

Apnea Monitoring and Sudden Infant Death Syndrome (SIDS): A Selected Annotated Bibliography

Burke MJ, Downes R.

A fuzzy logic based apnoea monitor for SIDS risk infants.

J Med Eng Technol. 2006 Nov-Dec; 30(6):397-411.

A unit has been designed which monitors newborn infants at risk of Sudden Infant Death Syndrome (SIDS) in a home environment. The unit monitors respiration, electrocardiogram (ECG) and haemoglobin oxygen saturation (SpO₂) in combination, in order to detect any potentially life threatening event at an early stage. Provision is made for the generation of both audible and silent alarms and for the storage of signals and other information before, during and after an alarm episode for diagnostic purposes. An intelligent fuzzy logic algorithm is used to process the signals monitored and to implement several propositions concerning their status in order to determine the probability of an apnoea event and initiate the appropriate action. This has substantially reduced the number of false alarms and of undetected dangerous situations compared with previous units, which greatly improves the reliability and usefulness of such a monitor.

Full-text available at: <http://taylorandfrancis.metapress.com> (not a U.S. Government site)

Sleep architecture in term and preterm infants beyond the neonatal period: the influence of gestational age, steroids, and ventilatory support.

Sleep. 2005 Nov 1; 28(11):1428-36.

Study Objective: To examine (1) sleep architecture of infants at varied risk for sudden infant death syndrome, (2) delays or advances in preterm infants at term postmenstrual age, (3) whether ventilatory support and gestational age alter sleep, (4) whether steroids alter sleep, (5) confounding influences of sex, small for gestational age, and maternal smoking. Design: Overnight polysomnography. Dependent variables: Percentage of active sleep, quiet sleep, indeterminate, and awake time per total recording time; mean and longest duration of state epochs; number of episodes > or = 10 minutes; and sleep efficiency. Setting: Collaborative Home Infant Monitoring Evaluation (CHIME). Participants: Two hundred one preterm and 198 term infants between 33 and 58 weeks postmenstrual age during polysomnography. Fifty-one term infants with an apparent life-threatening event without known etiology (apnea of infancy), 59 subsequent siblings of babies who died of sudden infant death syndrome, and 88 healthy term infants. Results: Tracings of infants with apnea of infancy and healthy term infants were similar. Subsequent siblings of babies who died of sudden infant death syndrome spent less time in quiet sleep. Preterm infants (< or = 37 weeks postmenstrual age) exhibited immature

architecture compared with infants of term postmenstrual age. The latter exhibited similar sleep except that they had a lower percentage of quiet sleep and longer mean indeterminate and longest indeterminate episodes. Preterm infants with the youngest gestational age lagged behind older preterm infants. Neither sex nor use of steroids affected sleep. Assisted ventilation was associated with a delay in maturation, small-for-gestational age status with increased active sleep, and smoking with increased awake time. Conclusion: With few exceptions, asymptomatic premature infants do not exhibit significant delays in sleep architecture compared with term infants at comparable postmenstrual age. The preterm infant with an early gestational age and morbidity exhibited delayed sleep architecture.

Full-text available at: <http://www.journalsleep.org/> (not a U.S. Government site)

Hall KL, Zalman B.

Evaluation and management of apparent life-threatening events in children.

Am Fam Physician. 2005 Jun 15; 71(12):2301-8.

Apparent life-threatening event syndrome predominantly affects children younger than one year. This syndrome is characterized by a frightening constellation of symptoms in which the child exhibits some combination of apnea, change in color, change in muscle tone, coughing, or gagging. Approximately 50 percent of these children are diagnosed with an underlying condition that explains the apparent life-threatening event. Commonly, the problems are digestive (up to 50 percent), neurologic (30 percent), respiratory (20 percent), cardiac (5 percent), and endocrine or metabolic (less than 5 percent). Fifty percent of these events are idiopathic, which causes great concern to parents and physicians. The evaluation of an affected infant involves a thorough description of the event as well as prenatal, birth, medical, social, and family history. The physical examination, including careful neurologic examination and notation of any apparent anatomic abnormalities, helps diagnose congenital problems, infection, and conditions contributing to respiratory compromise. The laboratory evaluation is driven by historical and physical findings. Inpatient evaluation and monitoring are recommended in virtually all cases unless investigations are normal. Should the history reflect a severe episode, or should the child require major interventions such as cardiopulmonary resuscitation, inpatient observation and monitoring are recommended, even if physical examination and laboratory findings are normal. Once a presumptive diagnosis is made, events should cease after appropriate intervention. If not, reviewing the history, performing another physical examination, and reassessing the need for laboratory and imaging studies are the next steps. Although consensus statements by the National Institutes of Health and the American Academy of Pediatrics support home monitoring, the relationship of apparent life-threatening event syndrome to sudden infant death syndrome is controversial.

Full-text downloading available at: <http://www.aafp.org/afp/20050615/2301.html> (not a U.S. Government site)

Richardson MA, Adams J.

Fatal apnea in piglets by way of laryngeal chemoreflex: postmortem findings as anatomic correlates of sudden infant death syndrome in the human infant.

Laryngoscope. 2005 Jul; 115(7):1163-9.

Objectives/Hypothesis: Intrathoracic petechiae are a prominent diagnostic finding in sudden infant death syndrome (SIDS) victims. In this study, the laryngeal chemoreflex (LCR) was elicited experimentally to discover whether intrathoracic petechiae would be produced by way of the LCR. The hypothesis was that water stimulation of the larynx in piglets, leading to death by prolonged apnea, would produce postmortem findings similar to those found in SIDS victims. Study Design: Using the piglet as an animal model, the LCR was initiated by way of water stimulation of the larynx, resulting in death.

Normoxic and hypoxic conditions were established before the stimulation. The piglets were studied postmortem to determine the relationship between the physiologic mechanisms of the LCR and characteristic pathologic findings in SIDS. Methods: Using protocols approved by animal care, 14 mixed-breed piglets aged 7 to 14 days were sedated with a ketamine/xylazine mixture. Respiratory and pressure-monitoring devices were affixed and light anesthesia maintained with Surital infusion. In 10 of the piglets, a small catheter was placed between the arytenoid cartilages, and 5 mL of tap water was introduced over 1 second. The LCR ensued, producing periods of central apnea bordered by gasping efforts and resulting in hypoxemia and death in all cases. Four piglets underwent this manipulation in normoxic conditions. Six breathed a hypoxic gas mixture for 1 hour to bring their Po₂ down to below 50 torr before water was introduced into the larynx. Four control piglets breathed the hypoxic gas mixture for 1 hour (without water stimulation or LCR) before Surital overdose. Within 24 hours of death, all piglets underwent thoracoabdominal autopsy by a blinded evaluator experienced in SIDS pathology. Results: The autopsies revealed nothing remarkable in the abdominal viscera of any of the experimental animals. Thymus, heart, and lungs were graded 0 to 4 to indicate the degree of petechiae on external surfaces. Average cumulative scores (ACS) were applied to each animal. The control (hypoxic) piglets had no petechiae (ACS 0.0). The normoxic experimental piglets had moderate petechiae (ACS 3.5). The hypoxic experimental piglets had more prominent petechiae (ACS 6.3). Conclusions: Stimulation of the LCR, leading to death by prolonged apnea, produces postmortem findings in piglets similar to those found in SIDS victims. Petechiae were more severe among piglets pretreated with a hypoxic mixture of gases. This study supports the hypothesis that initiation of the LCR may produce pathologic features often prominent in SIDS.

Full-text available at: <http://www.laryngoscope.com> (not a U.S. Government site)

Silvestri JM, Lister G, Corwin MJ, Smok-Pearsall SM, Baird TM, Crowell DH, Cantey-Kiser J, Hunt CE, Tinsley L, Palmer PH, Mendenhall RS, Hoppenbrouwers TT, Neuman MR, Weese-Mayer DE, Willinger M; Collaborative Home Infant Monitoring Evaluation Study Group.

Factors that influence use of a home cardiorespiratory monitor for infants: the collaborative home infant monitoring evaluation.

Arch Pediatr Adolesc Med. 2005 Jan; 159(1): 18-24.

Background: As part of the Collaborative Home Infant Monitoring Evaluation, a home monitor was developed to record breathing, heart rate, other physiologic variables, and the time the monitor was used. Objective: To determine the frequency of monitor use, factors that influence use, and validity of a model developed to predict use. *Design:* We developed a model to predict monitor use using multiple linear regression analysis; we then tested the validity of this model to predict adherence for the first week of monitoring and for the subsequent 4-week period (weeks 2-5). Setting: Clinical research centers in Chicago, Ill; Cleveland, Ohio; Honolulu, Hawaii; Los Angeles, Calif; and Toledo, Ohio. Patients Preterm infants, infants younger than 1 month with a history of autopsy-confirmed sudden infant death syndrome in a sibling, and infants with an idiopathic apparent life-threatening event were divided into 2 cohorts based on enrollment date. Main Outcome Measure: Mean hours of monitor use per week. Results: In cohort 1, the variables available before monitoring were only weakly associated with total hours of monitor use in weeks 2 to 5 (total model $r(2) = 0.08$). However, when hours of monitor use in week 1 were included as a variable to predict monitor use in weeks 2 to 5, the $r(2)$ increased to 0.64 for hours of monitor use per week. Conclusions: Our data show that monitor use in the first week was the most important variable for predicting subsequent monitor use. The study suggests that a major focus of home monitoring should be adherence in the first week, although it remains to be tested whether this adherence can be altered.

Full-text available at: <http://archpedi.ama-assn.org/> (not a U.S. Government site)

Shoemaker M, Ellis M, et al.

Should Home Apnea Monitoring be recommended to prevent SIDS?

J Fam Pract 2004 May; 53(5): 418-9.

While home apnea monitoring may find an increased incidence of apnea and bradycardia in preterm infants compared with term infants, no association links these events with sudden infant death syndrome (SIDS). Apnea of prematurity is not a proven risk factor for SIDS. Since apnea of prematurity has not been shown to be a precursor to SIDS, home apnea monitoring for the purpose of preventing SIDS cannot be recommended (strength of recommendation [SOR]: B, based on a single prospective cohort study and multiple case-control studies). Neonates with significant neurologic or pulmonary disease may benefit from apnea monitoring.

Full-text available at: <http://www.jfponline.com/default.asp> (not a U.S. Government site)

Poets CF.

Apparent life-threatening events and sudden infant death on a monitor.

Paediatr Respir Rev. 2004; 5 Suppl A:S383-6.

This review summarises recent data on mechanisms for apparent life-threatening events (ALTE) and sudden infant death (SID) which show that (i). recordings obtained during ALTE allow the detection of previously unrecognised but preventable mechanisms in a significant proportion of infants and should thus be performed routinely in infants with

such a history, (ii). in recordings obtained during SID and idiopathic ALTE, prolonged apnoea was found in only a minority, while severe hypoxaemia appeared to the common mechanism, (iii). it remains yet unclear by which mechanism this hypoxaemia develops, with upper and/or lower airway obstruction, rebreathing of expired air and intrapulmonary shunting being potential candidates, (iv). there is evidence that arousal fails during SID, which could be related to known risk factors such as tobacco smoke exposure, whereas (v).gaspings occurred during the majority of SID cases where respiratory patterns have been analysed, but it remains unclear why gasping remains ineffective in resuscitating the infant from hypoxaemia.

Full-text available at: <http://www.sciencedirect.com> (not a U.S. Government site)

Bard H, Cote A, Praud JP, Infante-Rivard C, Gagnon C.

Fetal hemoglobin synthesis determined by gamma-mRNA/gamma-mRNA + beta-mRNA quantitation in infants at risk for sudden infant death syndrome being monitored at home for apnea.

Pediatrics. 2003 Oct; 112(4):e285.

Objective: Fetal hemoglobin (HbF) levels in the hemolysates obtained from infants who died from sudden infant death syndrome (SIDS) are reported to be markedly increased compared with controls. This finding could have been explained by increased HbF synthesis caused by episodes of hypoxemia in the SIDS infants. A prospective study in a group of infants being monitored at home after an apparent life-threatening event (ALTE) and considered at increased risk for SIDS was conducted with an improved ribonuclease protection assay. The ribonuclease protection assay allowed for the quantitation of [gamma/(gamma+beta)]-globin mRNAs, which has a highly significant correlation with the levels of HbF synthesis. Methods: Thirty-five infants who were admitted for an ALTE were included in the study. All infants were at home under surveillance with a cardiorespiratory monitor and followed in an apnea clinic with monthly appointments. Seventy-three blood samples were obtained between 38 and 61 weeks of postconceptional age. For control purposes, a similar group of 37 normal infants (99 samples) whose HbF synthesis was previously determined were included. RESULTS: Mean [gamma/(gamma+beta)]-globin mRNAs were increased in the ALTE group at 42 to 45 and 46 to 49 weeks of postconceptional age (mean: 55.2 +/- 17.4% and 33.9 +/- 14%) in comparison with HbF synthesis in controls (mean: 42.6 +/- 13.7% and 23.6 +/- 9.8%). Conclusions: The data obtained in this report from infants who were considered at risk for SIDS show that HbF synthesis is increased between 42 and 49 weeks of postconceptional age. Determining HbF synthesis as described in this study may have value as a marker for episodes of hypoxemia for certain infants who are at risk for SIDS.

Free Full-text downloading available at:

<http://pediatrics.aappublications.org/cgi/content/full/112/4/e285> (not a U.S. Government site)

Zotter H, Schenkeli R, et al.

Short-term event recording as a measure to rule out false alarms and to shorten the

duration of home monitoring in infants.

Wein Klin Wochenschr 2003 Jan 31; 115(1-2): 53-7.

Apnea and cardiorespiratory home monitors are commonly used for electronic surveillance of infants. Frequent alarms can be very stressful for parents and lead to unnecessarily prolonged home monitoring. The aims of this study were to determine the frequency and type of significant events by using short-term home event recordings of respiratory, electrocardiogram and oxygenation patterns, to consider the pros and cons of oxygenation recording, to correlate the findings with observations made by parents and to find out whether parents could be reassured by the use of these monitors. We investigated recordings from 26 healthy symptoms less infants (14 male, 12 female) whose parents experienced anxiety and stress owing to frequent alarms on their apnea (n = 2) or cardiorespiratory home monitors (n = 24). 770 events were analyzed and compared with the parents' interpretation. Median duration of monitoring was 10 days. Only 39/770 alarms (5.1%) were classified as true alarms. Of these, 30 alarms (76.9%) were misinterpreted as false alarms by parents. In contrast, of 218 alarms regarded as true by parents only 15 (6.9%) were in fact true, alarms. The comparison of monitor data and the parents' reports showed no correlation in interpretation of alarms, for both true (r = 0.06) and false alarms (r = -0.09). Of 283 oxygenation alarms, only two were due to real desaturation. Following short-term monitoring, 21/26 parents (80.7%) declared they were reassured. Monitoring could immediately be discontinued in 17/26 infants (65.4%). Short-term event recording can clarify the significance of frequent alarms, reassure parents and shorten the duration of home monitoring.

Sridhar R, Thach BT, et al.

Characterization of successful and failed autoresuscitation in human infants, including those dying of SIDS.

Pediatr Pulmonol 2003 Aug; 36(2): 113-22.

Our purpose was to identify and further characterize physiologic mechanisms relevant to autoresuscitation from hypoxic apnea in infants dying suddenly and unexpectedly. We studied cardiorespiratory recordings of 24 infants (age range, 0.8-21 months) who died suddenly while being monitored at home. These recordings were analyzed for features indicated by studies in animal models to be characteristic of hypoxic gasping, and of recovery from bradycardia and apnea associated with gasping (e.g., autoresuscitation). Findings in 5 infants diagnosed as having sudden infant death syndrome were compared with 6 non-SIDS infants whose deaths resulted from other conditions. Additionally, we studied 15 healthy infants during sleep, using home monitor and other respiratory recording techniques, in order to obtain comparison data. We found in recordings from 23 of 24 subjects that hypoxic gasps with characteristic features occurred immediately preceding death. A unique pattern of complex, closely spaced gasps (double or triple gasps) was present in many subjects. Evidence of partially successful autoresuscitation closely following one or more gasps occurred in 11 subjects, while another 4 had evidence of complete autoresuscitation with return of normal heart rate and resolution of apnea on one or more occasions. Significant differences between SIDS infants and those dying from other causes included increased occurrence of complex gasps and decreased

occurrence of partial or complete autoresuscitation in the SIDS infants. The non-SIDS cases were different from the SIDS cases in that only one had double gasps (n = 7), while none had triple gasps, as compared with 4 out of 5 SIDS cases with these patterns (P < 0.05, chi-square). Also, in contrast with the SIDS cases, more of the cases with specific postmortem diagnoses had evidence of partial (5 out of 6 cases) or complete (1 out of 6 cases) autoresuscitation (P < 0.05, chi-square). We conclude that partial or complete autoresuscitation by gasping is not uncommon in moribund infants during the first year of life. Failure of autoresuscitation mechanisms other than failure to initiate gasping may be characteristic of infants dying of SIDS. Some SIDS infants appear to be different from infants dying with other diagnoses with respect to efficacy and characteristics of hypoxic gasping.

Full-text available at: <http://www3.interscience.wiley.com/cgi-bin/jhome/39249> (not a U.S. Government site)

Apnea, sudden infant death syndrome, and home monitoring.

Pediatrics 2003 Apr; 111(4 Part 1): 914-917.

More than 25 years have elapsed since continuous cardiorespiratory monitoring at home was suggested to decrease the risk of sudden infant death syndrome (SIDS). In the ensuing interval, multiple studies have been unable to establish the alleged efficacy of its use. In this statement, the most recent research information concerning extreme limits for a prolonged course of apnea of prematurity is reviewed. Recommendations regarding the appropriate use of home cardiorespiratory monitoring after hospital discharge emphasize limiting use to specific clinical indications for a predetermined period, using only monitors equipped with an event recorder, and counseling parents that monitor use does not prevent sudden, unexpected death in all circumstances. The continued implementation of proven SIDS prevention measures is encouraged.

Full-text available at: <http://www.pediatrics.org> (not a U.S. Government site)

Uezono S, Kamata A, et al.

Intraoperative awareness and the depth of anesthesia in children: A perspective from pediatric anesthesia.

Sleep Medicine 2002 Dec; 3(Suppl 2): S67-70.

The bispectral index (BIS) monitoring, using electroencephalographically derived method, has shown some promise to measure 'depth of anesthesia' for various anesthetics. A large fraction of the literature that has investigated BIS monitoring demonstrates that BIS correlates well with clinically important endpoints and many clinical utility trials have been undertaken in adults to prove its effectiveness to improve preoperative patient care. As the use of the technology grows, other potential applications have been investigated; BIS as a monitor in pediatric anesthesia and BIS as a monitor to measure the depth of sleep may serve as examples. If the two are proved useful, these successes may bring clinicians another application of this technology: BIS to monitor unconsciousness state of babies to prevent sudden infant death syndrome or apparent life

threatening event.

Full-text available at: <http://www.sciencedirect.com> (not a U.S. Government site)

Kurz H, Neunteufl R, Eichler F, et al.

Does professional counseling improve infant home monitoring? Evaluation of an intensive instruction program for families using home monitoring on their babies.

Wien Klin Wochenschr 2002 Sept 30; 114(17-18): 801-806.

Home apnea/bradycardia monitoring was widely used in the 80s and 90s in the hope that Sudden Infant Death (SID) could be prevented. As no evidence could be found in favor of this hypothesis, HM today is restricted to symptomatic preterm infants, infants with cardiorespiratory problems and infants after an apparent life-threatening event (ALTE). HM can impose substantial stress on families, especially mothers. We introduced an intensive counseling program (IC) for home monitoring and evaluated its effects, using a questionnaire. The control group consisted of families who were using a home monitor before the IC program was instituted, and were instructed according to the standard protocol given by the "Austrian SIDS-Consensus". The IC program consisted of standard monitor instruction as well as instruction in infant cardiopulmonary resuscitation, and was extended by providing intensive support at the beginning and throughout the monitoring period with special regard to the monitor weaning phase. Results: Fifty-eight percent of the 90 questionnaires of the IC-families and 66% of the 70 questionnaires of the control families were returned. Home monitoring was considered to be reassuring by more than 60% of the families. We found the following differences between the two groups: parents taking part in the IC program liked the instruction better, were less stressed by the monitor and reacted less aggressively to monitor alarms. They used the monitor predominantly during sleeping periods and for a shorter period of time (6 vs. 7 1/2 months). IC could not reduce SID related anxiety or change the feelings associated with the use of the home monitor. Intensive counseling leads to a better use of home monitoring and reduces parents' stress. Even if home monitoring is used less frequently today, families should still be instructed and counseled intensively.

Freed GE, Meny R, Glomb WB, Hageman JR.

Effect of home monitoring on a high-risk population.

J Perinatol 2002 Mar; 22(2): 165-167.

A large cohort of infants (8,998) at high risk for sudden and unexpected death was followed with home cardiorespiratory monitoring over a five-year period. These infants included premature infants (23-36 weeks post-conceptual age), SIDS siblings, and infants who experienced an Apparent Life-Threatening Event. The overall SIDS rate in this high-risk population was 0.55/1,000, a rate significantly less than the 0.85 deaths/1,000 reported in the "general population" of Georgia over this same time period. In addition, we report our experience with using home monitors as a diagnostic tool, as well as how monitors can actually be cost-effective. Editorial opinions, and lay press summaries of the CHIME study (JAMA, May 2, 2001) imply that home cardiorespiratory monitors are of little value. Despite the fact that the study never made this claim, many clinicians are

now referring to this study as evidence that home monitoring is ineffective and not needed. This article disputes those misconceptions about home cardiorespiratory monitors based on our experience with a large high-risk population of infants.

Full-text available at: <http://www.nature.com/jp/index.html> (not a U.S. Government site)

Neuman MR, Watson H, Mendenhall RS, et al.

Cardiopulmonary monitoring at home: The CHIME monitor.

Physiol Meas 2001 May; 22(2): 267-286.

A new physiologic monitor for use in the home has been developed and used for the Collaborative Home Infant Monitor Evaluation (CHIME). This monitor measures infant breathing by respiratory inductance plethysmography and transthoracic impedance; infant electrocardiogram, heart rate and R-R interval; hemoglobin O₂ saturation of arterial blood at the periphery and sleep position. Monitor signals from a representative sample of 24 subjects from the CHIME database were of sufficient quality to be clinically interpreted 91.7% of the time for the respiratory inductance plethysmograph, 100% for the ECG, 99.7% for the heart rate and 87% for the 16 subjects of the 24 who used the pulse oximeter. The monitor detected breaths with a sensitivity of 96% and a specificity of 65% compared to human scorers. It detected all clinically significant bradycardias but identified an additional 737 events where a human scorer did not detect bradycardia. The monitor was considered to be superior to conventional monitors and, therefore, suitable for the successful conduct of the CHIME study.

Full-text available at: <http://www.iop.org/EJ/journal/PM> (not a U.S. Government site)

Hunt, C.E.; Durham, J.K.; Guess, S.J.; Kapuniai, L.E.; Golub, H.; et al.

Telephone subsidy: An effective incentive for successful participation in home memory monitor study.

Arch Pediatr Adolesc Med 2001 Aug; 155(8): 954-959.

The Collaborative Home Infant Monitoring Evaluation (CHIME) study enrolled healthy term infants and three groups of infants considered to be at increased risk for sudden infant death syndrome, to evaluate apnea and bradycardia events in the home. Mother-infant pairs without a telephone were ineligible for enrollment. The objective of this study was to determine whether mother-infant pairs who were offered a telephone subsidy would agree to enroll in CHIME and achieve protocol compliance rates comparable with those of matched subjects able to afford telephones. The setting for this study was the Collaborative Home Infant Monitoring Evaluation clinical research centers in Honolulu, Hawaii, and Toledo, Ohio. A telephone subsidy was provided to otherwise eligible enrollees for CHIME. Thirty-one telephone subsidy subjects were retrospectively compared with 55 control subjects matched for study group, site, birth weight, and maternal race, age, and education. The main outcome measured was the frequency of compliance with protocol requirements for follow-up evaluations and for extent of home monitoring. Results showed that the subsidy subjects achieved protocol completion rates that were comparable with those of control subjects, for developmental assessments at 56

and 92 weeks postconceptional age (PCA), and for the polysomnogram. Unexpectedly, however, subsidy subjects were more likely to have a developmental assessment at 44 weeks PCA ($P=.01$), as well as a cry analysis ($P=.04$). They were also more likely to use the CHIME home monitor for more hours during weeks 2 through 5 ($P=.004$), have a higher percentage using the monitor for 10 or more hours per week during weeks 2 through 5 ($P=.009$), and have a higher total number of days of monitor use throughout 6 months ($P<.001$). Mean cost of the subsidy was \$3.25 per day of monitor use, and monitor use per day was directly related to total cost of the subsidy ($P=.01$). It was concluded that a telephone subsidy is an effective financial incentive. At least within the context of the CHIME study, telephone subsidy enhanced access to health care, and in some categories, it resulted in enhanced protocol compliance.

Full-text available at: <http://archpedi.ama-assn.org/> (not a U.S. Government site)

Carbone T, Ostfeld BM, Gutter D, Hegyi T.

Parental compliance with home cardiorespiratory monitoring.

Arch Dis Child. 2001 Mar; 84(3):270-2.

Aims: To evaluate parental compliance with home cardiorespiratory monitoring of premature infants with apnoea, siblings of infants who died of sudden infant death syndrome (SIDS), and infants with an apparent life threatening event (ALTE), during the first month of use. **Methods:** A retrospective review of the first month's recordings was conducted on 39 premature infants with apnoea, 13 siblings of SIDS, and 16 infants with ALTE. All infants were singletons. Recommendations during the study period (1992-1994) were for daily use for 23 hours per day. Measurements were average daily hours of use and consistency of use (daily or variable). Gestational age, maternal age, and socioeconomic status as measured by receipt of public assistance were also recorded. **Results:** Siblings of SIDS were monitored for fewer hours than were premature or ALTE infants. Only 54% of siblings of SIDS were monitored daily, compared to 87% of premature infants and 93% of ALTEs. Within each diagnostic category socioeconomic status did not affect average hours of monitoring. Consistency of use was more evident in those with Private Insurance, Although the Trend Did Not Reach Significance. **Conclusions:** Parents of infants with apnoea of prematurity or ALTE are highly compliant with cardiorespiratory monitoring recommendations in the first month of monitor usage. Siblings of SIDS are monitored for fewer hours and are less likely to be monitored on a daily basis.

For Full-text: <http://adc.bmjournals.com/> (Not a U.S. Government Site)

Hershberger ML, Peeke KL, Levett J, Spear ML.

Effect of sleep position on apnea and bradycardia in high-risk infants.

J Perinatol 2001 Mar; 21(2): 85-89.

The purpose of this study was to investigate, in high-risk infants; the occurrence of abnormalities in documented monitor downloads during the side versus prone position. Forty infants admitted to the A. I. duPont Hospital for Children with diagnoses associated

with sudden infant death syndrome were included in this investigation. During an overnight hospitalization, infants were placed on home apnea monitors, with computer memory to capture alarms for apnea >20 seconds, age-defined bradycardia, and tachycardia. Infants were studied for 12 hours. Each infant was assigned to 6 hours of prone and side during the 12-hour period, with order of position randomly assigned by random number generation. Differences between the two positions in alarm frequency and significant events, as determined by a blinded interpreting physician were analyzed by Fisher exact test, with $p < 0.05$. Power analysis necessitated 20 patients in each group, with beta error of 0.2. Eleven episodes of apnea occurred in the prone position, and 16 in the side position ($p = \text{NS}$). The mean numbers of apnea events per tracing in the prone position was 0.27 ± 0.84 and 0.39 ± 1.1 in the side position ($p = 0.58$). The mean number of bradycardia events per tracing in the prone position was 0.44 ± 1.94 in the side position ($p = 0.9$). Clinicians need to be cautious when recommending the side or prone position in this group of high-risk infants. The results in this investigation provide support for the Back to Sleep Campaign recommendations to be applied, not only to healthy term infants, but higher risk infants as well. Studies of the high-risk infant in the supine position are warranted.

Full-text available at: <http://www.nature.com/jp/index.html> (Not a U.S. Government Site)

Ramanathan R, Corwin MJ, Hunt CE, Lister G, Tinsley LR, et al.

Cardiorespiratory events recorded on home monitors: Comparison of healthy infants with those at increased risk for SIDS.

JAMA 2001 May 2; 285(17): 2199-2207.

Context: Home monitors designed to identify cardiorespiratory events are frequently used in infants at increased risk for sudden infant death syndrome (SIDS), but the efficacy of such devices for this use is unproven. Objective: To test the hypothesis that preterm infants, siblings of infants who died of SIDS, and infants who have experienced an idiopathic, apparent life-threatening event have a greater risk of cardiorespiratory events than healthy term infants. Design: Longitudinal cohort study conducted from May 1994 through February 1998. Setting: Five metropolitan medical centers in the United States. Participants: A total of 1079 infants (classified as healthy term infants and 6 groups of those at risk for SIDS) who, during the first 6 months after birth, were observed with home cardiorespiratory monitors using respiratory inductance plethysmography to detect apnea and obstructed breathing. Main Outcome Measures: Occurrence of cardiorespiratory events that exceeded predefined conventional and extreme thresholds as recorded by the monitors. Results: During 718 358 hours of home monitoring, 6993 events exceeding conventional alarm thresholds occurred in 445 infants (41 percent). Of these, 653 were extreme events in 116 infants (10 percent), and of those events with apnea, 70 percent included at least 3 obstructed breaths. The frequency of at least 1 extreme event was similar in term infants in all groups, but preterm infants were at increased risk of extreme events until 43 weeks' postconceptional age. Conclusions: In this study, conventional events are quite common, even in healthy term infants. Extreme events were common only in preterm infants, and their timing suggests that they are not

likely to be immediate precursors to SIDS. The high frequency of obstructed breathing in study participants would likely preclude detection of many events by conventional techniques. These data should be important for designing future monitors and determining if an infant is likely to be at risk for a cardiorespiratory event.

Full-text available at: <http://jama.ama-assn.org/> (Not a U.S. Government Site)