under taken both research and program activities to better understand and prevent SIDS and SUID in the United States. This presentation will describe CDC's new efforts in establishing a national SUID case registry, including the type of data collected, available data sources, partners involved, and potential uses of the data for preventing infant deaths.

The CDC has convened a National Work Group to assist in defining the technical aspects and methods necessary to develop and implement a SUID case registry, including a comprehensive understanding of stakeholders, potential data sources, and logistics in collecting and analyzing information. The goal of the SUID Case Registry is to collect comprehensive epidemiological data from multiple sources about the circumstances and factors associated with SUID deaths. The information gathered in the registry will allow more accurate and consistent classification of SUID deaths that can improve our understanding about the incidence of, and risk factors associated with, SUID. This improved data will be essential in informing public health officials, prevention groups, and policy makers so that they can develop and monitor effective prevention strategies.

This presentation will describe the work accomplished by the National Work Group to date and outline the work ahead.

PP02.02 Sudden unexplained death in childhood program of CJF: information, support, and research opportunities for sudden unexplained toddler deaths

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The Sudden Unexplained Death In Childhood Program (SUDC) was created in September 2001 within the CJ Foundation for SIDS. It is the first and the only one of its kind worldwide. It is tasked with providing a centralized resource for information, support, advocacy, and research. It serves families and professionals affected by the tragedy of SUDC and promotes awareness of SUDC in communities.

Sudden Unexplained Death in Childhood (SUDC) is the sudden and unexpected death of a child over the age of 12 months, which remains unexplained even after a thorough case investigation is

conducted. This must include: examination of the death scene, performance of a complete autopsy, and a review of the child and family's medical history. SUDC is a diagnosis of exclusion—given when all known and possible causes of death have been ruled out.

Our mission is:

- To provide a centralized resource for SUDC
- To advocate for and provide research opportunities in the area of SUDC
- To develop peer support among families
- To share accurate and current SUDC information with families, professionals, and communities
- To improve the public's awareness and understanding of SUDC
- To advocate for issues relative to SUDC
- To raise charitable donations to meet the many needs of SUDC

Since its creation, the SUDC Program has assisted over 300 families worldwide who have suffered the loss of a child due to SUDC. Outreach services utilizing technology to bring together geographically separated families are an important part of our services. Collaborating with international organizations and U.S. State-based programs to assist in our mission is crucial to the support of families worldwide and the awareness of SUDC. The SUDC Program and the SUDC Research Project work closely together to uncover the cause(s) of SUDC and assist families in the aftermath of the death of their child.

PP02.03 Prevention of sudden unexpected death in infancy in Flandres, Belgium

de Ronne, N

Child and Family, Belgium

The first campaign concerning the prevention of sudden unexpected death in infancy started in autumn 1994. After this there has been a considerable fall in the prevalence of deaths in the first years after launching the campaign, but afterward there is a status quo.

Still sudden unexpected unexplained death remains the leading cause of postneonatal mortality in Flandres. Male infants are more vulnerable compared to female infants. Unlike other countries, there are more deaths during the week, especially the first days of the week.

As described by some other authors, there seems to be a problem in daycare initiatives in which there are relatively more cases of deaths compared to the home situation. Specific enforcement is needed to ensure the messages are being followed by every new parent, and especially by those in socioeconomic lower classes as well as in allochtone cultures living in Flandres.

Reinforcement of the preventive messages is needed with attention on back sleeping position, avoiding smoking during and after pregnancy, low temperature and safe sleep environment, and keeping an eye on the infant during sleep.

PP02.04 A 5-year analysis of 47 sudden unexpected infant and child deaths in the County of Hertfordshire

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This report analyzes police, coroner, and, where relevant, serious case review records in 27 "infants" (<1 year) and 20 "children" (aged

1–18 years) who had died suddenly and unexpectedly in Hertfordshire over the 5 years, Jan 2001–Dec 2005.

In the infants, 23 (85%) deaths were recorded as SIDS/SUDI. Thirteen infants died in the first 3 months of life and none had been sleeping in a cot or Moses basket. Nine died in the first month and breast feeding was the stated reason for co-sleeping in 4. Eight (30%) infants had child welfare concerns which could have been better managed in 4. Two with inflicted limb fractures repeatedly presented with irritability associated with suspected bruising and/or bleeding.

Thirteen children died at home, 5 outdoors, and 2 in hospital. Causes of death were usually stated and were many and varied with less child welfare concerns.

Discussion: In the infants, co-sleeping and child welfare problems were a frequent finding despite no apparent cause of death. In the children, there were no common factors despite a stated cause of death in most. Paradoxically, we should be able to prevent some infant deaths but few child deaths.

Messages: Recurrent irritability in conjunction with bruising or bleeding in an infant requires exclusion of occult injury. Assessment of parents of new-born infants should include ability to follow both Back to Sleep and UNICEF/FSID co-sleeping advice. Ascertainment of all deaths as currently proposed may have limited impact unless backed up by structured epidemiological research.

PP02.05 The SUDI protocol: a case report illustrating the value of the home visit and the dangers of choking on nappy sacs

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A 5-month-old girl was found unresponsive in the evening by her mother. She had been well during the day and had been put down to sleep supine in the corner of a double bed. The mother was living in a women's refuge where she had fled to escape domestic violence fuelled by alcohol misuse. Resuscitation was carried out at the scene by the staff at the refuge but she was dead on arrival in hospital. On examination, there was frothy blood stained secretion around her mouth and nose.

Investigations were carried out according to the local 'Sudden Unexplained Death in Infancy' (SUDI) protocol. A home visit was carried out by the pediatrician and police officer the next morning. The bedroom was untidy with several small plastic "nappy sacs" (for disposing of used nappies) scattered around the room and on the bed within easy reach of the infant. On the floor in the corridor outside the bedroom, a crumpled nappy sac covered in pink froth was found. On further questioning, the mother said that she had picked up her baby, put her over her shoulder, and run down the corridor screaming. At the place where the crumpled nappy sac was found, she had passed the baby to a staff member who attempted resuscitation. The infant had been seen playing with one of these nappy sacs in the hostel the previous day. It was thought likely that she had screwed up the nappy sac, put it in her mouth, and asphyxiated. When her mother gave her to the staff member, the nappy sac would have become dislodged from her airway and fallen onto the floor.

All the SUDI investigations, including the skeletal survey, were normal and the cause of death could not be ascertained on postmortem examination. At the multiagency meeting which followed, serious child welfare concerns were expressed but the most likely explanation was thought to be accidental asphyxia. If the nappy sac had not been found, a very different conclusion might have been reached.

The SUDI protocol and death scene will be illustrated.

PP02.06 Cytomegalovirus (CMV) infection diagnosis in a case of sudden unexpected infant death (SUDI)

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Sudden Unexpected Infant Deaths (SUDI) are the major causes of death in infants between 1 month and 1 year of age. They may be due to infections, congenital anomalies, metabolic diseases, accidental and non-accidental injuries, or by causes which remain unidentifiable even after "a thorough case investigation, including the performing of a complete autopsy, examination of the death scene, and review of the clinical history." Epidemiologic aspects and several studies indicate that infectious agents might play a specific pathogenetic role in SUDI and a number of histological findings confirm this hypothesis. We report a case of a 2-month-old infant who died suddenly and unexpectedly without prodromal symptoms and was found dead in a prone position in his crib. As mentioned above, a thorough investigation of the case, including a complete autopsy and a review of the circumstances of his death and clinical history, was performed. Multiple sections of paraffin-embedded samples from heart, conducting system, lung, brain, and other organs were stained with conventional hematoxylin-eosin and immunohistochemistry (LCA; CD45RO; CD 20; CD68; CD4; CD8).

Total DNA was also extracted from the paraffin-embedded tissues for performing a Real-Time PCR for CMV viral DNA. Histological features of diffuse interstitial leukocytes were found in the myocardium, also involving the cardiac conduction system, with focal necrosis of myocardial cells and diffuse interstitial pneumonia. No intranuclear and intracytoplasmic CMV inclusions were found in any of the autopsy samples. CMV viral DNA was detected in liver, kidney, and myocardial samples but not in any of the cardiac conduction system samples.

Conclusions: This complex picture emphasizes the need for a very careful diagnostic approach based on rigid protocols every time an infant dies suddenly and unexpectedly, in order to offer adequate counseling to the bereaved families and provide unequivocal diagnoses.

PP02.07 Bed-sharing and the need for parental education in King County, Washington, USA

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Background: Most of the SIDS and SUID deaths in King County, Washington, USA, occur in the presence of one or more risk factors. Educational messages in this region have stressed the importance of supine positioning during sleep, while issues related to bed sharing have received far less emphasis. Using data from King County Medical Examiner's Office, Child Death Review surveyed the SIDS and SUID deaths for 2006–2007 to determine the risk factors at the time of death and parental awareness of safe sleep recommendations. Because a complete data set was not

available for all of the infants, some of the figures below are presented as numerator/denominator.

Infant characteristics: In 2006–2007, there were 32 SIDS deaths and 2 SUID deaths (hereafter, all are referred to as SIDS deaths). Infant ages ranged from 14 to 267 days, with a median age of 60 days. 14 of the infants were female; 20 were male.

Risk factors: 23/24 infants (68%) expired in a bed sharing situation. 21/23 (91%) infants were bed sharing with one or both parents. One infant was bed sharing with a sibling and one infant was sleeping with a grandmother. 12/33 (36%) were exposed to cigarette smoke in the home. 3/13 (23%) parents may have been impaired because of drug or alcohol use.

Parental knowledge of SIDS risk factors: 15/16 (93%) were aware that an infant should be put to sleep on his/her back, confirming the “Back to Sleep Campaign” has raised awareness of this issue. This knowledge has changed behavior, as 20/33 (60%) of infants slept supine and only 7/33 (21%) slept prone. 6/33 slept in other positions.

SIDS prevention opportunities: The Back to Sleep Campaign is a model for reducing infant deaths through parental education. In our area, bed sharing now appears to be the major risk factor for SIDS. There is an opportunity to reduce the SIDS deaths through an aggressive public education campaign directed at reducing bed sharing.

PP03.02 Exposure to intermittent hypoxia leads to habituation of the arousal response in developing rodents: implications for SIDS

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Arousal from sleep is an important apnea recovery mechanism. Many Sudden Infant Death Syndrome (SIDS) infants have evidence of repeated periods of apnea, hypoxia, and bradycardia in the days and weeks prior to death. Moreover, infants who have subsequently died of SIDS have impaired arousal mechanisms.

Objective: We hypothesized that repeated exposure to hypoxia would cause arousal habituation as evidenced by a lengthening of the time to arousal and an increase in arousal threshold over the course of repeated exposures.

Methods: Four rat pups (P13-P17) were exposed to 6 trials of 5% oxygen (3 min) alternating with room air (approximately 6 min). Inspired oxygen concentration (IO₂), oxyhemoglobin saturation (SAT), heart rate (HR), and respiratory rate were continuously recorded. Rat pups were studied at thermoneutrality on piezoelectric film to detect body movements and were continuously videotaped. Arousals were identified as a stereotypical sequence of forepaw extension, head lifting, and an increase in HR.

Results: During the 6 trials of hypoxia, the time to arousal from the onset of the decrease in IO₂ increased from 31.8 ± 7.0 to 53.2 ± 3.1 s ($P = 0.024$) and the IO₂ at which arousal occurred decreased from 12.9 ± 0.8 to 9.5 ± 0.6% ($P = 0.003$). Similarly, the time of arousal from the onset of the decrease in SAT increased from 18.6 ± 5.8 to 48.9 ± 3.7 s ($P = 0.032$).

Conclusions: These results support the hypothesis that exposure to intermittent hypoxia results in habituation of the arousal response in developing rat pups. We speculate that hypoxia-induced arousal habituation may be an important mechanism in SIDS. Supported by NIH P01 HD36379.

PP03.03 TNF polymorphisms in SIDS

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Objective: Several studies show that the immune system is stimulated in SIDS victims. TNF- is a proinflammatory cytokine with a strong effect on the cytokine cascade. A genetic variant associated with high production of TNF- may thus be of significance in the pathogenesis of SIDS. The purpose of the present study was to investigate a possible relationship between the promoter polymorphisms -1031T/C, -857C/T, 308G/A, -244G/A, and -238G/A in the TNF- gene and sudden infant death.

Methods: The subjects investigated consisted of 148 SIDS cases, 56 borderline SIDS cases, 41 cases of infectious death, and 131 controls. The genotyping was done using a multiplex analysis MassARRAY technology on SEQUENOM platform.

Results: When investigating each SNP separately, associations between the genotype -238GG and SIDS ($P = 0.022$), and between the genotype -308GA and borderline SIDS ($P = 0.005$) were found. There were no differences between any of the groups for the other SNPs investigated. Furthermore, a SNP profile was constructed by creating a genotype pattern from the five SNPs. Fifteen gene combinations were obtained, and four profiles showed significant association with SIDS. This finding supports our theory, and indicates that the SNP profile -1031CT, -238GG, -857CC, -308GG and -1031TT, -238GG, -857CC, -308AA may be unfavorable with regard to SIDS.

Conclusion: The findings add further evidence to the theory that an unfavorable genetic profile in the TNF- gene may be involved in SIDS, by exposing the infant to both a high level of and prolonged exposure to TNF-.

PP03.04 HSP70 may be a biomarker for overheating in sudden infant death syndrome

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Objective: If overheating is a cause of some cases of SIDS, it may cause elevation of the heat inducible protein HSP70. The goal of our investigation is to examine HSP70 synthesis in liver tissue from SIDS victims.

Methods: Medical examiners from five locales contribute samples to our investigation (Seattle, San Diego, Spokane, Savannah, Detroit). Currently, we have 109 liver samples from infants that expired from SIDS. The liver samples are harvested from cadavers up to 48 h postmortem, placed in RNAlater (a solution that preserves RNA), and stored in a freezer until shipment to Seattle. Western blot analysis is performed using a monoclonal antibody specific for the inducible form of HSP70 (Stressgen SPA-810). 40 µg of protein is loaded in each lane.

Results: Although all but one of the samples have considerable HSP70 expression, the amount of HSP70 is variable, with some samples showing substantially more HSP70 than others.

Conclusion: The western blot data indicate that human infants who expire from SIDS have substantial hepatic HSP70 synthesis at the time of their death. Although there are no published data regarding HSP70 synthesis in the hepatic tissue of human infants, HSP70 has been widely studied in cell culture and in animal models. In normal, unstressed tissue, this inducible protein is either absent or present at very low levels (considerably lower than the levels observed in the liver samples from SIDS victims). These data suggest that prior to death, SIDS victims are undergoing a severe physiologic stress. While it is known that severe ischemia can lead to HSP70 synthesis, our laboratory has data from an animal model (not shown) which indicates that lethal hypoxia, such as would be experienced with suffocation, does not result in the synthesis of substantial amounts of HSP70 in the animals' livers. Taken in conjunction with our animal

data, these experiments suggest that overheating may precede some SIDS deaths.

PP03.05 Genetic and environmental predispositions of SIDS in the Netherlands; a case-control study

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Objective: Over the last two decades, many environmental risk factors for SIDS have been suggested. In the Netherlands, the incidence of SIDS has decreased dramatically from 1987 onward when advice against prone sleeping was introduced; now it is 0.059 cases below 1 year of age per 1,000 living births per year. A working group on SIDS of the Dutch Paediatric Association (Landelijke Werkgroep Wiegendood, LWW) gathers information on Dutch SIDS cases since 1996; therefore data on many environmental risk factors of SIDS cases are available. In the last decade, more and more genetic risk factors were suggested, none of which has been tested on the Dutch population, yet.

Methods: Of the 200 Dutch SIDS cases from 1984 up till 2005, we collected paraffin blocks, histology slides, pathology reports, and, if the case had occurred after 1996, the LWW reports. Histology was reviewed and genomic DNA was isolated from the paraffin blocks. Control DNA of 1,107 young and healthy Dutch children and information on their exposure to environmental risk factors was provided by the Generation R Study of Erasmus MC. The case and control DNA samples were tested for 108 SNPs and insertion/deletion polymorphisms ascertained from 21 previously suggested candidate genes, via fragment analysis, SNaPshot[®], Sequenom[®], and Taqman[®] technologies. SPSS was used for statistical analysis on environmental and genetic predispositions.

Results and conclusions: Most known environmental risk factors were still more often present in the cases compared to the controls. Furthermore, we found in 10% of the cases a possible cause of death by histology review, thus excluding them from the SIDS classification. The genotype analysis is still going on at the time of submission.

PP03.06 Does a novel Picorna virus cause malformation, intrauterine fetal death, and sudden infant death syndrome?

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Objective: Ljungan virus in the Parecho virus genus, family picornaviridae, was originally isolated from its wild reservoir, the bank

vole (*Myodes glareolus*), at the Ljungan River in central Sweden. Ljungan virus is associated with diseases such as myocarditis, encephalitis, pregnancy-related diseases, and diabetes in several species of wild rodents. The same outcomes can be induced in CD-1 mice under controlled laboratory conditions. The present study investigates whether malformation, intrauterine fetal death (IUFD), and sudden infant death syndrome in humans may have Ljungan virus as a common zoonotic etiology.

Methods: Formalin fixed tissues from IUFD, SIDS, and hydrocephalus cases were investigated with immunohistochemistry using Ljungan virus-specific monoclonal antibodies. Tissues from elective abortions due to trisomia were used as controls.

Results: Ljungan virus was detected in the 5 out of 10 cases of IUFD, in all 8 SIDS cases, in 9 of 10 cases of hydrocephalus, and in 2 of 18 trisomia control cases when investigated by immunohistochemistry.

Conclusions: The evidence points to a widespread role for LV in a variety of perinatal outcomes. This newly identified agent may prove to be a major explanatory factor in a number or reproductive outcomes, each with largely unsolved etiologies.

PP03.07 Sudden infant death syndrome associated with Ljungan virus

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Objective: A novel picornavirus, the Ljungan virus (LV), has recently been associated with reproductive disorders in its natural reservoir, the bank vole (*myodes glareolus*). We have also demonstrated that LV infection in combination with stress results in a high frequency of early abortions, malformations, and neonatal death in an out-bred CD 1 mouse model. A strong epidemiological association has been found between small rodent abundance in Sweden and the incidence of intrauterine fetal death (IUFD) in humans. LV antigen has been detected in half of the IUFD cases tested. The question was therefore raised if Sudden Infant Death Syndrome (SIDS) was associated to rodent abundance and whether LV is found in cases of SIDS.

Methods: Population fluctuations of native rodents in Sweden were compared to the incidence of SIDS using the Swedish cause-of-death database. Formalin fixed tissues from brain and other organs were investigated using LV specific immunohistochemistry (IHC).

Results: Variation in the incidence of SIDS closely tracked the fluctuations in native rodent populations. Ljungan virus was detected in the brain tissue of each of the eight SIDS cases investigated by IHC. Frozen tissue from SIDS cases was positive for PCR testing. Subsequent sequence analysis confirmed the presence of LV in SIDS cases.

Conclusions: These studies suggest that LV may be playing a prominent role in human SIDS.

PP03.08 Recurrence risk of unexplained infant death

Sugalski, R; Schulman, L; Toruner, GA; Kurvathi, R; Tozzi, R; Wallerstein, R

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Objective: Review of the literature shows that recurrence risk for SIDS is quoted as 0.8% up to 10%. There are no consistent risk estimates, which is problematic for patient counseling. Our objective

was to determine the recurrence risk in the families who were referred to our Genetics Program at Hackensack University Medical Center due to sudden infant death.

Methods: Forty-three families that had a child who died unexpectedly received genetic counseling including pedigree analysis and recurrence assessment as part of an IRB-approved protocol assaying genetic risk factors for unexplained death in infancy and childhood. The family study participants had an age that ranged from 16 days to 27 months.

Results: Pedigree analysis of the evaluated families showed that there was unexplained death in 7 families (15.9%) and recurrence in a sibling in 2 families.

Conclusion: In our study group, we observed a recurrence risk of 4.5% for sudden infant death, but this risk may be inherently biased due to multiple factors of ascertainment.

PP03.09 Association of de novo copy number variations with sudden infant death

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Objective: The influence of genetic factors has been recognized for sudden infant death, but copy number variations (CNVs) as potential risk factors have not been evaluated yet. Our objective was to determine whether de novo copy number variations (CNVs) are associated with sudden infant death.

Methods: Forty-three families were enrolled in this study. We were able to obtain specimens from 27 deceased children from the medical examiners in the state of New Jersey per written permission of the families. We performed array-based comparative genomic hybridization experiments using Agilent 4 × 44 K arrays on genomic DNA obtained from these specimens. We also analyzed the parents to determine whether the CNV in the deceased child is de novo or not.

Results: We found de novo CNVs in 3 of the 27 cases (11%). In case 1, we detected a 3 Mb (chr8: 143,211,215 to q-ter) duplication on 8q24.3-qter and a 4.4 Mb deletion on the 22q13.3-qter (chr 22: 45,047,068-qter). Subtelomeric chromosome analysis of the father and the surviving sibling of case 1 showed a balanced reciprocal translocation, 46,XY t(8;22)(q24.3;q13.3), between chromosomes 8 and 22. A 1.9 Mb deletion (chr 6: 26,085,971–27,966,150) and a 240 kb (chr 6: 26,139,810–26,380,787) duplication at chromosome 6p22 were found in cases 2 and 3, respectively. Array-CGH and conventional cytogenetic studies did not reveal the observed CNVs in the parents and the siblings of the cases 2 and 3.

Conclusion: Array-CGH analysis may be beneficial during the investigations after sudden infant death. Further studies on study groups with larger sample sizes are warranted.

PP03.10 Epithelial desquamation in the airways in SIDS: a consequence of mast cell activation?

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Objective: Desquamation of the bronchial epithelium has been noted frequently in cases of SIDS (Bodian Heslop lesions). As there is evidence for an increased degree of mast cell degranulation in the airways of many SIDS cases, we have investigated the potential for chymase and tryptase, the major proteases of mast cells, to stimulate epithelial injury.

Methods: Bronchial tissue from freshly resected human lung tissue was incubated at 37°C with chymase or tryptase (recombinant or purified from human tissues) for various periods. Sections of paraffin-embedded tissues were stained with hematoxylin and eosin, and analyzed using a computerized image analysis system to assess epithelial damage. Primary epithelial cells and cells of the 16HBE line were cultured in the presence of these proteases. Effects on cell numbers and on cell viability were determined, and immunocytochemistry or Western blotting applied to detect alterations in cytokeratin and adhesion molecule expression using antibodies against occludin; ZO-1; claudin 1, 2, and 4; E-cadherin; and cytokeratins.

Results: Both chymase and tryptase induced the shedding of cells from the epithelial layer. Chymase was particularly potent, and incubation at a concentration of 2 ig/ml resulted in a reduction of 40% in the length of epithelium that was intact, with detachment of columnar epithelial cells and even of basal cells. At low concentrations, chymase and tryptase stimulated increased proliferation of epithelial cells in culture, but at higher concentrations there was a decrease of epithelial cell numbers and evidence for cytotoxic responses. There was detachment of epithelial cells in culture, and, in intact layers, loss of adhesion molecules and cytokeratin disruption.

Conclusions: The release of mast cell proteases into the airways could contribute to the damage to the bronchial epithelium in SIDS.

PP03.11 PACAP: a stress neuropeptide involved in respiratory chemosensitivity and implicated in sudden infant death of African-Americans but not Caucasians

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Mice lacking pituitary adenylate cyclase-activating peptide (PACAP) die suddenly in the second week of life, a phenotype that is exaggerated by mild thermal stress. We have shown that: (a) breathing and respiratory chemosensitivity is blunted in these mice; (b) PACAP is required to protect breathing during thermal stress; (c) PACAP is present in the carotid bodies (the main peripheral respiratory chemoreceptors); and (d) PACAP stimulates the carotid body sufficiently to increase ventilation. Here, we report a novel, highly significant association between a non-synonymous genetic coding variant in the PACAP gene and SIDS, in African-Americans but not Caucasians. We hypothesize that PACAP gene abnormalities may reduce the ability of some African-American infants to respond appropriately to environmental stress, reducing respiratory system efficacy, leading to sudden neonatal death.

PP04.01 NHE3 expression in human brainstem: implication for the pathogenesis of SIDS?

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The cause of death in Sudden infant death syndrome is still unknown. It has been discussed that a disturbance of the central cardiorespiratory control could lead to respiratory failure and sudden death. In particular, the serotonin transporters influence central regulation of cardiorespiratory functions and arousal (Kinney et al. 2005; Sawaguchi et al. 2003). Recently, a genetic variant of the serotonin transporter gene has been identified in SIDS cases. The subtype 5HT1A-D could have limited functionality. But there are some other proteins which act as neurotransmitters in the human brainstem, e.g., NHE3. The sodium proton exchanger subtype 3 (NHE3) functions as a regulator of the pH of brainstem neurons in rabbits (Wiemann et al. 1999).

We investigated therefore the brainstem NHE3 expression in tissue specimens obtained from the medulla oblongata in 104 SIDS cases and 12 controls using real-time RT-PCR and found significant higher relative fluorescence intensity in SIDS cases compared to non-SIDS ($P < 0.037$).

We suggest NHE3 expression as a causative factor for disturbances in breathing control in humans and as a possible factor in SIDS pathogenesis. However, the regulation of NHE3 expression remains to be investigated, since a variety of at present unknown factors (e.g., genetic, developmental, and physiological) may be involved.

PP04.02 Previously reported serotonin-related FEV gene mutation in SIDS is a common variant in the African-American population

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Objective: Previously we reported multiple abnormalities in SIDS infants in the brainstem serotonergic (5HT) system that helps modulate homeostatic functions during sleep and arousal (Paterson et al., JAMA, 2006). Subsequently, Rand et al. (Pediatrics, 2007) reported a rare mutation (IVS2-191_190insA) in the fifth Ewing variant gene (FEV), which encodes a transcription factor critical for 5-HT neuronal development. Here, we test the hypothesis that this FEV mutation is associated with SIDS infants in an independent dataset accrued by the San Diego medical examiner's office.

Methods: DNA samples were prepared from 71 SIDS and 53 controls. Additional 195 DNA samples were obtained from Coriell Cell Repositories (99 from the African-American Human Variation Panel (HD100AA) and 96 from the Caucasian Human Variation Panel (HD100CAU)). Standard PCR and sequencing were performed to genotype cases for the FEV mutation.

Results: We did not observe a significant association between the FEV mutation and SIDS in either the African-American subgroup or overall cohort. Heterozygosity for IVS2-191_190insA was observed in both the SIDS and control populations, with the mutation identified in 1 of 7 African-American SIDS cases and 33 of 106 African-American controls ($P = 0.70$). Among Caucasians, the variant was seen in zero of the 30 SIDS cases and 1 of 120 controls. We observed an additional mutation (single base deletion coupled with the insertion) which also was not significantly associated with SIDS.

Conclusion: We were not able to replicate the previously reported association of the FEV mutation with SIDS. We find that this

mutation is a common variant in African-American populations, in contrast to the previous study where the mutation was found exclusively in SIDS cases and never in 49 African-American controls. Thus, the relationship of the FEV gene to SIDS remains uncertain.

PP04.03 Staphylococcal pyrogenic toxins in infant urine: a possible marker of transient bacteremia

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Objectives: To measure staphylococcal pyrogenic toxins in infant urine as a possible marker for transient bacteremia.

Methods: Nasopharyngeal swabs and stool and urine samples were collected from 30 infants at 2 weeks, 10 weeks, and 7 months of age when the infants were healthy and from infants of 7 months of age when they had a cold. Samples were cultured and *Staphylococcus aureus* isolates identified. Isolates were tested for the production of staphylococcal enterotoxin B (SEB), staphylococcal enterotoxin C (SEC), and toxic shock syndrome toxin (TSST-1). Urine samples were analyzed for the presence of the same toxins by an enzyme-linked immunosorbent assay (ELISA) method that we have developed.

Results: Nasopharyngeal carriage of *S. aureus* decreased with age from 50% at 2 weeks of age to 13% in healthy infants at 7 months of age. Carriage was increased in infants over 7 months of age with a cold when 36% had nasopharyngeal cultures positive for *S. aureus*. Stool carriage remained constant (37–40%) in healthy infants but increased significantly in infants over 7 months of age with a cold when 82% of stool cultures were positive. 13.9% of the isolates produced SEB, 16.7% produced SEC, and 18% produced TSST-1. Some isolates produced more than one toxin. 43% of infants were colonized at some time with a toxigenic *S. aureus* strain. Picogram levels of *S. aureus* toxins were detected in 9 of 101 urine samples analyzed by ELISA. The proportion of positive samples was increased with infection and at 10 weeks of age.

Conclusion: Infants are exposed early in life to *S. aureus* pyrogenic toxins which can be detected in infant urine samples. Age and infection affect the proportion of positive samples. The pattern of results can be explained by episodes of transient bacteremia.

PP04.04 Carriage of *S. aureus* during pregnancy and detection of antibodies to staphylococcal toxins in antenatal serum, cord blood, and breast milk samples

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Objectives: (i) To establish if carriage of toxigenic strains of *S. aureus* in the latter stages of pregnancy influences the levels of antibody specific to the *S. aureus* toxins, SEB, SEC, and TSST-1 in cord blood and breast milk. (ii) To explore the relationship between levels of antibody in antenatal serum and cord blood.

Methods: Nasopharyngeal swabs and stool samples were collected on two occasions, from 96 women, during the last 6 weeks of pregnancy. Samples were cultured and toxigenic *S. aureus* isolates identified. Antenatal and cord blood samples from the same women were analyzed for IgG antibody to SEB, SEC, and TSST-1 by ELISA. Breast milk samples were analyzed by ELISA for IgA antibody to the same toxins.

Results: IgG to SEB, SEC, and TSST-1 was detected in 91.3, 93.5, and 89.1%, respectively, of antenatal samples and 92.7, 96.9, and 92.7%, respectively, of cord blood samples. There was a significant positive correlation between antenatal samples and cord blood samples for each of the anti-toxins. Specific IgG levels for each toxin were significantly greater in cord blood than in antenatal samples (Wilcoxon test). Thirty percent of women were colonized with *S. aureus*. 13% of the isolates produced the toxin SEB, 13% produced SEC, and 24% produced TSST-1. There was a trend in women colonized with a toxin producing isolate for her infant's cord blood to have greater levels of the corresponding anti-toxin. This reached statistical significance for SEB/anti-SEB IgG ($P < 0.05$, Mann Whitney *U* test). Women colonized with isolates producing TSST-1 had significantly greater levels of breast milk anti-TSST-1 IgA ($P < 0.01$) and the same trend was shown for SEC/anti-SEC IgA and SEB/anti-SEB IgA.

Conclusion: Levels of cord blood IgG and breast milk IgA specific for staphylococcal toxins vary. Exposure to the toxins in pregnancy is common and boosts immunity, but some infants lack protection and could be at risk of toxin-induced disease.

PP04.05 The ontogeny of orexin receptor 1 expression in the developing human brainstem

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Objective: From midgestation through infancy, rapid and dramatic changes occur in the sleep/wake cycle but virtually nothing is known about their neurochemical substrate in the developing human brain. The hypothalamic neuropeptide orexin, via postsynaptic orexin receptors 1 and 2, plays a critical role in waking in part through descending interactions with brainstem serotonergic (5-HT) neurons of particular relevance to SIDS in which multiple abnormalities of 5-HT markers in the lower brainstem (medulla) have been reported (Paterson et al. JAMA, 2006). Here, we determined the developmental profile of orexin receptor 1 (OX-R1) in the fetal and infant brainstem as a first step toward characterizing the chemical anatomy of the orexin system in the developing human brain.

Methods: Immunocytochemistry with an OX-R1 antibody was performed on normative brainstem sections in 12 (non-SIDS) cases from 15 gestational weeks to 10 postnatal months (median age, term).

Results: At 22 gestational weeks (the earliest time-point analyzed), OX-R1 immunostaining was restricted to raphe fibers throughout the rostrocaudal brainstem axis and primary motor neurons. By birth, it included raphe neurons, vagal subdivisions, inferior olive, and arcuate nucleus, as well as dendritic/axonal processes (neuropil) in the hypoglossal nucleus and inferior olive. In the postneonatal period, immunostaining of raphe fibers was no longer detected.

Conclusions: Striking changes occur in the regional and cellular distribution of OX-R1 immunostaining between the fetal and infant periods in the developing human brainstem, suggesting that a critical period in orexin maturation parallels the time-frame of SIDS pathogenesis. These data provide important information for future analysis of the orexin brainstem system in SIDS.

PP04.06 Socioeconomic and demographic comparison of sudden infant death syndrome and sudden unexplained intrauterine death in Wirral

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UK

Aims: To examine socioeconomic and demographic data for sudden infant death syndrome (SIDS) and sudden unexplained intrauterine death (SUID) in Wirral to ascertain whether the two phenomena may be related.

Methods: Infant and maternal case notes were examined for SIDS and SUID cases in Wirral between 1995 and 2001 inclusive. Socio-economic and demographic data, including maternal age, maternal body mass index, Townsend deprivation index, and birth weight standard deviation scores, were recorded and compared.

Results: There were 22 SIDS cases and 50 SUID cases during the 7-year study period. Significantly more of the SIDS mothers were aged under 25 years (68 vs. 40%, $P = 0.046$) and the median deprivation index was significantly higher in the SIDS cohort (5 vs. 1, $P = 0.006$). Birth weight standard deviation scores tended to be lower, and maternal body mass index higher, in the SUID cohort, but these differences did not reach significance ($P = 0.073$ and $P = 0.052$, respectively).

Conclusions: In Wirral, there are significant social and demographic differences between families who experience SIDS and SUID, respectively. Our findings do not support the hypothesis that SUID and SIDS are the same entity. These findings are similar to that of a previous study in Oslo1 which compared epidemiologic and demographic data in a different socioeconomic population.

1 Froen JF, Arnestad M, Vege A, et al. Comparative epidemiology of sudden infant death syndrome and sudden intrauterine unexplained death. Arch Dis Child Fetal Neonatal Ed 2002; 87: F118–F122.

PP04.07 The significance of –amyloid precursor protein staining and SIDS

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Objective: The amount of intracerebral –amyloid precursor protein (–APP) staining in a group of SIDS infants was graded and compared to controls looking at possible factors that might result in this type of intracerebral deposition.

Method: All infant deaths in South Australia were reviewed over a 3-and-a-half-year period from 1999, 2000, 2005, and 2006. Data concerning autopsy results, ancillary testing, and circumstances of death were collected. Brain histology was reviewed in all cases and the amount of –APP staining was scored as mild, moderate, or severe.

Preliminary results: Out of 85 cases, 19 SIDS infants were identified with –APP staining: 3 with severe, 6 with moderate, and 10 with minor staining. When correlating the amount of staining to sleeping environment, 6 of 8 infants found in cot/bassinets had moderate to severe staining compared to only 3 of 11 with other sleeping arrangements (e.g., co-sleeping, couches, prams). The remainder of the cases had only minor staining. In the 65 non-SIDS cases, the least amount of staining was found in cases of drowning, simple dehydration, and congenital heart disease.

Conclusion: –APP staining in SIDS infants ranged from mild to severe, with minimal staining being found in control infants who had died from drowning, simple dehydration, and congenital heart disease. In the relatively small number of cases examined so far, the intensity of –APP staining varied with the nature of the sleeping environment. The possible significance of this observation is uncertain in terms of the length of agonal processes and exposure to hypoxia.

PP04.08 Sudden Unexplained Death in Childhood (SUDC)

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Objective: SUDC is defined as the sudden death of a child older than 1 year of age which remains unexplained after a thorough case investigation, including review of the clinical history and circumstances of death, and performance of a complete autopsy with appropriate ancillary testing (Krous HF, et al. *Pediatr Dev Pathol.* 2005;8:307–19). Its incidence is 1/50th that of SIDS. We report 75 cases of sudden unexpected death in childhood and summarize findings of those deaths attributed to SUDC.

Methods: Retrospective review of cases accessioned in the San Diego SUDC Research Project from various sources and sites.

Results: Seventy-two percent (54 of 75) of the cases remained unexplained after thorough investigation and were assigned a study diagnosis of SUDC. Nearly all (98%) SUDC cases were less than 6 years of age; the mean age was 2.1 ± 1.6 years. 61% were male, 92% were born at term, and 52% were firstborn. There was a seizure history in 30%; 75% of these were associated with a fever. Family seizure history was present in 49% of the cases for which this information was known; 74% were associated with fever. 26% had both a case and family history of seizure; 63% had a case and/or family history of seizure. The majority (93%) were apparently sleeping when they died and 80% were found prone; 44% were found face down. The lengths, weights, and weight-for-length percentiles for age were greater than the 50th percentile for approximately 75% of the cases. The brain weight, as a percentage of that expected for the crown-heel length of each case, exceeded 100% in 47 of 54 cases. Intrathoracic petechiae were present in 54% of the cases.

Conclusions: SUDC is rare and occurs primarily in toddlers, and death appears to be associated with sleep. It is frequently associated with a case and/or family seizure history.

PP04.09 Intrathoracic petechiae in SIDS: a population-based retrospective 15-year study

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Objective: Intrathoracic petechiae (IP), the most common gross finding in SIDS cases at autopsy, suggest upper airway obstruction (UAO) occurs during the terminal event. If such obstruction were external, IP would be expected more frequently among SIDS cases found face down compared to other face positions. We compare the rates of IP and the severity of thymic petechiae (TP) in SIDS cases found face down versus other face positions.

Methods: Retrospective 15-year review of IP among all cases of SIDS occurring from 1991 through 2005 accessioned by the San Diego County Medical Examiner's Office. The presence or absence of IP was based on both gross and microscopic observations of the thoracic organs. The severity of TP was scored semiquantitatively from microscopic observations as follows: 0 = absent, 1 = very mild, 2 = mild, 3 = moderate, 4 = severe.

Results: Face position when found was known for 348 of 489 SIDS cases. The incidence of IP by face position when found was not significantly different between groups. Of 130 cases found face down, 117 (90%) had IP, compared to 180 (83%) of 218 infants found with

the face up or to the side ($P = 0.06$). TP were present in 67 (52%) of the face down group and 123 (56%) of the face up/side group (mean scores 2.3 ± 1.2 and 2 ± 1.1 , respectively; $P = 0.2$). The groups were not different with respect to age or gender, but the racial distribution was significantly different ($P = 0.007$). More than a quarter of the face down group were African-American infants (27%), compared to only 12% of the face up/side group.

Conclusion: Our data do not support a role for external UAO caused by face positioning directly into the sleep surface in SIDS, but are consistent with obstructive apnea or gasping without UAO.

PP04.10 Changes in the epidemiology of SIDS in San Diego County, 1991–2005

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Background: Infant mortality has fallen dramatically in developed countries during the last two decades, in part as a result of global campaigns aimed at reducing risk factors for SIDS. The prevalence of SIDS risk factors has not been investigated in San Diego County, which has experienced reductions in total infant mortality and SIDS deaths since the Back to Sleep campaign was implemented in the United States in 1994.

Aims: (1) To determine the epidemiologic profile of SIDS cases during a 15-year study period that spans the Back to Sleep Campaign in San Diego County and (2) To evaluate the frequency of common risk factors during the same interval.

Methods: Retrospective 15-year population-based analysis of all cases of sudden infant death in San Diego County occurring from 1991 through 2005. Causes of death were based upon information gathered from standardized scene investigation and autopsy protocols. A SIDS diagnosis was assigned retrospectively when criteria for the 2004 San Diego SIDS general definition were fulfilled.

Results: There was a significant decrease in the percentages of infants placed prone (84% in 1991 to 32% in 2005, $P < 0.001$) and found prone (83% in 1991 to 48% in 2005, $P < 0.001$). The proportion of infants found face down remained relatively constant (46% in 1991 and 38% in 2005). The percentage of bedsharing SIDS cases increased significantly, from 20% in 1991 to 38% in 2005 ($P < 0.0005$). Only 7% of SIDS cases were found supine, alone, and on a firm sleeping surface with their head uncovered.

Conclusions: The percentage of infants who died while sharing a sleep surface has increased significantly. Very few infants were found in a safe-sleeping environment. Independent of how babies were placed, the proportion found face down suggests that rebreathing or external airway obstruction is important.

PP04.11 Administration of an adenosine A2A receptor antagonist in the NTS prevents thermal prolongation of the laryngeal chemoreflex in decerebrate piglets

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As part of a larger group of projects examining the pathogenesis of Sudden Infant Death Syndrome (SIDS), we have been investigating the effect of hyperthermia on the laryngeal chemoreflex (LCR)—a reflex that many investigators feel initiates apneas in neonates that

may end in sudden death. Hyperthermia is a risk factor for SIDS, and hyperthermia prolongs the LCR. Thermal prolongation of the LCR originates in the dorsal medulla in the region of the nucleus of the solitary tract (NTS), and the thermal effect on the LCR seems to require GABAergic activity within the NTS, since GABAA receptor antagonists prevent thermal prolongation of the LCR. Adenosine antagonists shorten the LCR, and we tested the hypothesis that an antagonist of adenosine A2A receptors, which seems to enhance GABAergic, would also prevent thermal prolongation of the LCR when injected focally within the NTS. We studied decerebrate piglets aged 6–13 days. We elicited the LCR by injecting 0.1 ml of water into the larynx and recorded respiratory activity as integrated phrenic nerve activity. The laryngeal chemoreflex was prolonged when the body temperature of each piglet was raised -2°C , and an adenosine A2A antagonist reversed the thermal prolongation of the LCR when injected into the NTS ($n = 11$). Similar injections in the nucleus ambiguus did not alter the thermal prolongation of the LCR. We conclude that activation of adenosine receptors, perhaps located on GABAergic neurons in the NTS, may contribute to thermal prolongation of the LCR. We speculate that blocking adenosine A2A receptors may have therapeutic value in preventing SIDS in infants at high risk for sudden death.

PP04.12 The role of cigarette smoking, breast feeding, and iron in the Sudden Infant Death syndrome (SIDS): is oxidative cell damage the explanation?

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Objective: A review of the literature to determine the role of tobacco smoke as a causative agent in the etiology of SIDS.

Method: PubMed and Medline searches were used to find papers linking SIDS with smoking, breast feeding, iron, and free radical-mediated/oxidative cell damage.

Results: Exposure to tobacco smoke causes oxidant stress in infants and there is a clear dose–response relationship between maternal cigarette smoking and the risk of SIDS (OR 5.19, 95%CI 3.57–7.55). SIDS occurs at an age when tissue iron concentrations are higher than at any other time of life and liver iron stores have been found to be significantly higher in SIDS than controls (296 vs. 105 $\mu\text{g/g}$, $P = 0.002$). Unbound iron promotes the formation of toxic free radicals and tobacco smoke contains both free radicals and unbound iron. Iron in breast milk is bound to lactoferrin and so unavailable for bacterial metabolism or free radical production. Adding iron to breast milk and fortifying formulae with iron both increase oxidative stress in infants. Protective anti-oxidants such as Vitamin A and E can prevent tissue damage such as peroxidation of lipid membranes resulting in hemolysis and increased permeability of pulmonary capillaries. SIDS has been associated with not giving Vitamin A supplements to infants (adjusted OR 28.4 95%CI 4.7–171.3 $P < 0.001$). The association of *Helicobacter pylori* infection with SIDS can be explained by increased free radical production.

Conclusion: Oxidative cell damage as the final event in SIDS provides a unifying hypothesis linking smoking, artificial feeding, infection, and the peak age incidence. There are implications for infant feeding and vitamin and iron supplementation in infancy.

PP04.13 Fatty acid oxidation disorder in a case of sudden and unexpected infant death

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Inherited metabolic disorders account for a small but significant number of sudden unexpected deaths in the first year of age. Furthermore, the genetic components of sudden infant death are usually divided in two categories: gene mutations giving rise to diseases that determine death by themselves and gene polymorphisms that could predispose infants to sudden infant death when associated with other factors as summarized in the “three hit” or “triple risk” model. We report a case of a male baby who died suddenly and unexpectedly in the first days of life after being placed and then found prone in his crib. The parents were first cousins: the mother, gravida 1, was 16 years old and the father was 26. Her gestation and delivery were uncomplicated and spontaneous, and she had no history of metabolic diseases. No risk factors (smoke, alcohol, drugs) were present during the pregnancy. The baby, born at 40 + 2 weeks of gestation, had normal Apgar scores. A complete and standardized autopsy was performed and revealed a liver with normal weight (121 g) with diffuse, marked fatty changes of liver cells and a heavy brain (414 g) showing diffuse encephalopathy with vacuolar degeneration of cortical, cerebellar, basal nuclei, and brainstem neurons. Conventional histology, histochemical, and metabolic investigations suggested a possible fatty acid oxidation disorder.

Conclusions: Severe inherited metabolic disorders may mimic sudden infant death syndrome and only a standardized and global approach to each case offers the opportunity of establishing a diagnosis that is of great importance with regard to the possibility of genetic counseling and antenatal diagnosis.

PP04.15 The relationship between head circumference and the risk of sudden infant death syndrome

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Objective: The aim of the project is to study the association of birth head circumference with the risk of subsequent SIDS, in a cohort of Swedish infants.

Methods: The cohort is based on 2,085,162 infants without major congenital abnormalities born in Sweden between 1982 and 2002. Head circumference, body length, and weight at birth were normalized by gestation and gender to produce z-scores. For each SIDS infant, 10 controls, still alive at 1 year of age, were randomly identified matched for year of birth and gestation. The effect of head circumference was estimated on the risk of SIDS using conditional logistic regression. Chained equations were used to impute missing values of covariates alone. Presented odds ratios are for each SD increase in head circumference.

Results: The overall risk of SIDS was 7.1 (6.8–7.5) per 10,000 births. In the unadjusted model, infants who died of SIDS had smaller heads than those of controls (OR 0.93 (0.88–0.98)). After adjusting for birth weight and length this trend was reversed, and after adjusting for covariates, infants with SIDS had larger head to body ratios than cases (OR 1.10 (1.02–1.18)). The association of larger head sizes and the risk of SIDS was more apparent in male infants (Males, OR 1.18 (0.95–1.48); Females, OR 1.03 (0.81–1.30)), and appeared to be restricted to non-smoking mothers (OR 1.31 (1.04–1.65)), with little association seen in infants born to mothers who smoked 1–9 (OR 1.04 (0.75–1.44)) or >9 cigarettes a day (OR 0.82 (0.59–1.13)). Restricting the analysis to term infants with weights and lengths within 1 SD from the mean produced a comparable result (OR 1.18 (1.06–1.31)). There was no association between head circumference and death by other causes (OR 0.97 (0.91–1.02)) after adjustment for weight and length.

Conclusions: Infants with larger heads for their body size have an increased risk of SIDS, although the association may be limited to infants of non-smoking mothers.

PP04.16 Monoamine oxidase A gene variation and SIDS: a pilot study

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Findings in medulla from cases of sudden infant death syndrome (SIDS) indicate that a dysfunction of the serotonergic network may be involved in sudden infant death. This makes monoamine oxidase A (MAOA) interesting, as it is involved in regulation of monoamine transmitter levels in the central nervous system. The MAOA gene is located on the X chromosome, and a variable number of tandem repeats (VNTR) in the promoter is reported to influence the expression of the gene. Alleles with 3.5 or 4 copies of the repeat sequence are transcribed more efficiently than those with 3 or 5 copies of the repeat. The VNTR is reported to be clinically significant in disorders involving the serotonergic system.

Objective: The purpose of this study was to investigate the promoter VNTR in the MAOA gene in SIDS cases and controls.

Methods: 72 SIDS cases (43 male, 29 female) and 55 controls (36 male, 19 female) were included. The genotypes were determined using polymerase chain reaction and gel electrophoresis.

Results: Two different alleles were observed, corresponding to 3 and 4 copies of the repeat. In male, the allele distribution was 16 (37%) SIDS cases and 12 (33%) controls with the 3 allele, compared to 27 (63%) SIDS cases and 24 (67%) controls with the 4 allele ($P = 0.72$). In female, the genotype distribution in the SIDS cases was 2 (7%) cases with 3/3, 15 (52%) cases with 3/4, and 12 (41%) cases with 4/4, while in the controls 4 (21%) cases had 3/3, 8 (42%) cases had 3/4, and 7 (37%) cases had 4/4 ($P = 0.35$).

Conclusion: The VNTR in the promoter of the MAOA gene does not seem to be involved in SIDS.

PP04.17 Serotonin transporter promoter polymorphism in SIDS: correlation of genotype and serotonin transporter binding density in the medulla oblongata

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Objective: Multiple abnormalities in markers of serotonin (5-HT) function have been identified by us in the medulla oblongata of SIDS cases that may result in respiratory and autonomic dysfunction during sleep and ultimately death (Paterson et al., JAMA 2006). A polymorphism in the promoter of the 5-HT transporter (5-HTT) gene that differentially regulates 5-HTT expression, with the long (L) allele a more effective promoter than the short (S) allele, has been identified in higher frequency in SIDS cases compared to controls (Narita et al., Pediatrics 2001; Weese-Mayer et al., Am J Med Gen 2003), suggesting that increased 5-HTT expression in SIDS contributes to 5-HT dysfunction. Previously, we observed no significant difference in the density of 5-HTT binding sites in the medulla between 30 SIDS and 7 controls or any correlation between 5-HTTLPR genotype and 5-HTT

binding. Here, we report on 50 SIDS and 15 control cases and test the hypotheses that 5-HTT binding site density in the medulla is higher in SIDS cases compared to controls and those cases with the L allele or LL genotype will have higher binding values than cases with the SS genotype. This study is unprecedented in its correlation of 5-HTTLPR genotype and 5-HTT binding in SIDS.

Methods: Medullary 5-HTT binding site density was determined using tissue section autoradiography with 125I RTI-55. 5-HTTLPR genotyping was performed using PCR amplification and agarose gel electrophoresis.

Results: No difference in 5-HTT binding density between SIDS cases and control cases was observed in any of the nuclei measured ($P > 0.05$). Moreover, no correlation between 5-HTTLPR genotype and 5-HTT binding density was observed in the SIDS and Control populations separately or in a combined population ($P > 0.05$).

Conclusions: This study confirms that 5-HTT expression is not increased in the medullary 5-HT system in SIDS and that 5-HTTLPR genotype does not significantly influence 5-HTT expression in SIDS and/or Control medulla.

PP04.18 Cardiorespiratory recordings after admission for apparent life-threatening events (ALTE): a multicenter retrospective study

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Objective: A multicenter retrospective study of the cardiorespiratory and oxygenation recordings performed in infants with ALTE. Three Italian hospitals (Meyer Children's Hospital-Florence, Buccheri la Ferla Children's Hospital-Palermo, and Insubria Children's Hospital-Varese) participated in the study. The common diagnostic algorithm included the performance of a documented cardiorespiratory monitoring lasting at least 24 h after the infant's admission.

Methods: The recordings, collected between January 2006 and June 2007, were performed using cardiorespiratory monitors which allow for detecting both transthoracic impedance (TTI) and pulseoximetry (Po). The cases were divided into ALTE, in which a known cause of the event was found, and idiopathic ALTE (IALTE) in which a plausible cause was not evident. We enrolled 111 patients (61 males), with a median age of between 2 months and 22 days (range 1–341 days). Sixty infants (54%) were diagnosed as ALTE.

Results: Four infants also had ALTE after admission. Two had IALTE, and after the monitor download showed central apneas, bradycardias, and desaturations, one had desaturations related to a bronchiolitis and one showed tachycardias and desaturations caused by epileptic seizures. In all the 111 infants, the number of cardiorespiratory events was not significantly different between the two groups (ALTE/IALTE) ($P = 0.22$). Male infants showed a significantly higher number of events ($P = 0.010$), as well as those having a low Apgar score ($P = 0.005$), a history of at least one tactile stimulation necessary for resolving the event ($P = 0.006$), a cesarean section ($P = 0.043$), or a lower gestational age ($P = 0.015$).

Conclusions: Documented TTI and Po monitoring performed after the admission of infants with ALTE is a useful, low-cost technique which may allow for more effective surveillance and the detection of cardiorespiratory and pulseoximetric patterns that could contribute toward a more accurate evaluation of the infants.

PP04.19 Ingestion of cigarette butts, an unrecognized cause of unexpected infant death. A case report

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Background: It is well known that inhalation of tobacco smoke is injurious to health and associated with a higher risk of infant death. Poisoning due to cigarette ingestion is less well known but does occur. In 1995, nearly 8,000 cases of nicotine poisoning due to cigarette ingestion were reported in the USA but there are few published reports from other countries.

Case report: A 5-month-old baby girl was found dead with her face in an ashtray. There had been concerns about her welfare but these were not thought to warrant specific action. She had been mildly unwell for a day prior to death but had not been seen by a doctor. An autopsy failed to identify a definitive cause of death. Six cigarette butts were found in her stomach at autopsy with a trace of nicotine in her blood.

Discussion: This case highlights the tragic consequence that may occur due to ingestion of tobacco by a young infant. Arrhythmias and cardiac arrest can occur in children sensitive to nicotine. Perhaps this death could have been prevented. The parents were charged with willful neglect.

The dangers of smoking in the home are well known as are the adverse effects of inhaling second-hand smoke. The possibility of infants and young children ingesting cigarette butts and coming to harm as a result is another consequence that needs to be publicized.

The dangers of poisonings in infants by nicotine transdermal patches are beginning to be recognized as well.

PP04.20 Cell stress markers in cases of sudden unexpected death in infancy

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Objective: The study was set up to find genetic variations in cellular stress response systems. The sudden and unexpected infant death has been associated with hyperthermia, which is a situation with cellular stress. We wished to test for activity in the genes coding for proteins in the cellular stress-response and antioxidant systems in cases of Sudden Unexpected Death in Infancy (SUDI), by setting up an experiment that mimics stressful events.

Methods: Fibroblast cultures have been established from Achilles tendons sampled during autopsies of children from 1989 to 2005. The material provides an opportunity for performing functional analysis on cells harvested from individuals who died from unexplained causes. The study is a case-control study. We analyze cells from children who died of unnatural known causes, and compared them with cells from children who died suddenly and unexpected, where postmortem examinations could not reveal the cause of death. The fibroblasts are cultured and exposed to hyperthermia (40°C). In order to follow the stress response of the cells, they are harvested at several time points over a period of 24 h. Selected stress response genes (Hsp70, Hsp60, HO-1, and SOD2) are monitored using quantitative real-time PCR methods to measure the amount of mRNA expressed under both stressed and unstressed conditions.

Results: Preliminary results from the first cases indicate that some cases of sudden infant death may show a slight delay in response of Hsp70, but further cases need to be analyzed.

Conclusion: If we can show differences in stress response, we may be able to explain why some individuals are more vulnerable to stressors than others.

PP04.21 Association between birth weight and cardiovascular control during sleep in prematurely born infants: implications for sudden infant death syndrome

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Objective: Epidemiological studies have identified that premature birth and low birth weight are infant characteristics associated with Sudden Infant Death Syndrome (SIDS). Furthermore, studies of infants who subsequently died from SIDS have identified abnormalities in cardiovascular control. We aimed to assess cardiovascular control during sleep in prematurely born infants with LBW, very low (VLBW), and extremely low (ELBW) birth weights.

Methods: Twenty-seven preterm infants (28–32 weeks GA) were studied using daytime polysomnography at 23 weeks, 2–3, and 5–6 months corrected age (CA). Infants slept supine and blood pressure (BP) was recorded using a photoplethysmographic cuff (FinometerTM) placed around the infant's wrist, during quiet (QS) and active (AS) sleep. Infants were divided into birth weight groups for data comparison: LBW (1,500–2,500 g), VLBW (1,000–1,500 g), and ELBW (<1,000 g).

Results: There were no significant effects of birth weight on heart rate (HR) during sleep at any age studied. During QS, HR variability (HRV) was significantly greater in the ELBW group compared to the VLBW group at 2–3 weeks CA. Systolic, diastolic, and mean BP were significantly greater during AS in the ELBW group compared to both VLBW and LBW groups at 2–3 weeks CA ($P < 0.05$). Regression analysis demonstrated a significant negative correlation in AS between birth weight and BP at 2–3 weeks CA ($r = 0.4$, $P < 0.05$). A significant negative correlation was also found between birth weight and BP variability (BPV) during QS and AS at 2–3 weeks CA ($r = 0.4$ each; $P < 0.05$). There were no significant effects of birth weight on any of the cardiovascular variables at 2–3 or 5–6 months CA.

Conclusion: Birth weight has significant effects on subsequent HRV, BP, and BPV during sleep in prematurely born infants at 2–3 weeks CA. The legacy of impaired cardiovascular control may place premature infants with lower birth weights at a significantly greater risk of SIDS in the first few weeks after term equivalent age.

PP04.22 Measurement of cotinine in SIDS victims: is the risk for SIDS associated with bed sharing primarily associated with tobacco smoke exposure

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Aims: Bed sharing has been associated with an increased risk for SIDS. In particular, infants <4 months of age bed sharing with

parents who smoke are at high risk. To evaluate the role of exposure to tobacco smoke with regard to the risk of bed sharing, the cotinine concentrations in SIDS victims were determined.

Methods: Whole blood and pericardial samples from 83 SIDS victims and 12 victims of sudden accidental death were obtained during autopsy between 1990 and 2004. Information regarding the circumstances of death was collected from police reports, questionnaires, and death scene investigations. Concentrations of cotinine, the main metabolite of nicotine, were determined by liquid chromatography-tandem mass spectrometry (LC/MS/MS).

Results: The cotinine concentrations in pericardial fluid and blood were strongly correlated ($R = 0.96$). The mean pericardial cotinine conc. [95% CI] in SIDS victims of non-smoking mothers who had slept in their own bed were 16.9 nM [0–45.6], compared to 15.5 nM [0–34.5] in the group of accidental deaths. SIDS victims of a tobacco smoking mother who were found in their own bed had mean cotinine conc. of 43.7 nM [25.7–61.6], $P < 0.001$. The highest cotinine conc. was found in bed-sharing SIDS victims of smoking mothers: 142.5 nM [87.0–198.0], $P < 0.001$.

Conclusion: In the case of maternal smoking, SIDS victims who died in a bed-sharing situation demonstrated threefold higher cotinine concentrations than victims found dead in their own bed. Bed sharing with a smoking parent thus seems to cause enhanced nicotine uptake, which may explain the increased risk for SIDS.

PP04.24 The effect of pacifier use on mandibular position in preterm infants

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Introduction: When an infant sucks on a finger the tongue pushes forward bringing it away from the pharynx. Epidemiologically, the use of pacifiers by infants when they are put to sleep has been consistently associated with a reduced risk of sudden infant death (SIDS); the association is much greater with actual use than with typical use suggesting that this link may be causal. This protection appears to occur despite the observation that pacifiers typically fall out of the infant's mouth after a relatively short time during sleep. Since SIDS deaths are presumed by most pathologists to be asphyxial deaths, we examined the hypothesis that pacifier use might move the jaw forward (and so presumptively the tongue within it) and thus enlarge the upper airway allowing improved oxygenation.

Objective: To measure the position of the mandible relative to the skull when preterm babies are sucking on a pacifier and after the pacifiers have been removed.

Methods: In 60 clinically stable premature infants (CGA 36.5 ± 0.3 weeks, mean \pm SEM), the distance from each ear where the pinna met the cheek to the most prominent point of the chin was measured bilaterally using finely adjustable engineering calipers, and the average used as an index of mandibular position. Mandibular position was determined before and after allowing the infants to suck on a pacifier for 10–15 min, and after removing the pacifier.

Results: There was a significant forward movement of the mandible when the pacifier was introduced (59.5 ± 0.7 vs. 58.62 ± 0.7 mm, $P = 0.001$). There was no significant change when the pacifier was removed (59.2 ± 0.7 mm).

Conclusion: Pacifier use in preterm infants was associated with a small significant forward displacement of the mandible. These data

help support the hypothesis that the strong association between pacifier use and reduced risk of SIDS may be mediated by improving or protecting the size of the upper airway.

PP04.25 A near miss smothering: accident or deliberate?

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In sudden infant death syndrome (SIDS), the pathological findings might be indistinguishable from those of a child who has been deliberately smothered. Little has been written about the difficulty of distinguishing deliberate from accidental smothering in the "near miss," the child who survives. We report such a case.

A 6-week-old male infant was admitted to hospital in the early hours of the morning severely shocked. The mother was being closely monitored by social services because of concerns of neglect of her 2-year-old daughter. The baby normally slept in the crib next to her bed. During the night, he was breast fed on the mother's bed.

On the morning of the admission, the mother was awakened by the baby crying. She woke to find the baby lying next to her in a pool of blood. The baby was brought to the casualty by the ambulance. Examination revealed a baby in shock with blood in both nostrils. His fundi were normal. Within 24 h of treatment, the baby's condition stabilized. He later survived without any sequelae.

Chest X-ray showed fluid in both lungs. Skeletal survey was normal as were hematological investigations. MRI scan showed brain swelling and symmetrical abnormalities in the basal ganglia and thalami consistent with acute asphyxial injury.

It is well established that a child can die from mechanical asphyxiation if a sleeping adult rolls over on top of the child and occludes the airway or causes chest constriction. Children who have been smothered frequently have nasal and intrapulmonary hemorrhage. This clearly appears like a case of attempted asphyxiation; however, our dilemma was whether this was accidental or deliberate? Recognizing that there cannot be certainty, after a thorough social service and police investigation, we concluded that the cause of the suffocation was accidental.

This report highlights the danger of an infant sleeping in the same bed as parents and the need for continuous education of parents and the public.

PP04.26 Is increased brain weight in SIDS victims related to elevated cerebrospinal fluid IL-6 levels?

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We have previously reported high levels of Interleukin-6 (IL-6) in cerebrospinal fluid (csf) in approximately half of our sudden infant death syndrome (SIDS) victims. It has been claimed that brain weights in SIDS victims are higher than in age-matched controls. Cytokine up-regulation in the brain of the SIDS victims has been suggested as a cause of the increased brain weight.

Objective: The purpose of this study was to investigate if there is any relationship between the brain weight (expressed as a ratio to body weight) and csf IL-6 levels. **Methods:** 99 SIDS cases (63 boys and 36 girls) were included in the study; all were under 1 year of age and all

were Caucasians. Ratios from 29 cases with IL6 levels 60–1,000 pg/ml were compared with 60 cases with IL-6 levels \bar{x} 5 pg/ml.

Results: There was no significant difference between brain/bodyweight ratios in the high IL-6 group and the low IL-6 group. Nor was there any difference in these ratios between cases with and without histopathological findings of brain edema.

Conclusion: High IL-6 levels in csf do not seem to be related to increased brain weight or brain edema in SIDS victims.

PP04.27 SIDS and insulation: is the issue all wrapped up?

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The validity of conclusions drawn about the relationship between sleep environment, insulation, and SIDS, and subsequent recommendations affecting care, depends on the method used to estimate insulation. Commonly SIDS researchers estimate insulation using two-dimensional (2D) models proposed in the 1980s (Holcombe and Hoschke, 1983; Weatherall, 1983; Clulow, 1986). More recently, a three-dimensional (3D) model (Wilson and Laing, 2002) that accommodates the effect of the geometric arrangement of the bedding, tucking method, and sleep position on insulation has been developed.

Objectives: This paper compares and contrasts estimates of insulation derived using both the 2D and 3D approaches. The work aims to: provide an overview of current findings about the SIDS/insulation relationship, compare and contrast estimates of bedding insulation derived using 2D and 3D models, and recommend how understanding of SIDS/insulation relationship can be progressed. What next...

Methods: Insulation of minimum, maximum, and typical bedding combinations used to cover SIDS, and control infants, is estimated.

Results: Insulation of bedding estimated using both the 2D and 3D models is described. Use of the 3D model (an accurate method for estimating intrinsic 'dry' thermal resistance during use (Wilson et al., 2004)) generates significantly different estimates of insulation to that of the commonly used 2D models. Findings indicate the relationship between insulation and risk is likely to vary according to the predictive model adopted.

Conclusions: The approach used to estimate resistance is critical. Conclusions drawn about heat loss associated with specific bedding combinations are likely to be erroneous if based only on estimates derived using two-dimensional fabric arrangements. Further investigation into the relationship between thermal resistance, conditions of use, and SIDS using the 3D model is recommended.

PP04.28 Polymorphisms in the NHE3 gene and their impact in sudden infant death syndrome

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A disturbance in the central breathing control is one of the causes discussed for sudden infant death, but the pathomechanism is still unclear. A regulatory function of pH in rat brainstem neurons has been demonstrated for the sodium proton exchanger subtype 3

(NHE3) (Wiemann et al. 1999). Moreover, NHE3 shows a higher expression in tissue specimens of the medulla oblongata from SIDS cases than in controls.

Looking for possible causes of this higher expression, we investigated six known polymorphisms of the NHE3 gene in SIDS cases already analyzed for NHE3 expression and compared the results with the published frequencies of the variations. Four of these variations are very rare and never occurred in our SIDS cases. The frequency of the other two polymorphisms showed no deviation from the frequencies published for white Americans. In addition, no differences were found between cases with high NHE3 expression and cases with low NHE3 expression.

In conclusion, the higher NHE3 expression in SIDS cases could not be explained by the gene variations studied here. An investigation of the promoter region for polymorphisms and their frequency in SIDS cases and controls is currently under way.

PP04.29 Are arousals a useful tool to identify infants at risk? Lessons learned from polysomnographic studies in term and preterm infants

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Objective: One of the current leading hypotheses to explain SIDS is a failure of the infants to arouse. It was the aim of the present study to find out whether arousals in term infants differ from arousals in preterm infants and whether infants at risk could be identified.

Methods: Polygraphic recordings were performed in 81 term (AFD, appropriate for date) and 81 preterm infants (33.2 ± 4.1 weeks gestational age, AFD) and a total number of 469 arousals was scored. Arousals were defined as suggested by the International Paediatric Work Group on Arousals and categorized either as cortical arousals (CA) or subcortical arousals (SCA). Furthermore, arousals were analyzed during bladder voiding in term and preterm infants. For these purposes, an adapted enuresis detector was connected to the polygraphic computer unit.

Results: In term infants ($n = 21$), bladder voiding was accompanied by CA during quiet sleep whereas in preterm infants ($n = 21$) bladder voiding was not accompanied by an arousal. In term infants ($n = 35$), an increase in heart rate (HR) during arousal could be shown ($P < 0.001$). This increase was greater during CA compared to SCA (13.7 ± 6.2% vs. 8.4 ± 9.4%; $P < 0.001$). In preterm infants ($n = 35$) HR decreased ($P < 0.05$) during CA and SCA. Heart rate-respiratory frequency-ratio (HRR) increased during arousals in term infants ($n = 25$). This was true for pooled CA and SCA of term infants ($P < 0.001$), but also for CA ($P < 0.001$) and SCA ($P < 0.05$) alone. In preterm infants ($n = 25$), there was no significant difference between HRR during arousals when compared to a reference period.

Conclusions: We found an immature arousals response in preterm infants. This was true for spontaneous CA and SCA and for endogenous induced arousals (bladder voiding). These findings may be helpful in order to understand the maturation process of arousals and to identify infants at risk who show an immature arousal response.

PP05.01 Ethics in the investigation of SID with reference to a case study

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Toxicological analysis of specimens from a SID revealed tolbutamide content of 340 mg/l. Suspicion of child abuse or accident was evident. Circumstances of the SID were inconsistent with this. Toxicologic analysis had been performed by an internationally accredited laboratory. No evidence of a fault in the autopsy routines could be demonstrated. Police investigation was delayed on ethical grounds by an intervention of the forensic medical expert. The family was spared from an intense interrogation in the period of deep emotional stress. Ethical problems in the case: a thorough forensic and police investigation of SID is justified by ethical principles. Delay in these investigations can prevent the detection of a crime or accident. The human rights of the child require the right solution of the case. Ethical dilemma arises from the principle of protection of the family and from the principle of avoiding unnecessary harm of individuals, which was in contradiction to the former principle. A thorough examination of the methods and autopsy routines showed a combined and until now hidden source of an incorrect result of the analysis of tolbutamide. The result of toxicologic analysis was corrected. (The case has been reported in poster exhibition/8th Intern.SIDS conference, Edmontont 2004.) The protection of the family on the ethical grounds was justified. The responsibility of the investigators of SID is stressed not only as an obligation to criminal examination but as a general obligation to follow the principles of medical ethics in the delicate investigation of SID. In this case it resulted in the benefit of the family with a new baby and in the toxicological methods and forensics enhancing the knowledge of hidden sources in the laboratory investigations. References: A.J. Jääskeläinen and Erkki O. Vuori: Pitfalls in the forensic medicolegal and toxicologic examination of SID. Poster exh. 8th Intern.Conf.SIDS 2004. J. Rawls: A Theory of Justice, Oxford University Press, 1971.

PP05.02 Unraveling the mystery of sudden infant death syndrome in the C20th to C21st

Limerick, S

FSID (Vice-chairman since 1971), UK

Sudden unexplained deaths of infants came into prominence in USA, UK, and other western countries as infant deaths from known causes declined in the twentieth century. In the USA, parent-led organizations to support bereaved parents were formed in the 1960s and International conferences of specialists were held in 1963 and 1969 which led to the definition of "Sudden Infant Death Syndrome" and in 1979 its acceptance in the International Classification of Diseases. In the UK, from 1951 research was promoted by Professor Camps and others, which was reviewed at a Symposium in Cambridge in 1970 attended by doctors and scientists from many parts of the world. This led to the formation of the Foundation for the Study of Infant Deaths registered as a charity in 1971. The approach taken by FSID in the fields of scientific research, support for bereaved parents, and education of health professionals and the public differed somewhat from that taken in the USA, arising from the understanding that there were many underlying causes of sudden infant deaths. FSID promoted international collaboration between scientists and parents which led to a series of international conferences and the formation of organizations in Canada, Australia, New Zealand, and some European countries. My paper/poster will present the key steps in the

development of collaborative research and cooperation which has led to successful strategies to prevent sudden infant deaths, and an assessment of the value of the term sudden infant death syndrome in the 21st century.

PP06.01 Peer supporters' and healthcare personnel's experiences about support interventions for grieving parents

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Background: The death of a child has been described as one of the most stressful of all possible losses that individuals can experience. Grieving parents need systematic and long-term support after the death of the child. There is very little scientific research on the role of bereavement follow-up. At the Department of Nursing Science, University of Tampere, grief and bereavement have been one main research topic. In this research, an intervention for grieving parents was developed and will be evaluated. This intervention included collaboration between peer supporters and healthcare personnel, who support grieving parents after leaving the hospital.

Purpose: The purpose of the study was to describe peer supporters' and professionals/healthcare personnel's experiences of support interventions for grieving parents.

Method: The sample consisted of healthcare personnel of two Finnish university hospital ($n = 25$) and peer supporters of SIDS Finland ($n = 15$), who implemented the support interventions. The data were collected by questionnaire with open-ended questions and interviews. Data were analyzed using qualitative content analysis.

Findings: The results indicate that both peer supporters and healthcare personnel had positive and negative experiences about the support interventions. The participants had ideas in order to develop the interventions. The main results of the study will be presented in the conference.

PP06.02 Information booklet about school children and grief

Kalstad, TG; Schrader, L

Unexpected Child Death Society of Norway, Norway Trine Giving Kalstad and Line Schrader, Unexpected Child Death Society of Norway, Kari Bugge and Eline Grelland, Akershus University Hospital

Grief may have serious consequences for children's life and development. They are in the midst of a vulnerable phase in life. Children's grief reactions are frequently misunderstood by their surroundings, and adults often do not know how to approach the children. Previous projects have shown that bereaved children, their families, friends, and schools need information about the grieving process among children and how to cope.

In this project, an information booklet about children in school age (5–12 years) and grief has been published. The purpose is to give children's social surroundings knowledge about children's grief, advice, and counseling on how to help children to cope with grief. It is also a purpose to give information directed at children to help them to cope. The booklet is based on interviews and conversations with children and adults who have different grief experiences, and advice

from different professionals. Professional experience, literature, and research have also been central.

The booklet School children and grief tells about how children experience grief, what children do and may do to improve their situation, and what others can do to support and help. The main part is directed at adults. One part is directed at the children themselves.

Several organizations have been involved in the elaboration process to secure wide relevance of the booklet: Unexpected Child Death Society of Norway, the Norwegian Cancer Society, the Norwegian Association of Lost a Child, the Norwegian Organisation for Suicide Survivors, the Association for Traffic Injured and Adults for Children. The booklet is distributed freely through the mentioned organizations.

PP06.03 Bereavement care: family support at the Medical University Innsbruck, Austria

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SIDS: Deceased infant has been transported to hospital.

Psychological acute care at SIDS outpatients' department or counseling support through Psychological Acute Service Austria (NDÖ) or Crisis Intervention Team/Red Cross. Appropriate psychological intervention in the form of crisis intervention—supporting family in parting with infant. Organizational support—considering needs of siblings, notifying relatives and social/family support network, preparing parents for police investigation/postmortem examination. Cooperation with pastoral worker and medical practitioners.

Discussion of autopsy results in multidisciplinary team (psychologist, medical practitioner, pathologist) and follow-up counseling support for family. Further counseling support as requested by family members (in particular consideration of anniversary dates and religious festivals). Closure session as requested by parents.

Subsequent pregnancy ante and postnatal counseling support in case of subsequent pregnancy as requested. Medical examination and consult at SIDS outpatients' department is offered as requested; possibility of child monitoring if mother presents overly anxious.

End of intervention (if requested by parents, follow-up contact for psychological or medical intervention possible). Alternative Pathologist to notify medical practitioners of SIDS outpatients' department. Condolences in writing with attached invitation of discussing medical results. Parents to contact psychology services if discussion of medical results requested. No set time frame for the date of discussion (even possible after 1 year or later). Discussion of medical results with medical practitioner/pathologist and psychologist present. If requested further psychological support.

Additional Possibility of attending information sessions on baby (breathing) monitors and education on infant resuscitation for parents (no cost to attend, held monthly). SIDS-information-brochure ("Coping with SIDS") available at outpatients' department.

PP06.04 11 Years ago, my young brother died when he was only 2 years old

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This is a conversation that I had with my teacher about 9 years ago. My teacher said, "You are so cute! Why don't you be my child?"

I said, "I'm sorry. I can't be your child. Because I lost my brother and if I become your child, my parents will be sad." Then now. Everyone thinks that I'm the only child in my house, but everyone calls me "Aneki." In Japanese "aneke" is a special word meaning "older sister." What is the influence of my brother's death? This is a report that I want to tell you.

PP06.05 Abstract

Johansson, P

Ambulance service, Sweden During my many years as a paramedic and reg. nurse, I sometimes come in contact with families who lost a child. In my work at the hospital of Kungälv at the emergency ward and in the ambulance, I have many examples of when information to parents went not so well. In the past, when CPR was stopped and the doctor declared the child dead, the doctor just went in to the room where the family was waiting and told them the horrible message. SORRY BUT YOUR CHILD IS DEAD!!! This has been something I always thought we can do better. I've been thinking about it for a couple of years and one night when we were working trying to save a critically ill child, and were doing CPR. When it was time to stop, I asked the doctor in charge to just listen for a couple seconds. I told him that if we could continue doing CPR for a couple of more minutes, he could go outside and talk to the parents about all that we were doing and then come in to the room as we were working. He thought this was a good idea, so he went out and talked to them and declared what we were doing, and he also prepared them to the fact that we had no response to the CPR. He also very calmly and quietly let the parents understand that their child now was no longer alive. He also told them that we had to stop doing CPR but he told them in a way so they were included in the discussion to stop. The Mother said calmly, Let my child die! The paramedics in the region of Gothenburg are always welcome to contact Jutta Kjarbeck, and we can always come to the hospital with the whole family that had lost a child. She is an angel to the parents and she is an angel for us. We are blessed with a very close cooperation of a person like Jutta. She takes care of the parents so professionally and she takes care of us in the paramedic division like we were her children. That makes it easier for us paramedics to move on.

PP07.01 Infant mortality (2004–2006) in Piemonte: Italians versus immigrants

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Objective: The aim of the study has been the evaluation of the differences in infants mortality and sudden deaths within 0 and 2 years in the Piemonte Region between Italians and immigrants from 2004 to 2006.

Method: We thoroughly analyzed all the death certificates belonging to the 369 children that died within the considered period (2004–2006). Then, we selected the cases (289) where the death diagnosis clearly excluded the sudden death (i.e., road accident, cancer, etc.). For the remaining cases, the complete clinical documentation has been analyzed (e.g., clinical file, autopsy, etc.) according to its availability. Hence, only in the case of suspected sudden deaths, we went through an interview of the medical staff who was in charge of

the first aid (ambulance, emergency department) in order to get more details about the death scene, the possible emergency maneuvers, and the status of the victim. We have classified the sudden deaths into SIDS, SUDI, and undefined sudden deaths (without autopsy). With regard to the statistical analysis, we have used the chi-square test.

Results:

Cases	Pop	Rate	LL	UL	chi-2	df	P-value
Deaths Italians	261	98,215	265.7	235.4	299.9		
Deaths immigrants	108	14,300	755.2	626.0	911.0		
Deaths total	369	11,2515	328.0	296.2	363.1	91,200	2 0.000
Total sudden deaths Italians	11	98,215	11.2	6.3	20.1		
Total sudden deaths immigrants	4	14,300	28.0	10.9	71.9		
Total sudden deaths	15	112,515	13.3	8.1	22	2,634	1 0.105
SIDS Italians	4	98,215	4.1	1.6	10.5		
SIDS immigrants	3	14,300	21.0	7.1	61.7		
SIDS total	7	112,515	6.2	3.0	12.8	5,735	1 0.017
SUDI Italians	4	98,215	4.1	1.6	10.5		
SUDI immigrants	0	14,300	0.0	0.0	26.9		
SUDI total	4	112,515	3.6	1.4	9.1	0,582	1 0.445

Conclusions: This study outlines an increasing incidence in Piemonte of the mortality below 2 years and the SIDS within the immigrants population with respect to the Italian one. This result could be helpful in addressing the next preventive actions.

PP07.02 Is there lower prevalence of sudden infant death syndrome in China?

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Despite declines in prevalence during the past two decades, sudden infant death syndrome (SIDS) continues to be the leading cause of death for infants aged between 1 month and 1 year in developed countries. However, infant mortality rate of China is 22.12/1 000 live births in 2007; the causes of infant death are mainly related to serious birth defects (neural tube defects, congenital heart diseases, etc.), Infectious (Pneumonia, Diarrhea, etc.), Neonatal asphyxia, respiratory distress syndrome, birth injury, low birth weight, and prematurity. So far, there is no epidemiological survey to indicate what the prevalence of sudden infant death syndrome (SIDS) is in China. But, there should be low prevalence for SIDS in China, or at least it is very close to the prevalence rates of SIDS in Hong Kong (0.3% in 1987) and Taiwan of China (0.56% in 1993). The prevalence rates of SIDS in developed countries are higher than that of China. The reason is that there are many differences in behavioral risk factors, such as prone and side positions for infant sleep, smoke exposure, soft bedding and sleep surfaces, overheating, and breastfeeding, between developed countries and China. China has traditional customs and child care model, having very low smoking rate in reproductive women, traditional supine position for infant sleep, most of infants sleeping at their mother's bed room until 2 or 3 years, more than 70% of breastfeeding rate, and lower rate of exposure to overheating. Therefore, it suggests that there should be very low prevalence for SIDS in China.