

California



EMSC
Emergency Medical
Services for Children™

Bedsharing and Sudden Infant Death Syndrome

Thomas G. Keens, M.D.

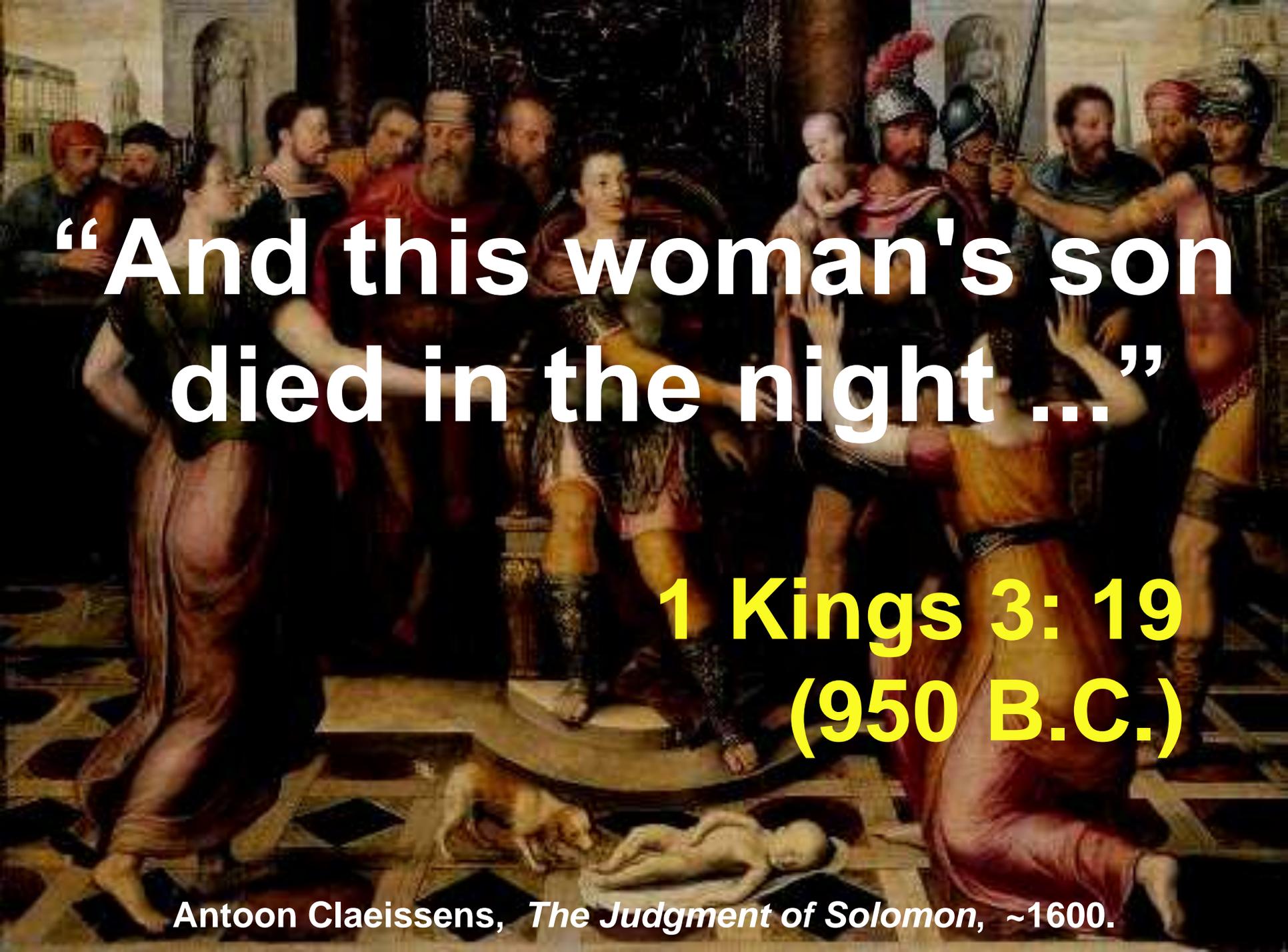
Chair, California SIDS Advisory Council

Professor of Pediatrics, Physiology and Biophysics

Keck School of Medicine of the University of Southern California

Division of Pediatric Pulmonology, Children's Hospital Los Angeles

No Conflicts of Interest to Disclose

The painting depicts King Solomon on a throne, surrounded by a crowd of people. A woman in a red dress is kneeling in the foreground, holding a dead child. Other figures are shown in various states of distress and confusion. The scene is set in a grand, classical-style interior with columns and a checkered floor.

**“And this woman's son
died in the night ...”**

**1 Kings 3: 19
(950 B.C.)**

Antoon Claeissens, *The Judgment of Solomon*, ~1600.

LAPSE OF TIME FROM MOMENT WHEN LAST SEEN ALIVE TO THE DISCOVERY OF DEATH (96 Cases)

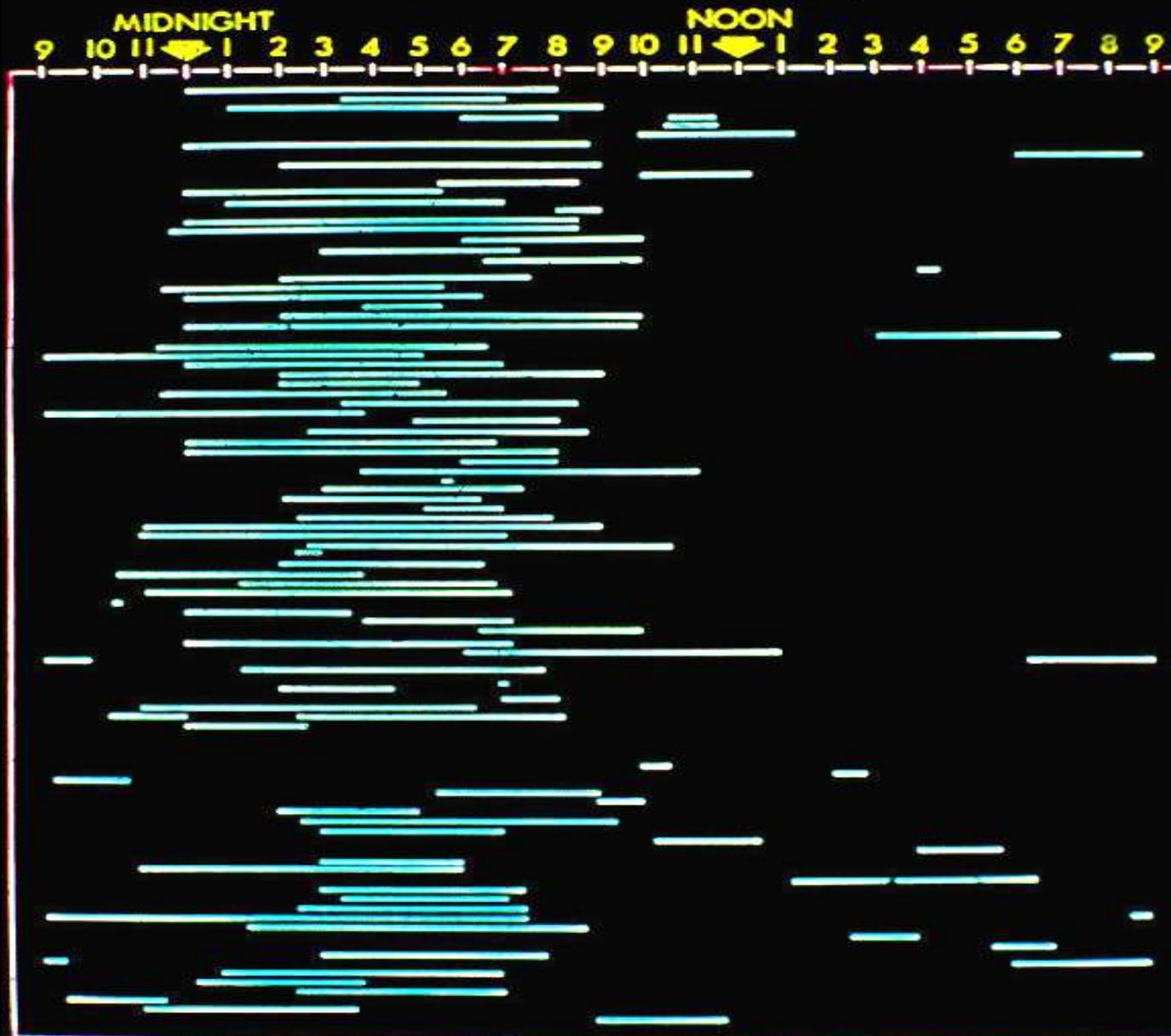


Figure Courtesy of Doctor Maria Valdes-Dapena

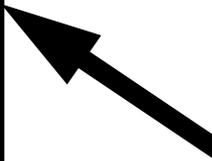
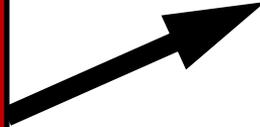
**Sudden
Death
of an Infant**

**Emergency
Responders**

**Coroner's
Investigation**

**Determination
of the Cause
of Death**

Autopsy

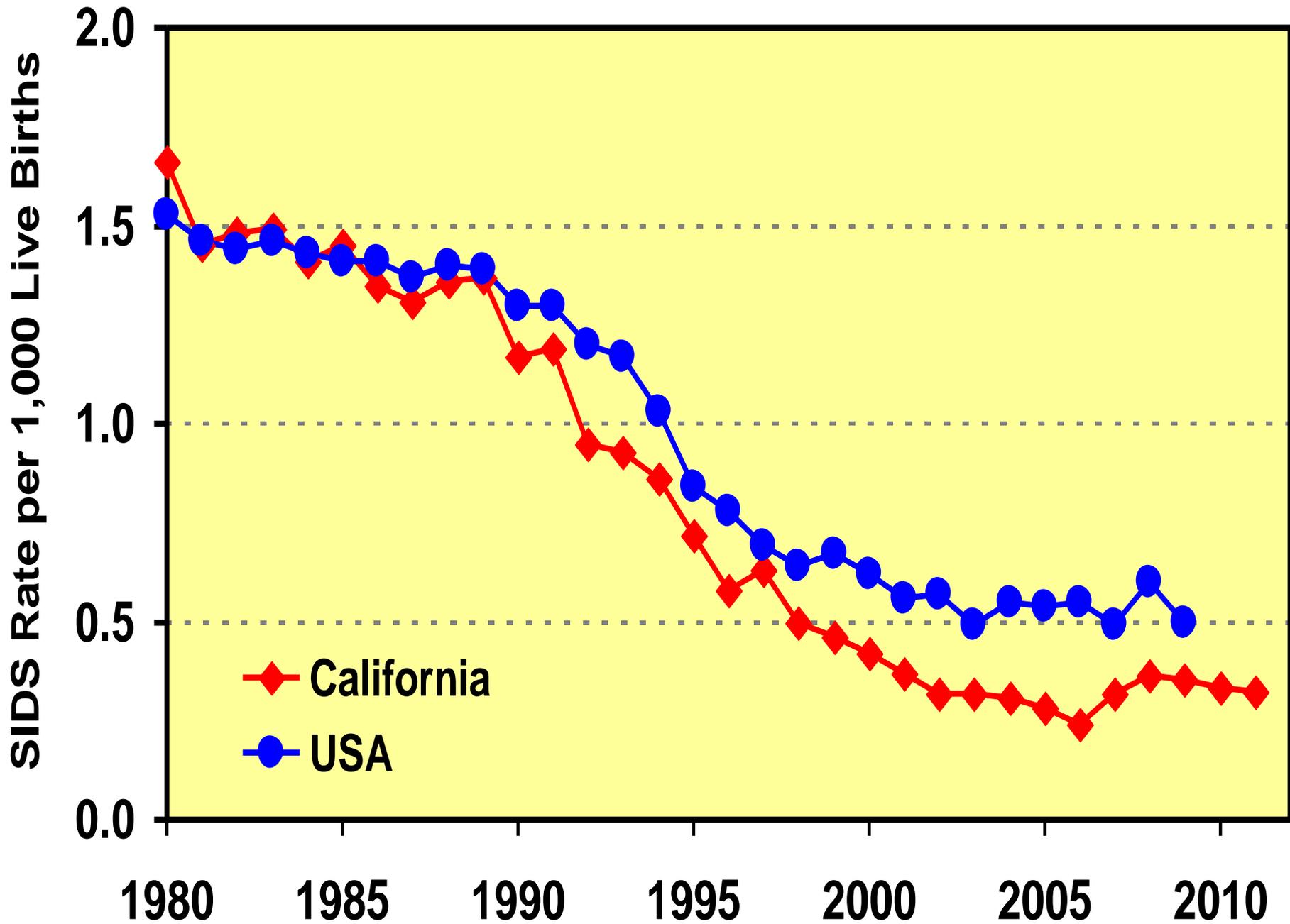


Sudden Infant Death Syndrome

The sudden unexpected death of an infant, under one-year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy, and review of the circumstances of death and the clinical history.

Krous, H.F., J.B. Beckwith, R.W. Byard, T.O. Rognum, T. Bajanowski, T. Corey, E. Cutz, R. Hanzlick, T.G. Keens, and E.A. Mitchell.

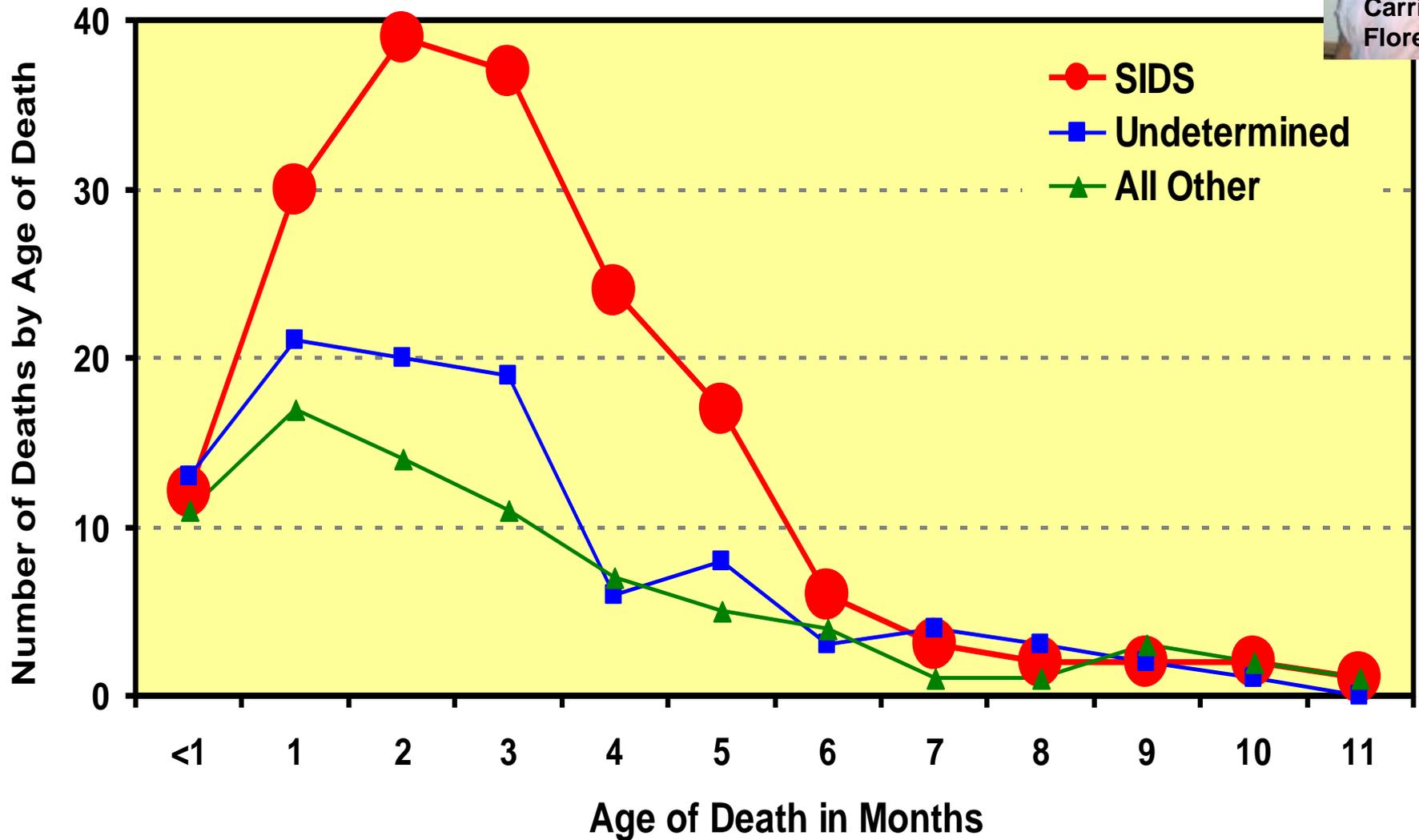
Pediatrics, 114: 234-238, 2004.

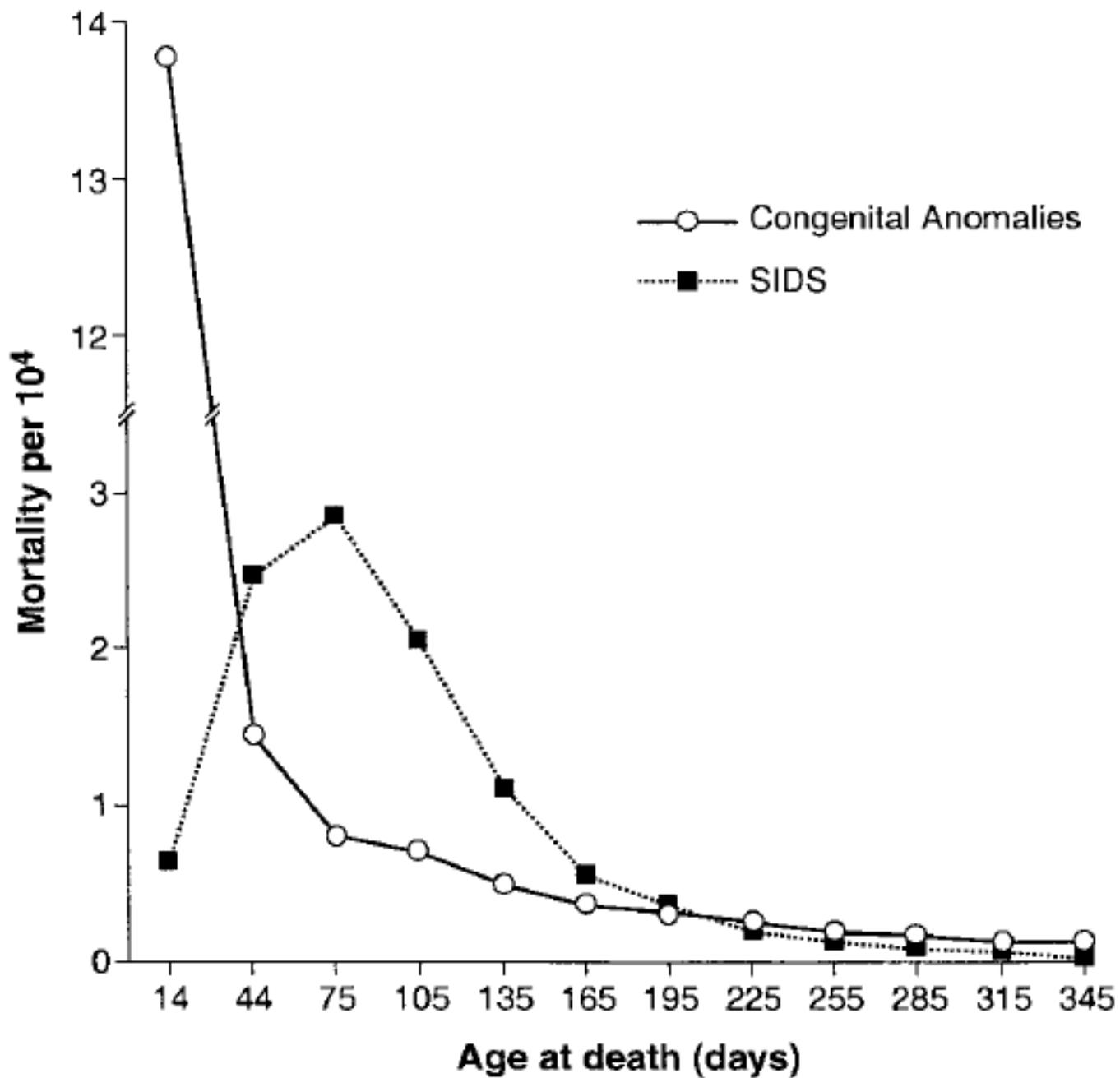


Infant Deaths by Age of Death



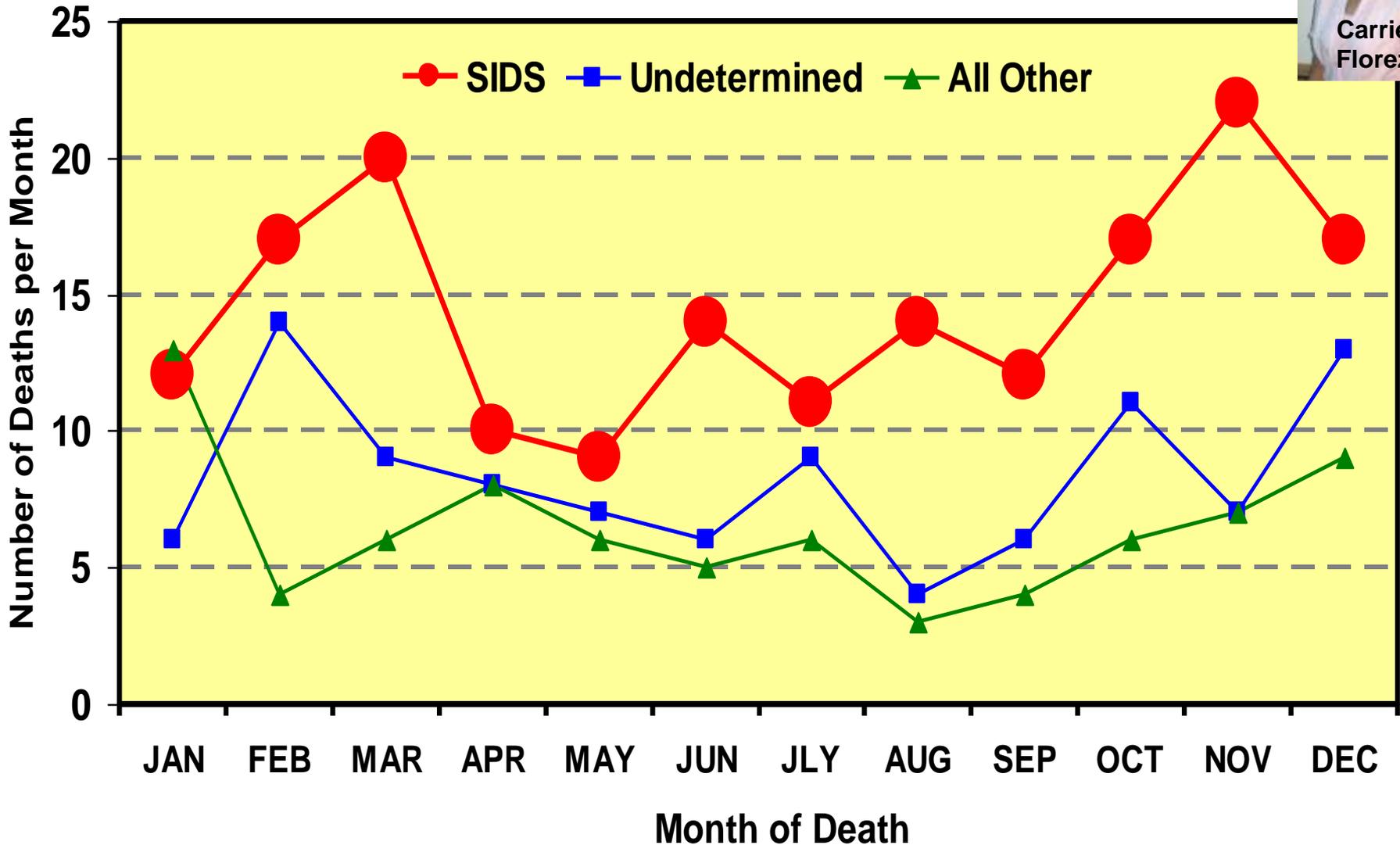
Carrie Florez



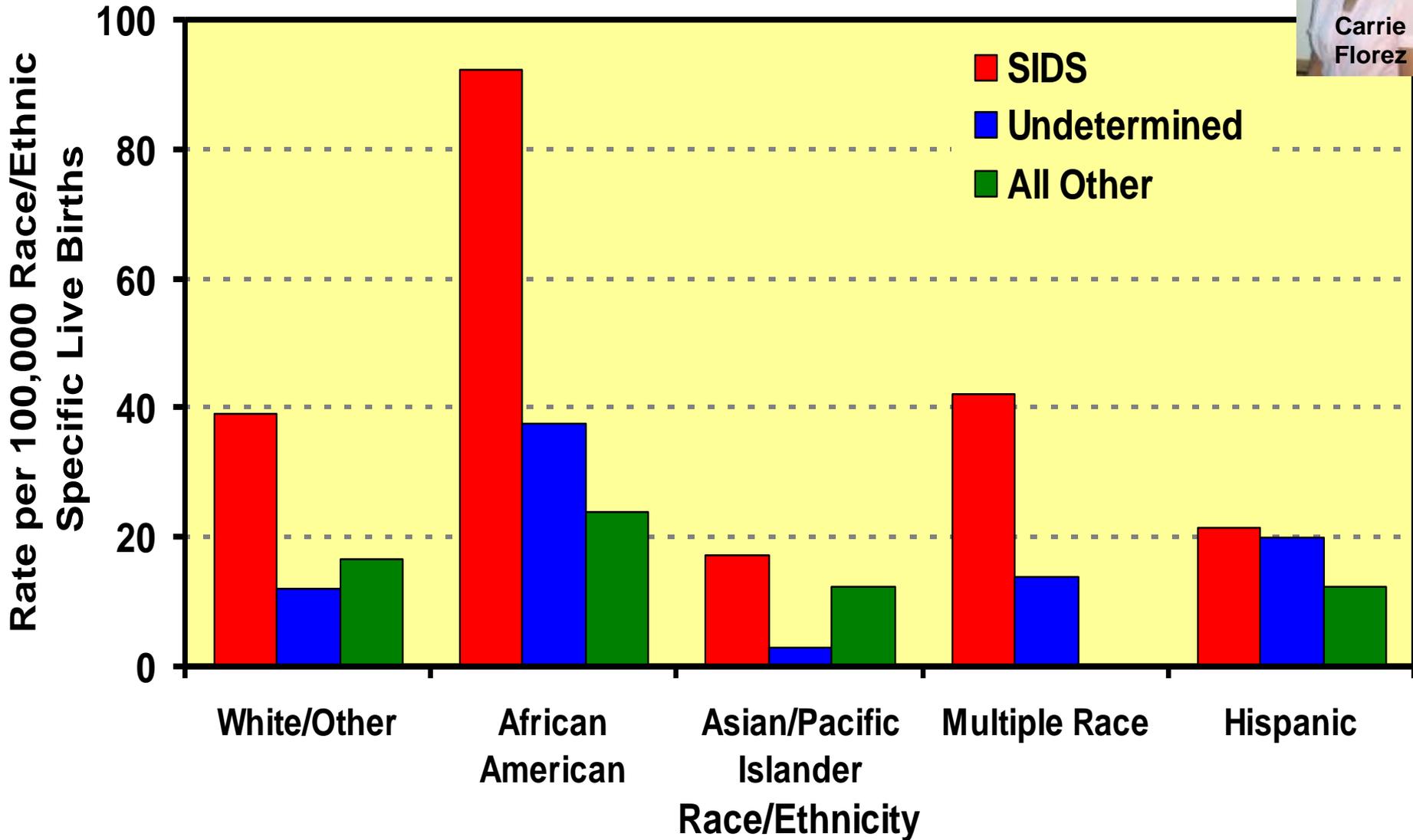


Gunteroth, W.G., and P.S. Spier. *Pediatrics*, 110: 110;e64, 2002.

Infant Deaths by Month of Death



Infant Deaths by Race/Ethnicity

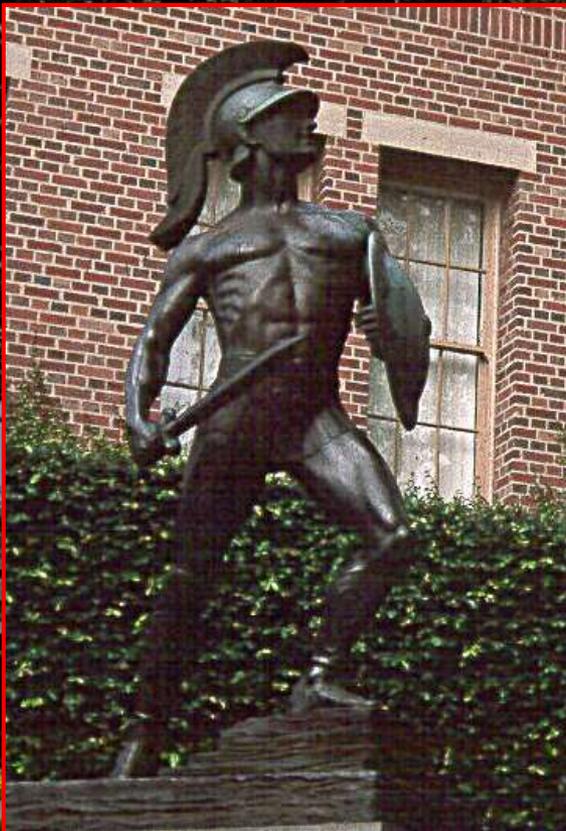


SIDS Autopsy Findings

- **No identifiable cause of death.**
- **No signs of severe illness.**
- **No signs of significant stress.**

With the perseverance of Trojans ...

- Faithful.
- Scholarly.
- Skillful.
- Courageous.
- Ambitious.



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“Here are provided seats of meditative joy,
Where shall arise again the destined reign of Troy.”

Virgil, Aeneid

How Are We to Understand SIDS?

Imagine a car driving up
a steep mountain road.

The car has stopped.

Why can't the car
continue up the hill?

Modified after Professor Jacopo P. Mortola. McGill University.

How Are We to Understand SIDS?

Imagine a car driving up a steep mountain road. The car has stopped.

Why can't the car continue up the hill?

- **Medical Model.**
 - All four tires are flat.
 - Identify the problem.
 - Find a solution to the problem.
 - Fix the problem.

Modified after Professor Jacopo P. Mortola. McGill University.

Medical Model of SIDS

- **Cardiac causes.**
- **Respiratory causes.**
- **Arousal disorders.**
- **Metabolic disorders.**
- **Infections.**
- **Vitamin deficiency.**
- **Environmental toxins.**

How Are We to Understand SIDS?

Imagine a car driving up a steep mountain road. The car has stopped.

Why can't the car continue up the hill?

- **A New Way of Thinking.**
 - There are too many passengers.
 - The engine is not powerful enough.
 - The road is too rocky.
 - The road is too steep.

Modified after Professor Jacopo P. Mortola. McGill University.

Step 1

Life-threatening event

Asphyxia and brain hypoperfusion



Head lifting or turning

Step 2

Failure of arousal



Progressive asphyxia

Step 3

Hypoxic coma

Step 4

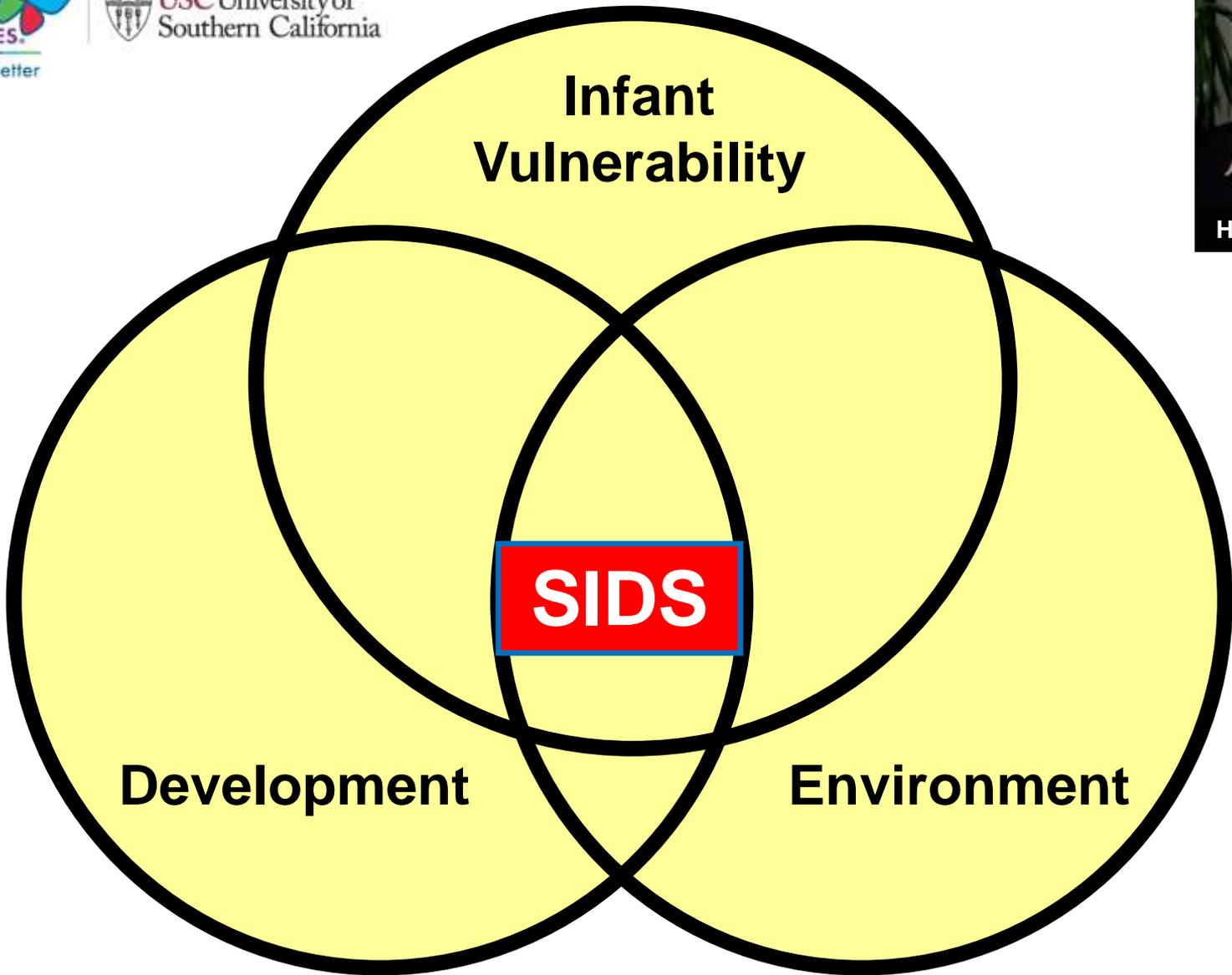
Bradycardia and gasping

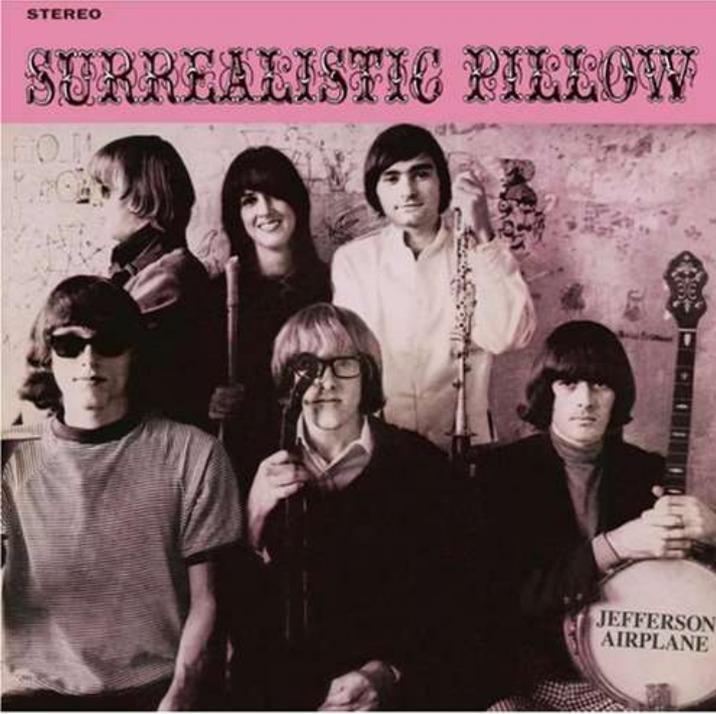
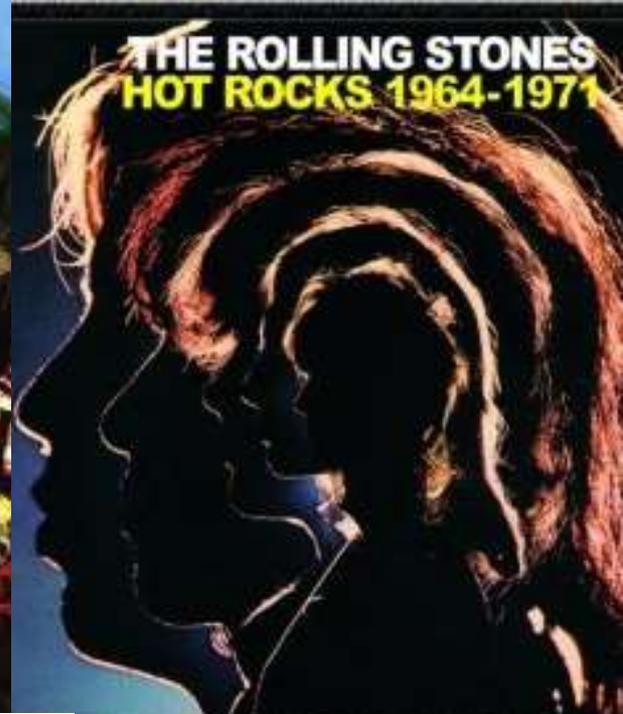
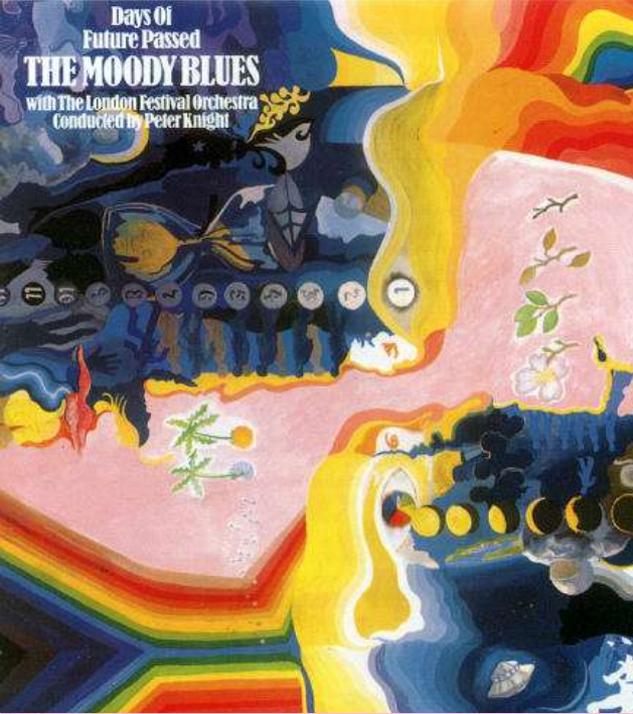
Step 5

Failure of autoresuscitation resulting in death



Hannah Kinney

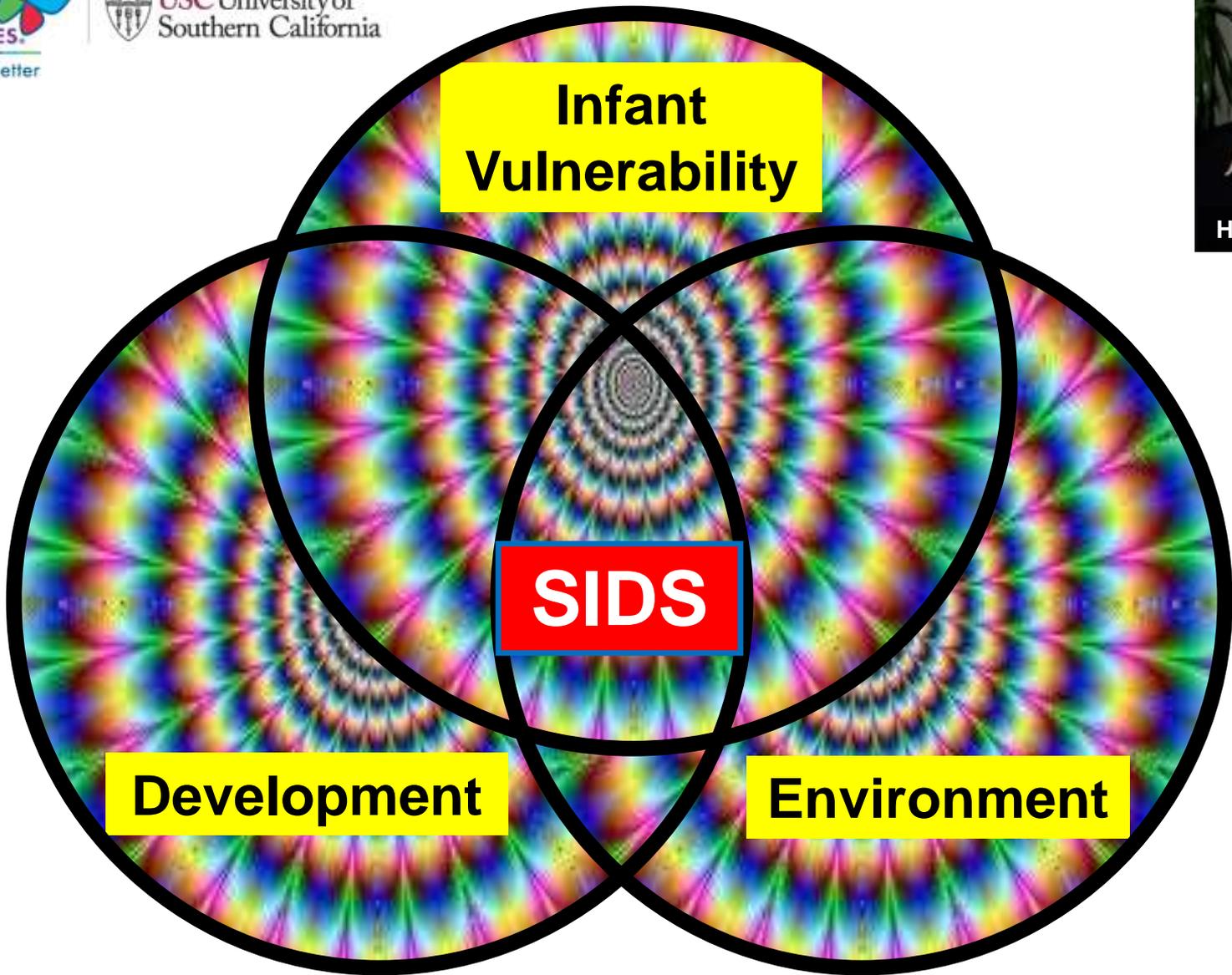






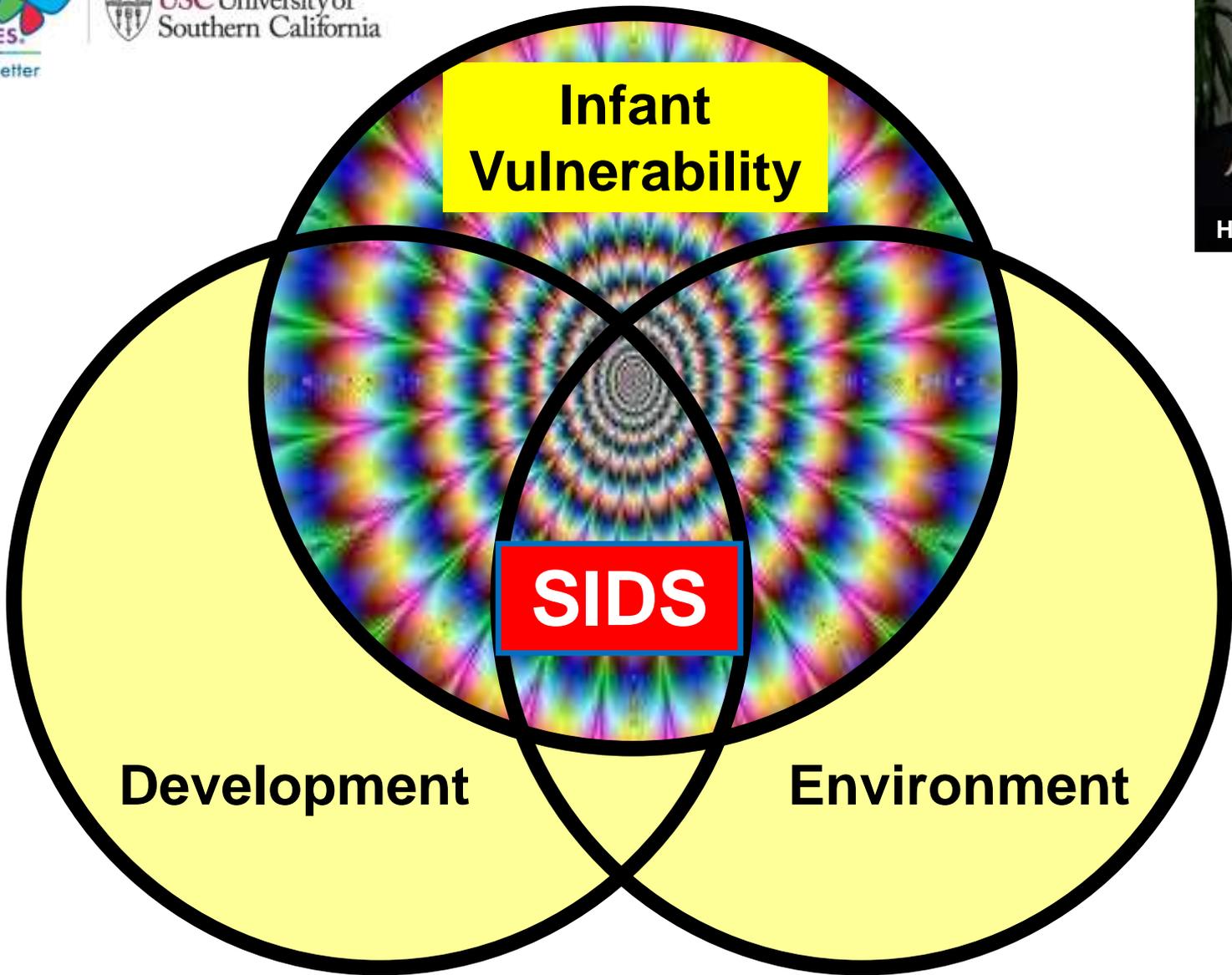


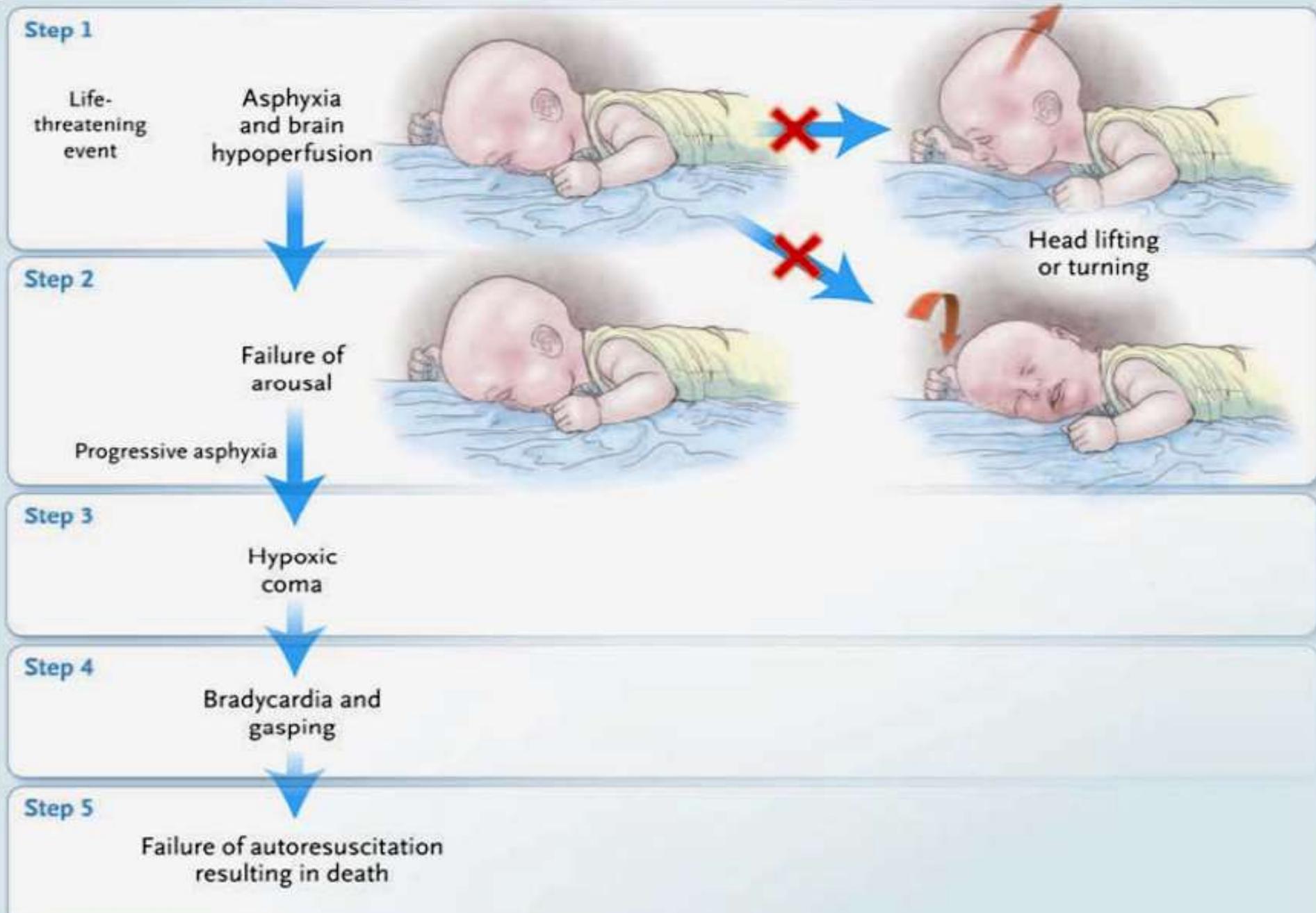
Hannah Kinney





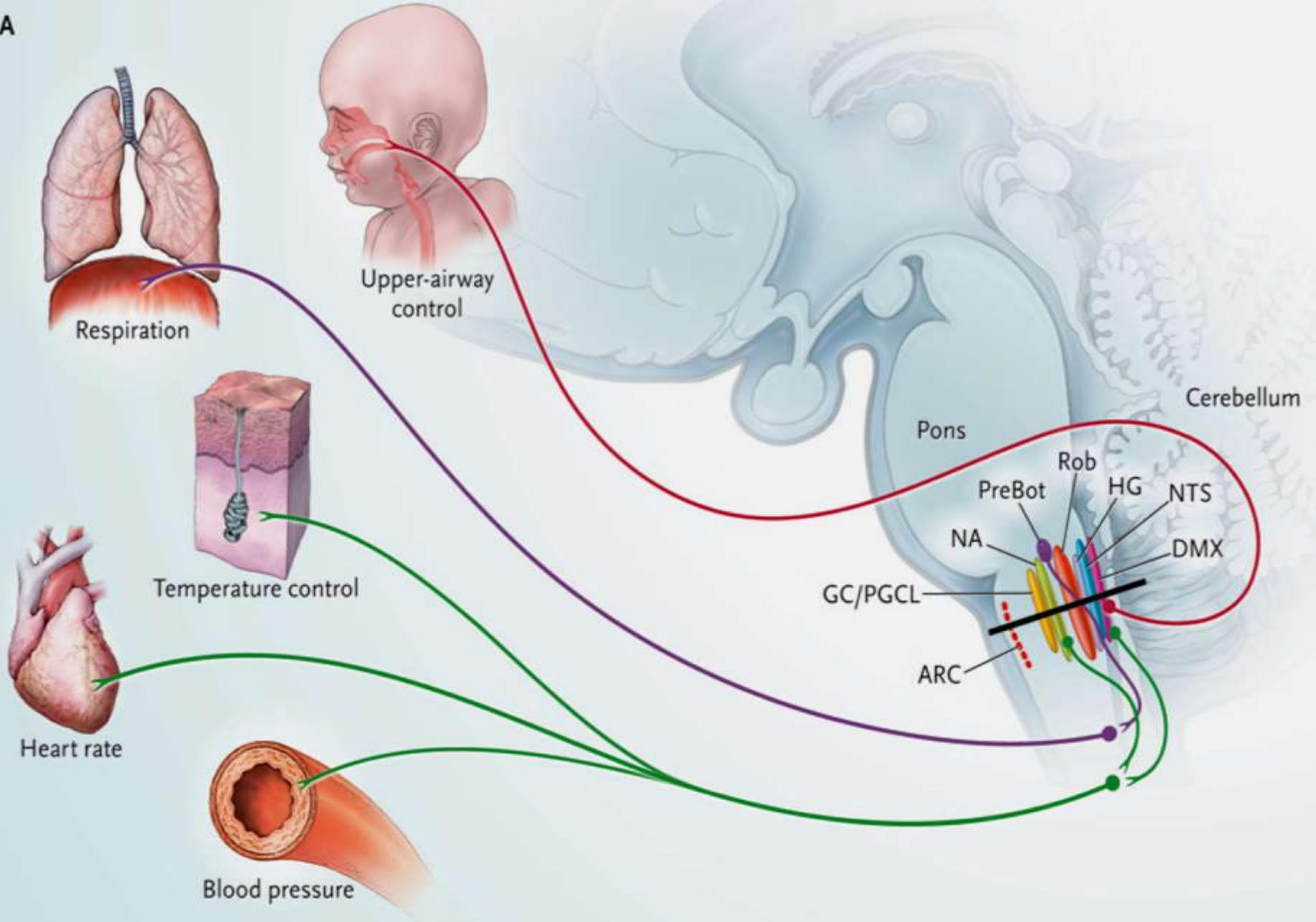
Hannah Kinney





Kinney, H.C., and B.T. Thach. *N. Eng. J. Med.*, 361: 795-805, 2009.

A



Kinney, H.C., and B.T. Thach. *N. Eng. J. Med.*, 361: 795-805, 2009.

Neurotransmitters in SIDS



- Brainstem is the *life support* portion of the brain.
- Autopsy studies found decreased serotonin (5-HT) and serotonergic neurotransmitter receptor binding activity in brainstems of **SIDS** vs controls infants.

Panigrahy, A., et al. *J. Neuropath. Exp. Neurol.*, 59: 377-384, 2000.
Kinney, H.C., et al. *J. Neuropath. Exp. Neurol.*, 60: 228-247, 2001.
Kinney, H.C., et al. *J. Neuropath. Exp. Neurol.*, 62: 1178-1191, 2003.
Paterson, D.S., et al. *J. Amer. Med. Assoc.*, 296: 2124-2132, 2006.
Duncan, J.R., et al. *J. Amer. Med. Assoc.*, 303: 430-437, 2010.
Randall, B.B., et al. *Pediatrics*, doi: 10.1542/peds.2013-0700. 2013

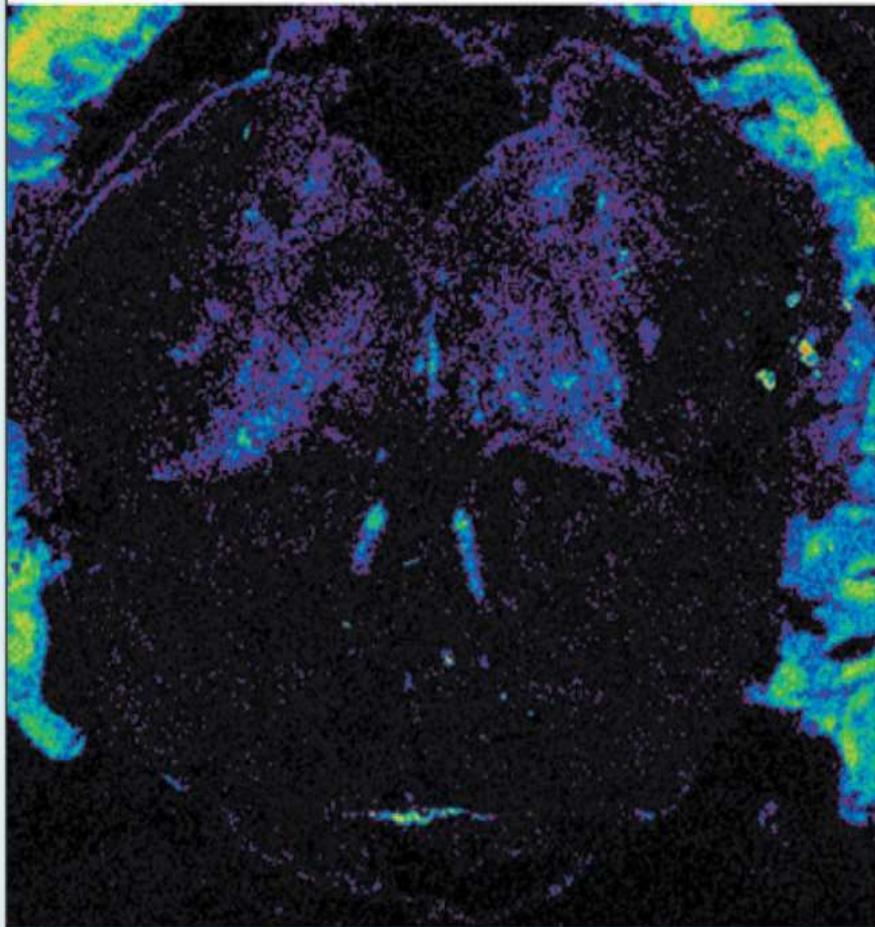


5-HT_{1A} Receptor Binding Density in the Mid-Medulla from SIDS vs Control

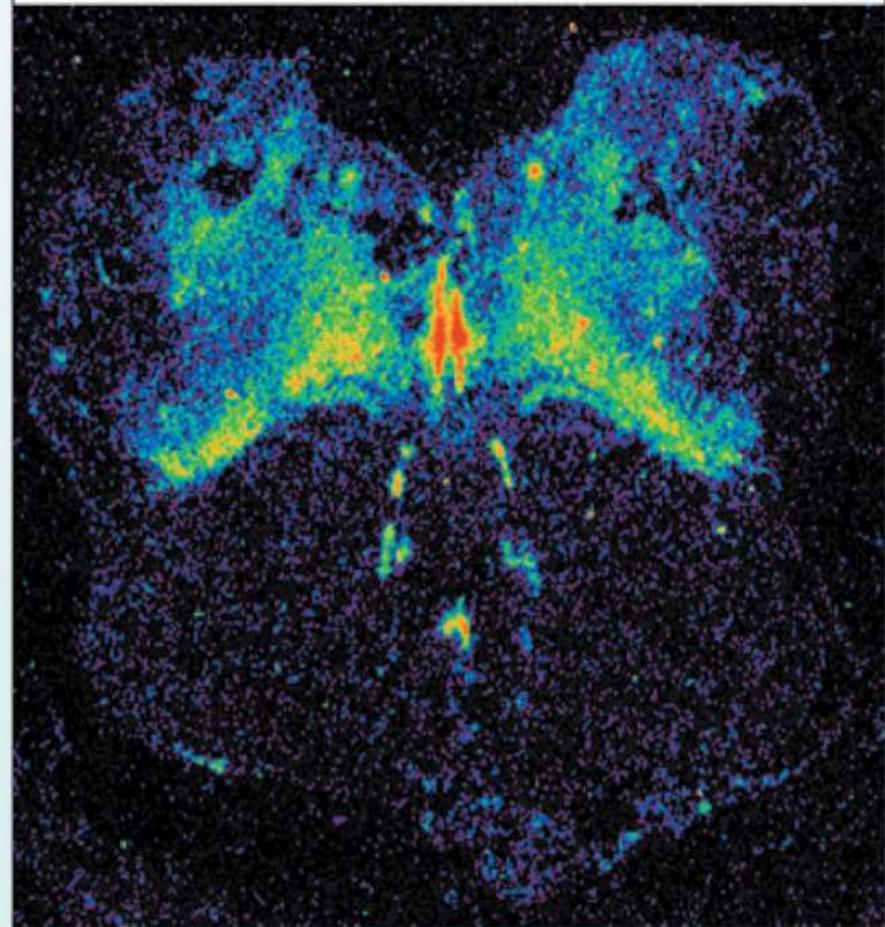


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B Infant with Sudden Infant Death Syndrome

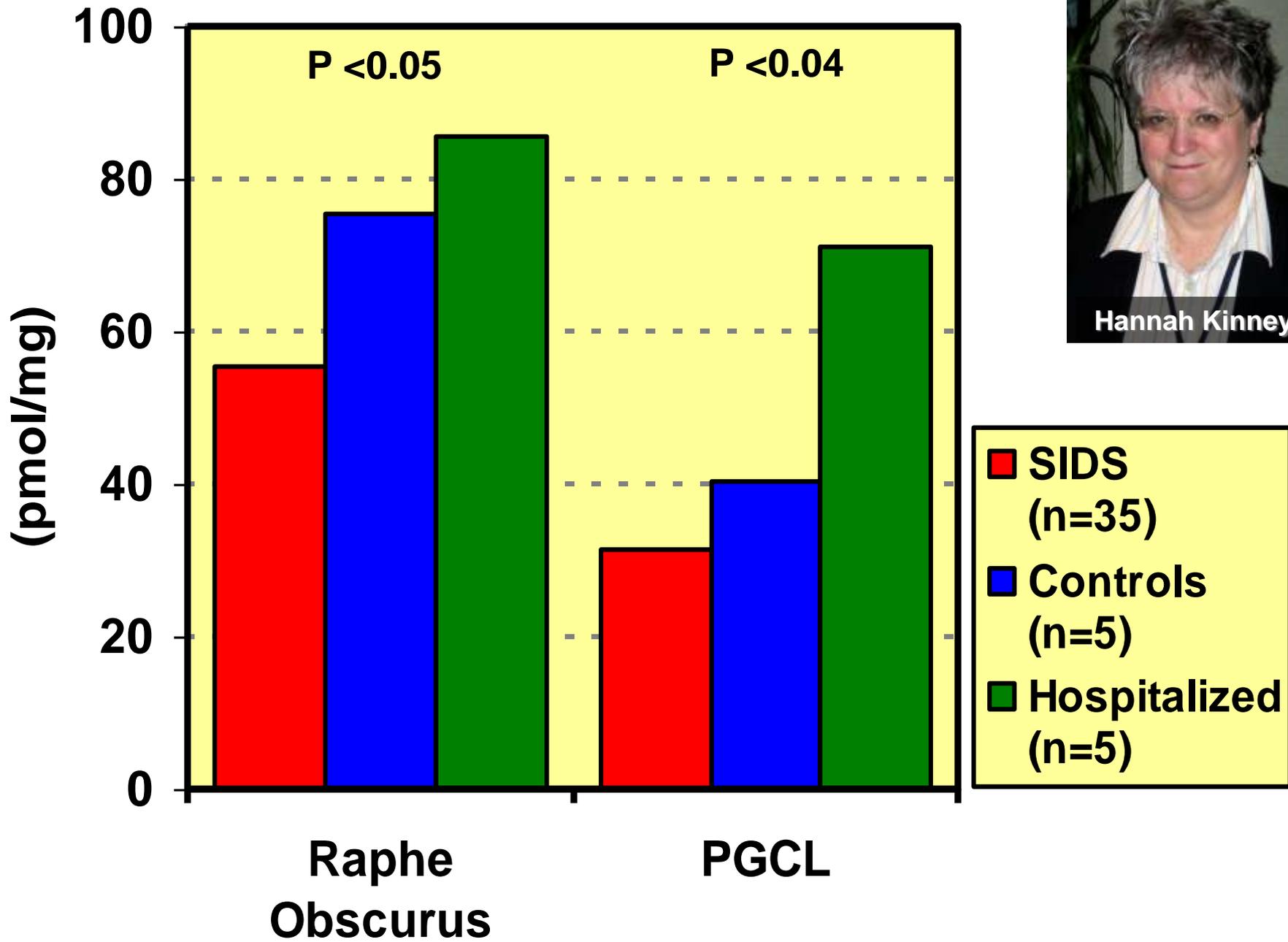


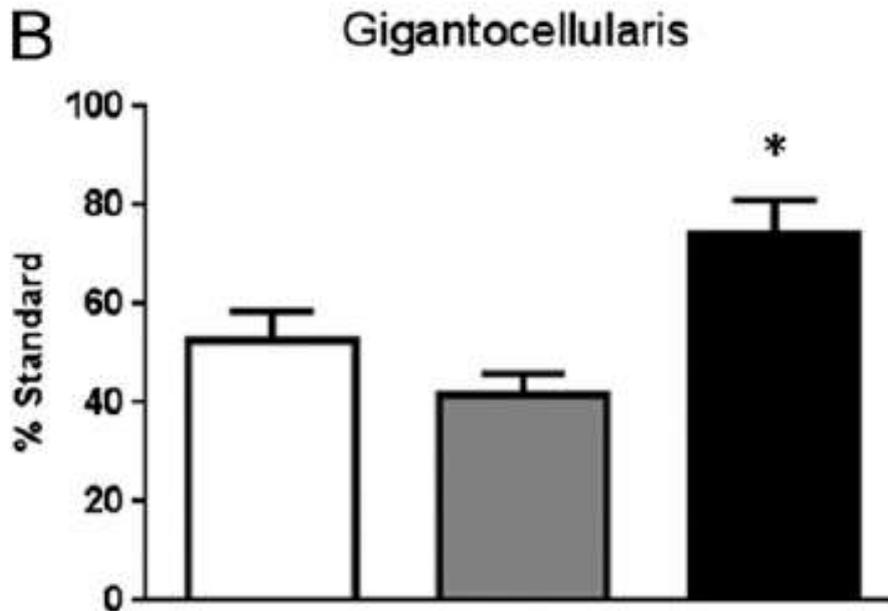
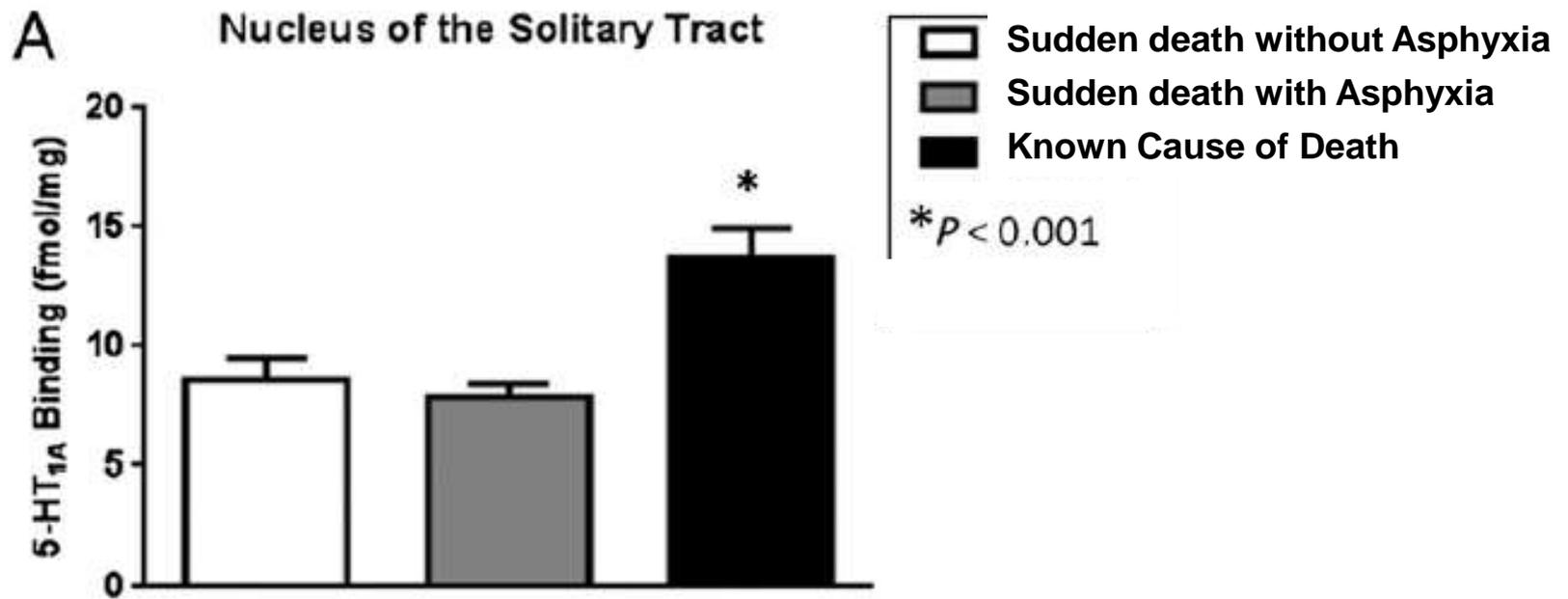
C Control Infant



Paterson, D.S., et al. *J. Amer. Med. Assoc.*, 296: 2124-2132, 2006.

Brainstem Serotonin Concentration







- **SIDS victims may have abnormal neurologic control of cardiac, respiratory, and/or arousal function.**
- **Infants thought to have died from asphyxia show similar brainstem neurotransmitter findings, suggesting some vulnerability.**
- **Supports risk reduction strategies.**

Panigrahy, A., et al. *J. Neuropath. Exp. Neurol.*, 59: 377-384, 2000.
Kinney, H.C., et al. *J. Neuropath. Exp. Neurol.*, 60: 228-247, 2001.
Kinney, H.C., et al. *J. Neuropath. Exp. Neurol.*, 62: 1178-1191, 2003.
Paterson, D.S., et al. *J. Amer. Med. Assoc.*, 296: 2124-2132, 2006.
Duncan, J.R., et al. *J. Amer. Med. Assoc.*, 303: 430-437, 2010.
Randall, B.B., et al. *Pediatrics*, doi: 10.1542/peds.2013-0700. 2013



Brainstem Abnormality

Small

Intermediate

Severe

Accidental
Asphyxia or
Suffocation

Sudden
Death with
Asphyxia

Sudden
Death
without
Asphyxia

Asphyxial Insult

Severe

Intermediate

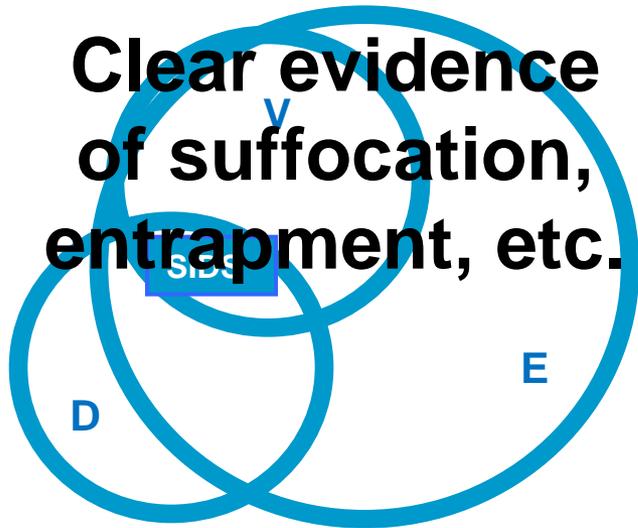
None

**Known
Cause of
Death**

**Biology
Interacts
with
Environment**

**“True”
SIDS**

**Clear evidence
of suffocation,
entrapment, etc.**



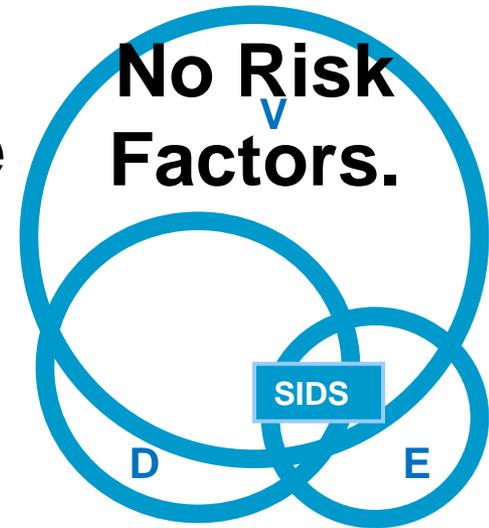
Dx: Accidental

**Some Risk Factors,
but would not cause
death in all infants.**



Dx: Variable

**No Risk
Factors.**

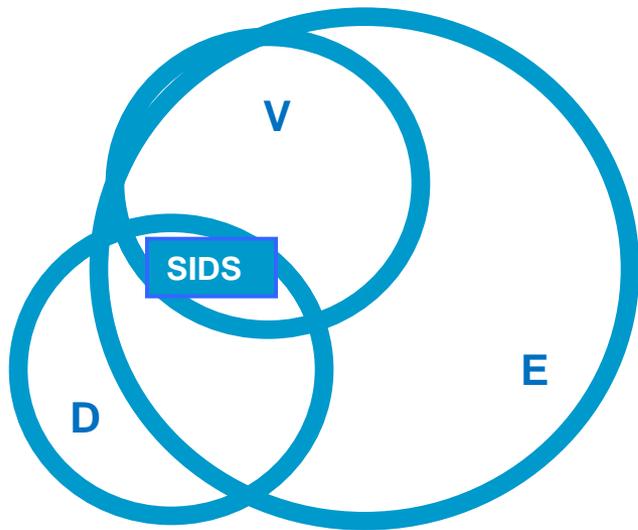


Dx: SIDS

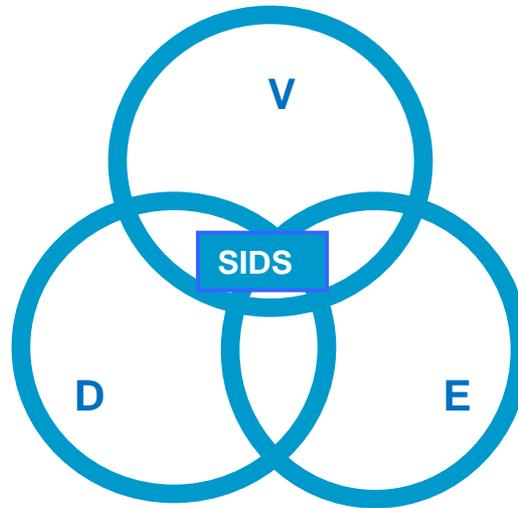
**Known
Cause of
Death**

**Biology
Interacts
with
Environment**

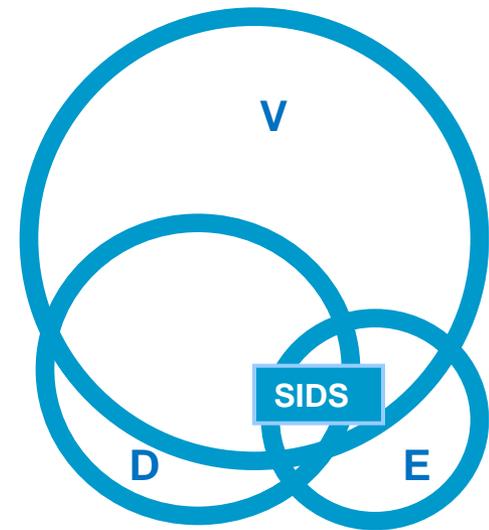
**“True”
SIDS**



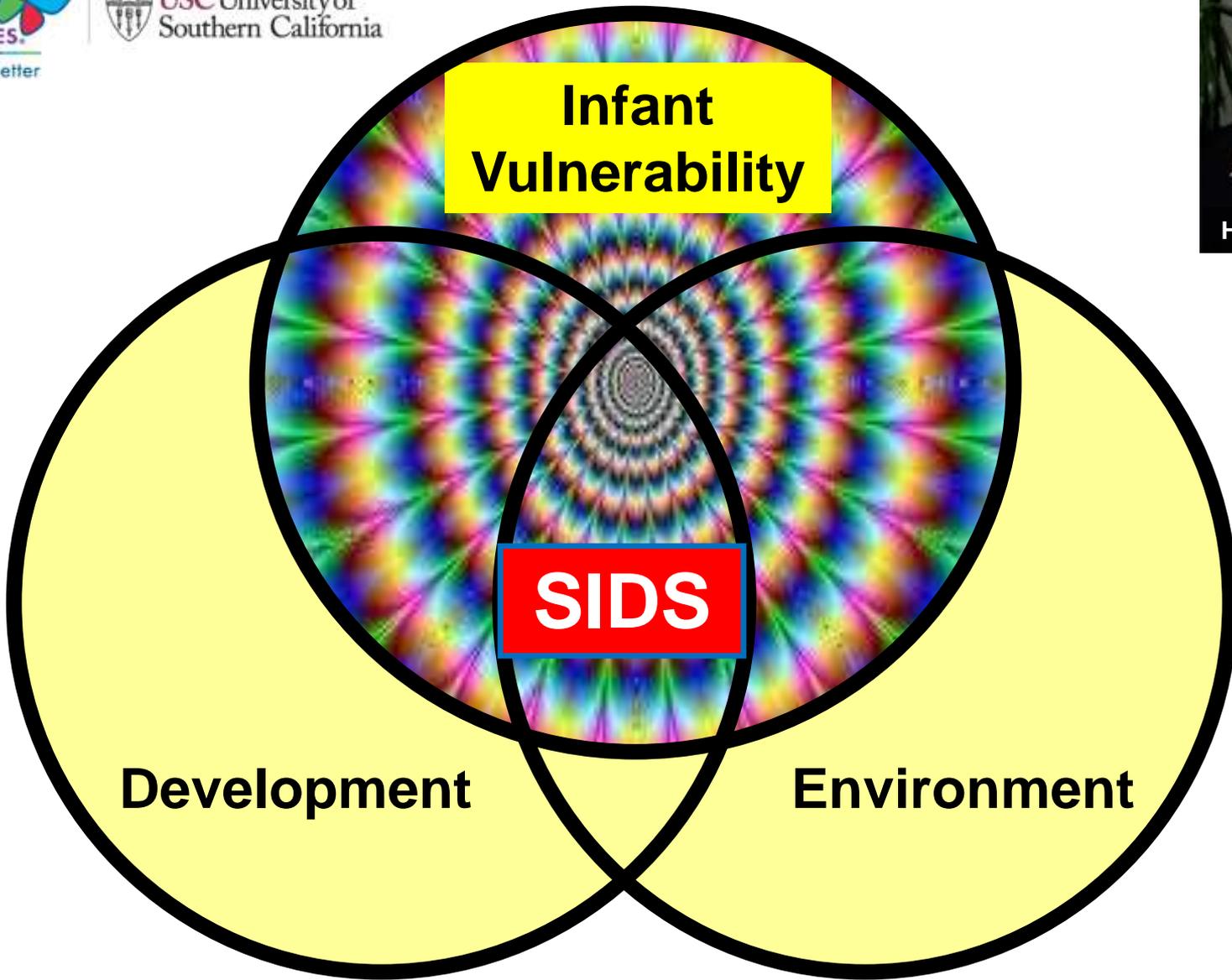
Dx: Accidental



Dx: Variable

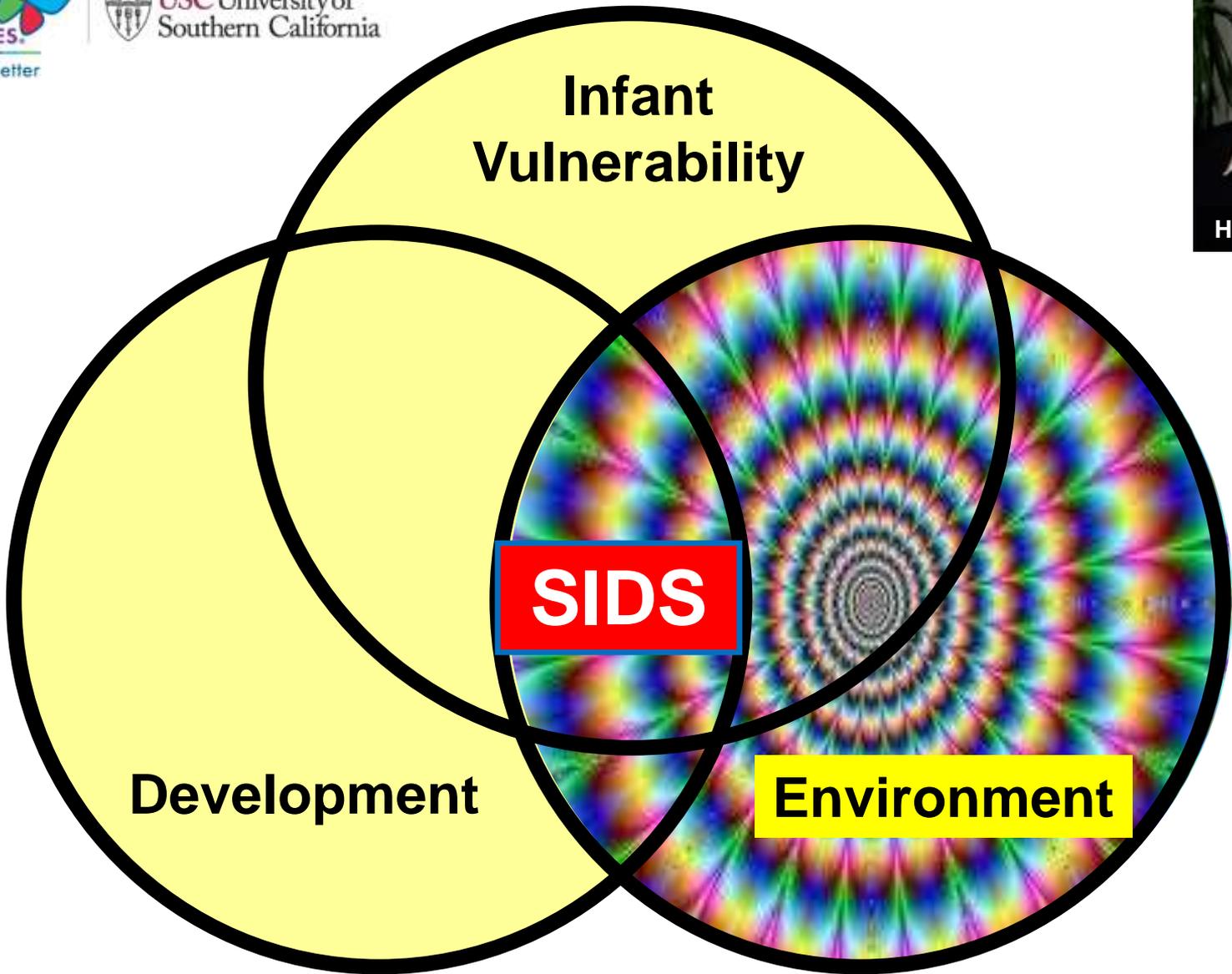


Dx: SIDS

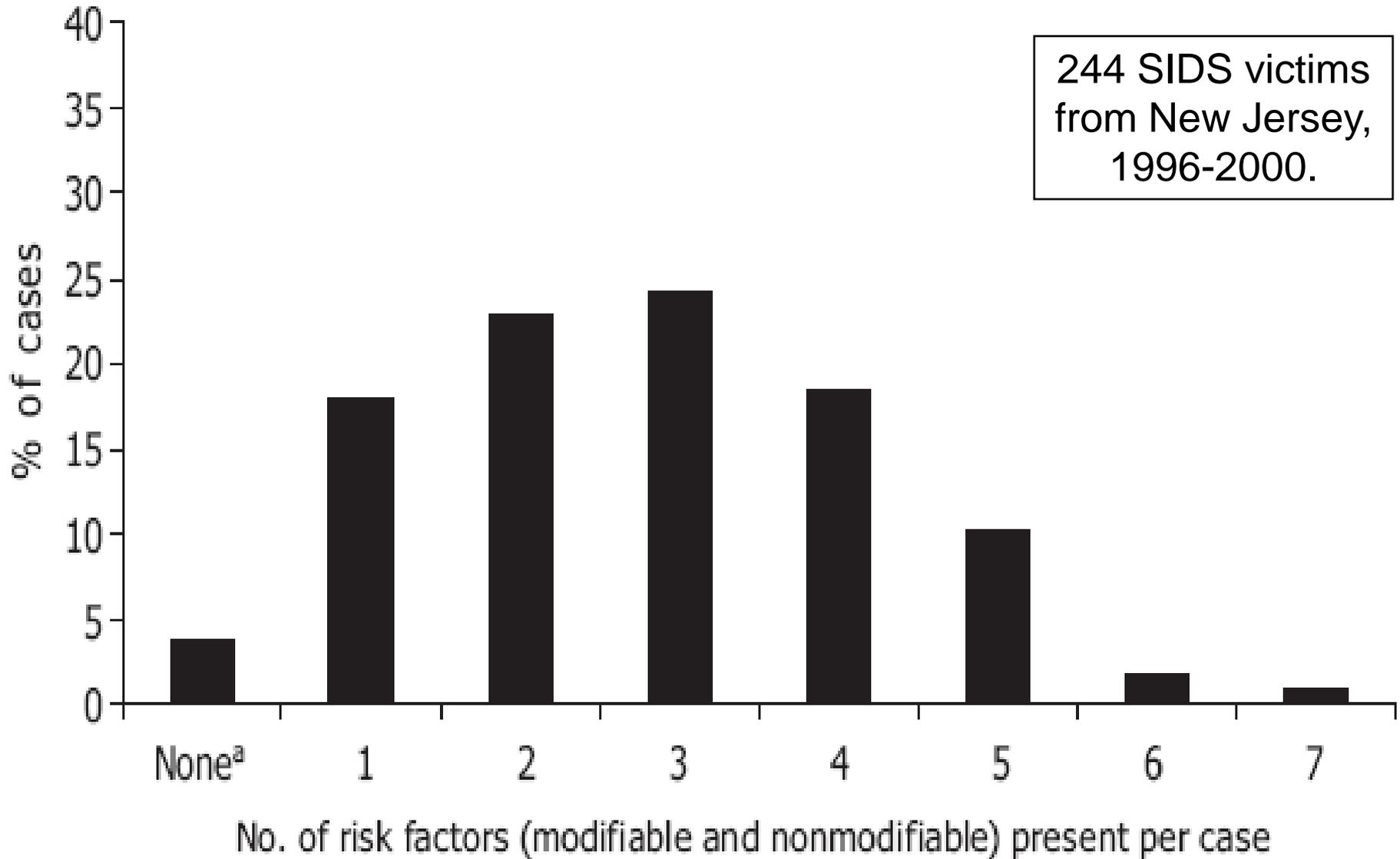




Hannah Kinney



The majority of SIDS victims have ≥ 1 Risk Factor



Ostfeld, B.M., et al. *Pediatrics*, 125: 447-453, 2010.

How can we, as a population, reduce the risks of SIDS?



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of USC



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Risk Factors \neq Causes

- **Most infants with risk factors will not die from SIDS.**
- **Some infants without risk factors will die from SIDS.**
- **However, infants with risk factors are at increased risk of dying from SIDS.**



POLICY STATEMENT

SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment

abstract

Despite a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed for sleep in a non-prone position, this decline has plateaued in recent years. Concurrently, other causes of sudden unexpected infant death that occur during sleep (sleep-related deaths), including suffocation, asphyxia,

and ill-defined or unspecified causes of death have increased, particularly since the AAP published its last policy statement in 2005. It has become increasingly important to address these causes of sleep-related infant death. Many of the

modifiable risk factors for SIDS and suffocation are preventable, therefore, the AAP is expanding its recommendations

from only on SIDS to focusing on a safe sleep environ-

FREE

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME

KEY WORDS

SIDS, sudden infant death, infant, bed-sharing, tobacco, pacifier, infant

ABBREVIATIONS

SIDS—sudden infant death syndrome
SUID—sudden unexpected infant death
AAP—American Academy of Pediatrics

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~~SIDS~~

[AAP Policy Statement. *Pediatrics*, 128: 1030-1039, 2011.](#)





AAP Recommendation #1

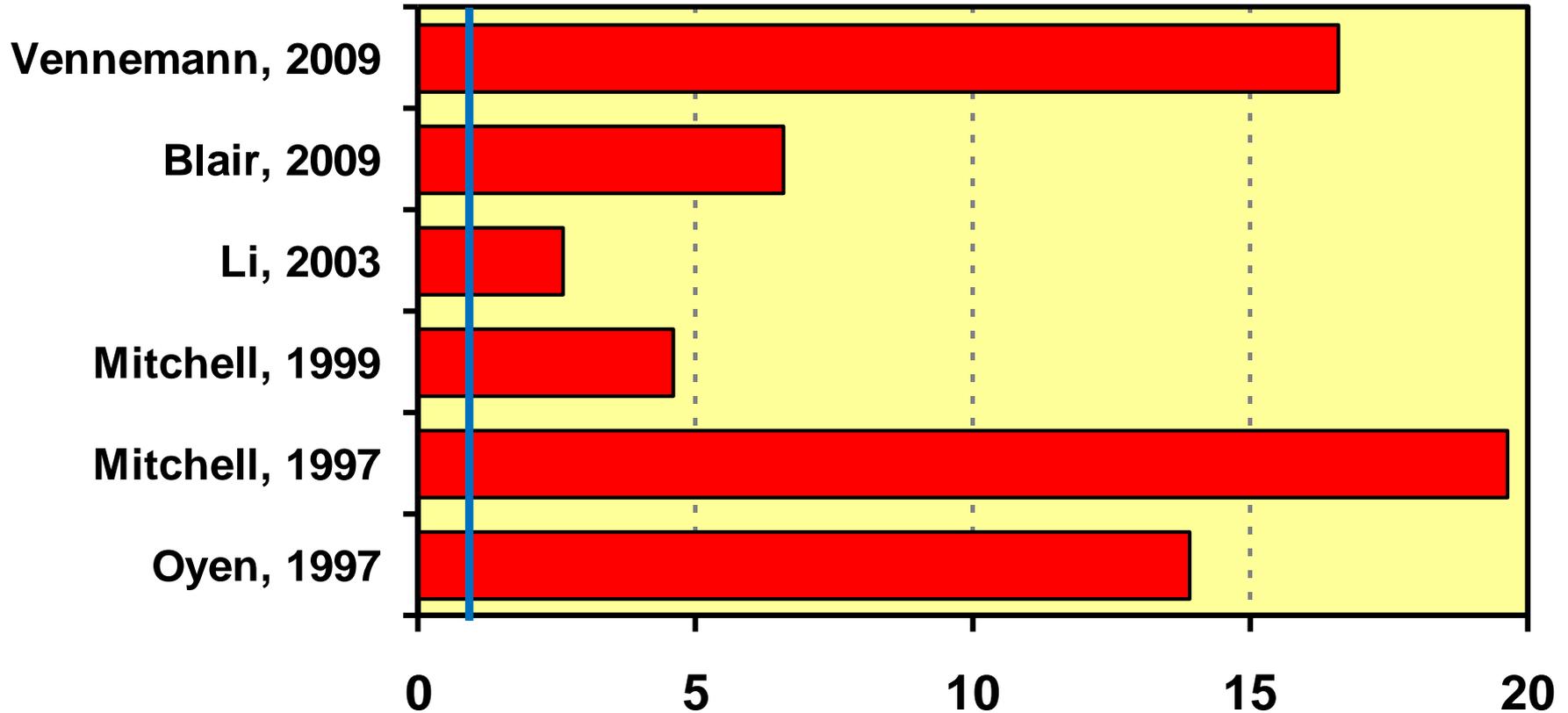


Back to Sleep for every sleep—To reduce the risk of SIDS, infants should be placed for sleep in a supine position (wholly on the back) for every sleep by every caregiver until 1 year of life.

Side sleeping is not safe and is not advised.

AAP Policy Statement. *Pediatrics*, 128: 1030-1039, 2011.

Prone Sleeping and SIDS (Odds Ratios vs Non-Prone Sleeping)



Vennemann, M.M., et al. *Pediatrics*, 123: 1162-1170, 2009.

Blair, P.S., et al. *B.M.J.*, 339: b3666, 2009.

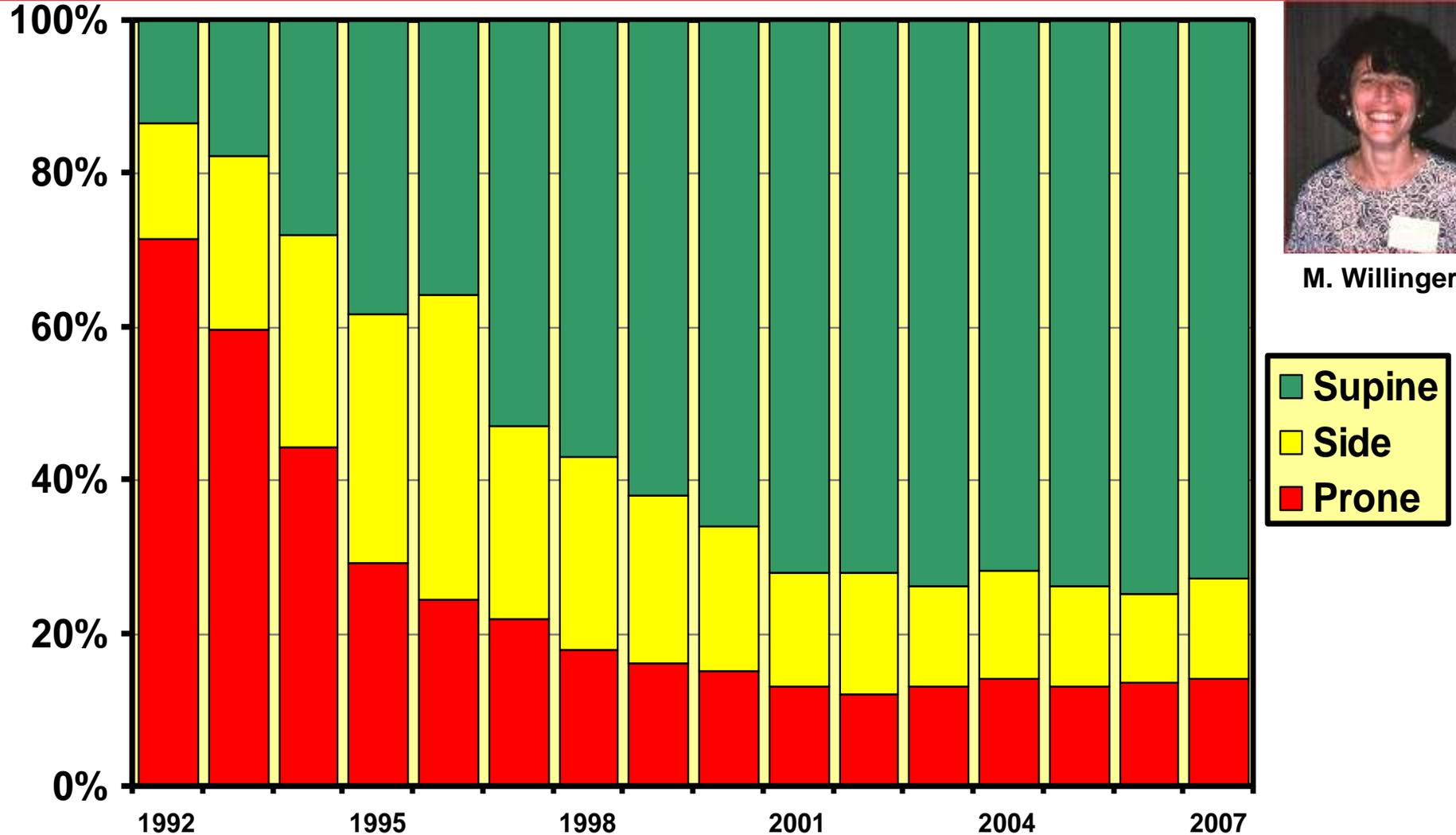
Li, D-K, et al. *Am. J. Epidemiol.*, 157: 446-455, 2003.

Mitchell, E.A., et al. *Arch. Pediatr. Adolesc. Med.*, 153: 1136-1141, 1999.

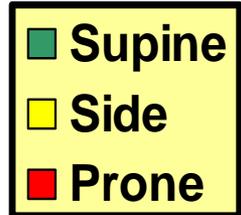
Mitchell, E.A., et al. *Pediatrics*, 100: 835-840, 1997.

Oyen, N., et al. *Pediatrics*, 100: 613-621, 1997.

National Infant Sleep Position Study (U.S.A.)

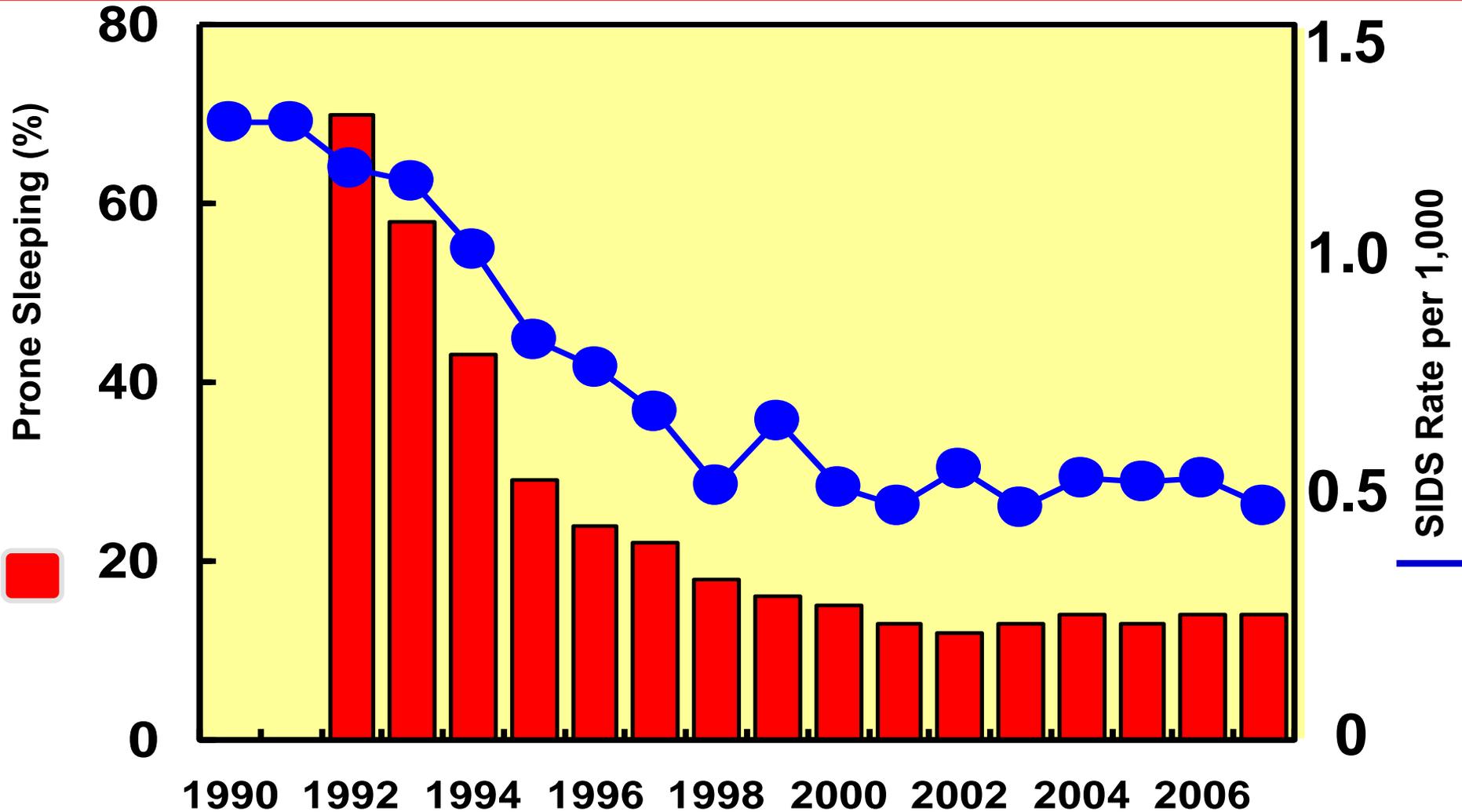


M. Willinger



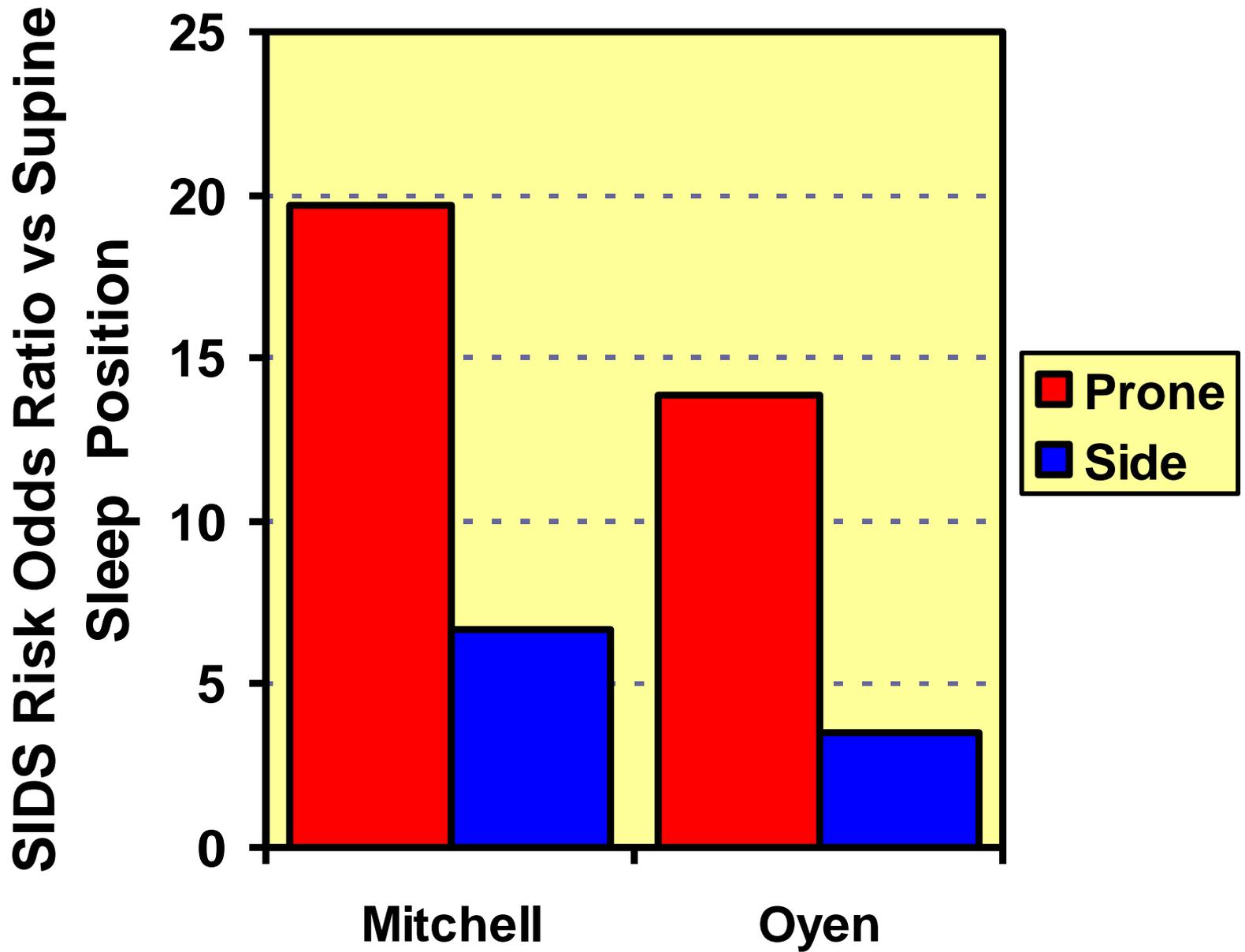
Willinger, M., et al. *J. Amer. Med. Assoc.*, 280: 329-335, 1998.
Colson, E.R., et al. *Arch. Pediatr. Adolesc. Med.*, 163: 1122-1128, 2009.

U.S. Prone Sleeping and SIDS Rate



M. Willinger, et al. *J. Amer. Med. Assoc.*, 280: 329-335, 1998.

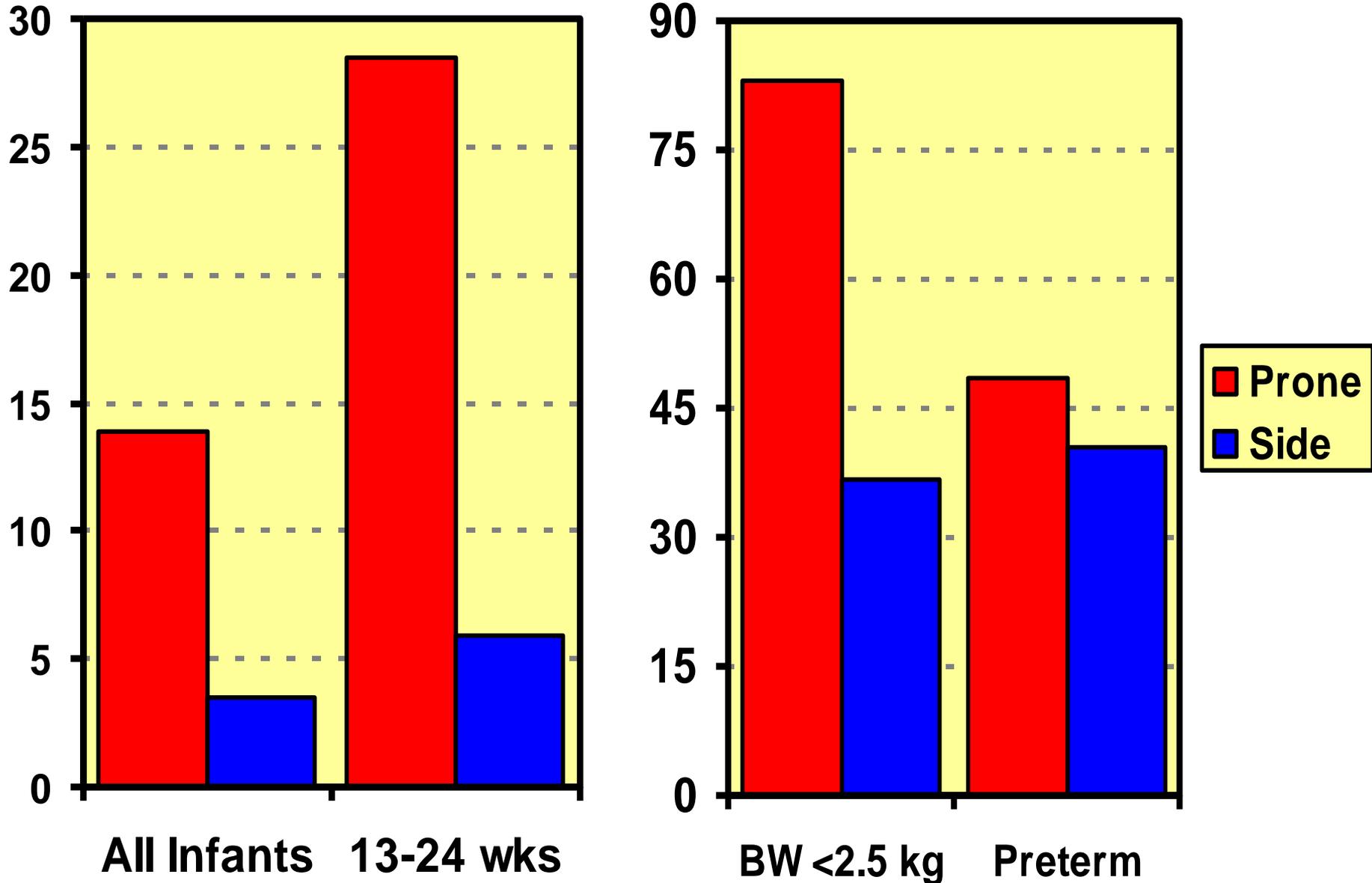
Colson, E.R., et al. *Arch. Pediatr. Adolesc. Med.*, 163: 1122-1128, 2009.



Mitchell, E.A., et al. *Pediatrics*, 100: 835-840, 1997.

Oyen, N., et al. *Pediatrics*, 100: 613-621, 1997.

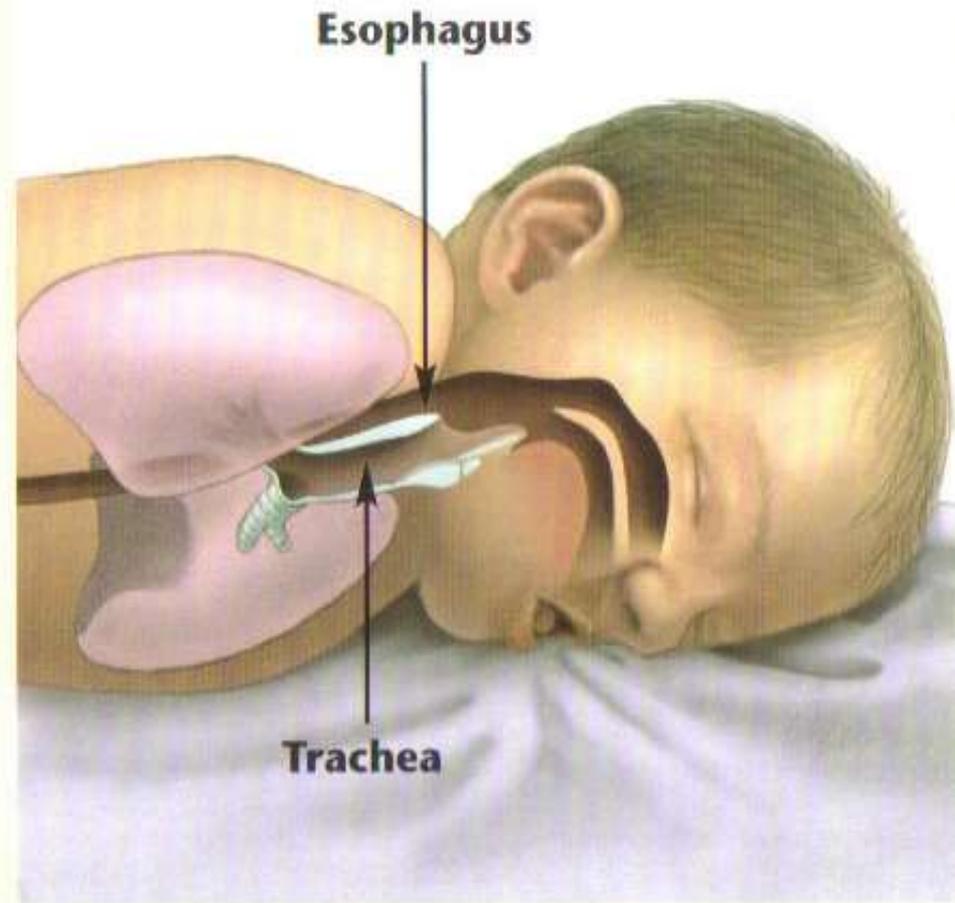
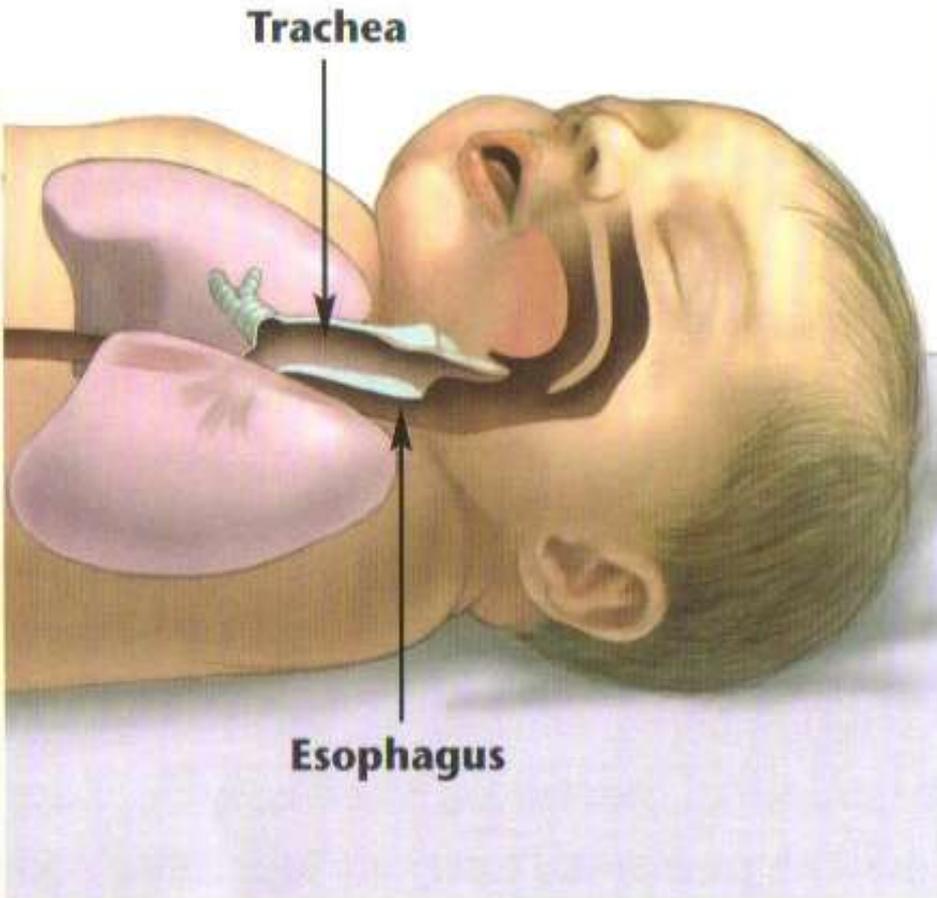
SIDS Risk Odds Ratio vs Supine Sleep Position



Oyen, N., et al. *Pediatrics*, 100: 613-621, 1997.

Supine

Prone



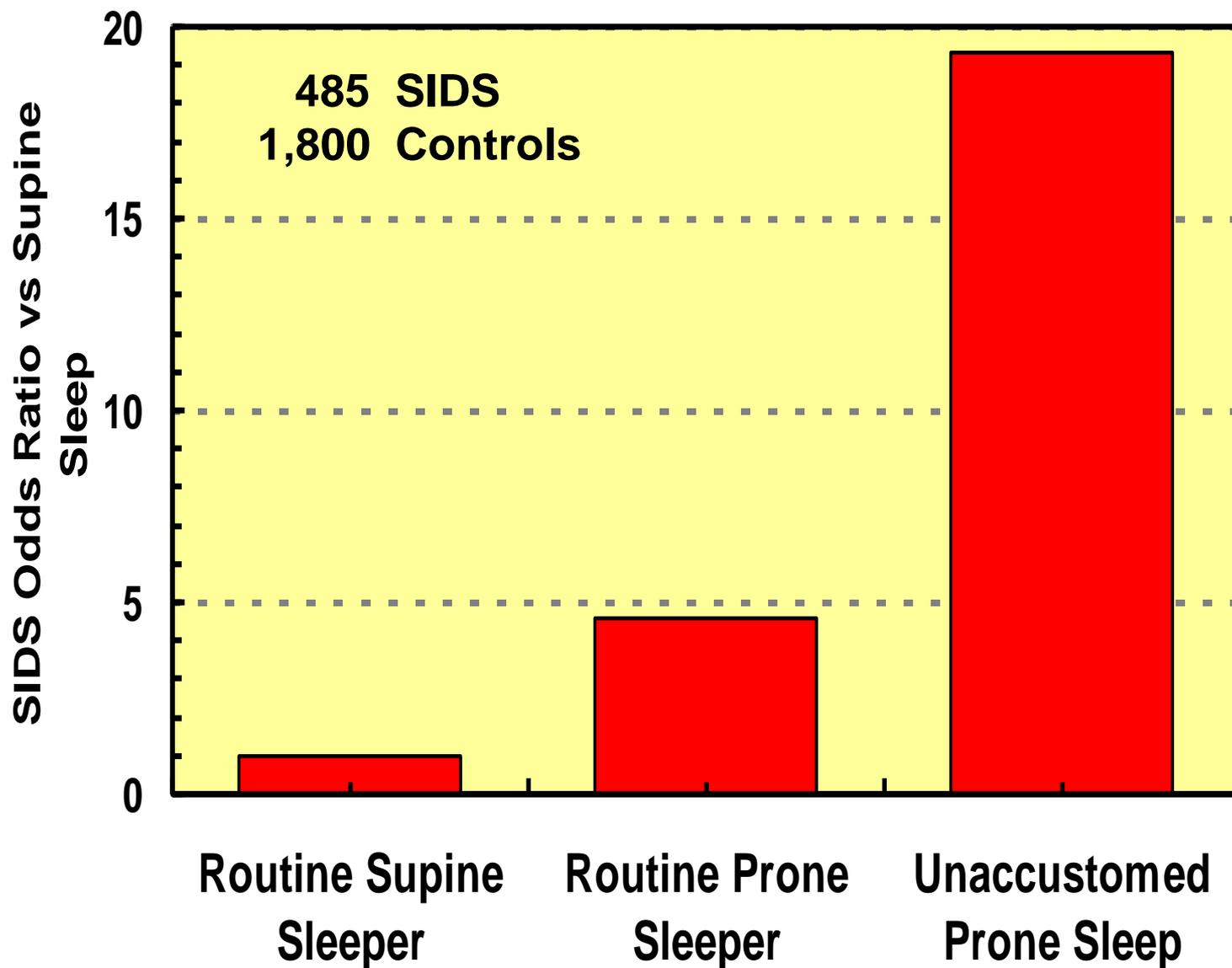
**SIDS Risk Reduction: Curriculum for Nurses, NICHD, 2006.
NIH Publication No. 06-6005.**

Unaccustomed Prone Sleeping ↑ SIDS Risk



Ed Mitchell

- 1987-1990, case control study in New Zealand.
- 20% of SIDS deaths involved lack of experience with prone position.



Safe Infant Sleep Recommendations



- **Use a firm mattress without blankets or pillows.**
- **Keep soft items out of the crib.**
- **Roomshare, but not bedshare.**
- **Avoid cigarette smoke, alcohol, and drug exposure.**
- **Breastfeed.**

Safe Infant Sleep Recommendations



- Offer a pacifier during sleep.
- Avoid overheating.
- Infants should be fully immunized.
- Avoid commercial devices claiming to prevent SIDS.
- Supervised *Tummy Time* while awake.



AAP Recommendation #3



Room-sharing without bedsharing is recommended---There is evidence that this arrangement decreases the risk of SIDS by as much as 50%. In addition, this arrangement is most likely to prevent suffocation, strangulation, and entrapment that might occur when the infant is sleeping in an adult bed.

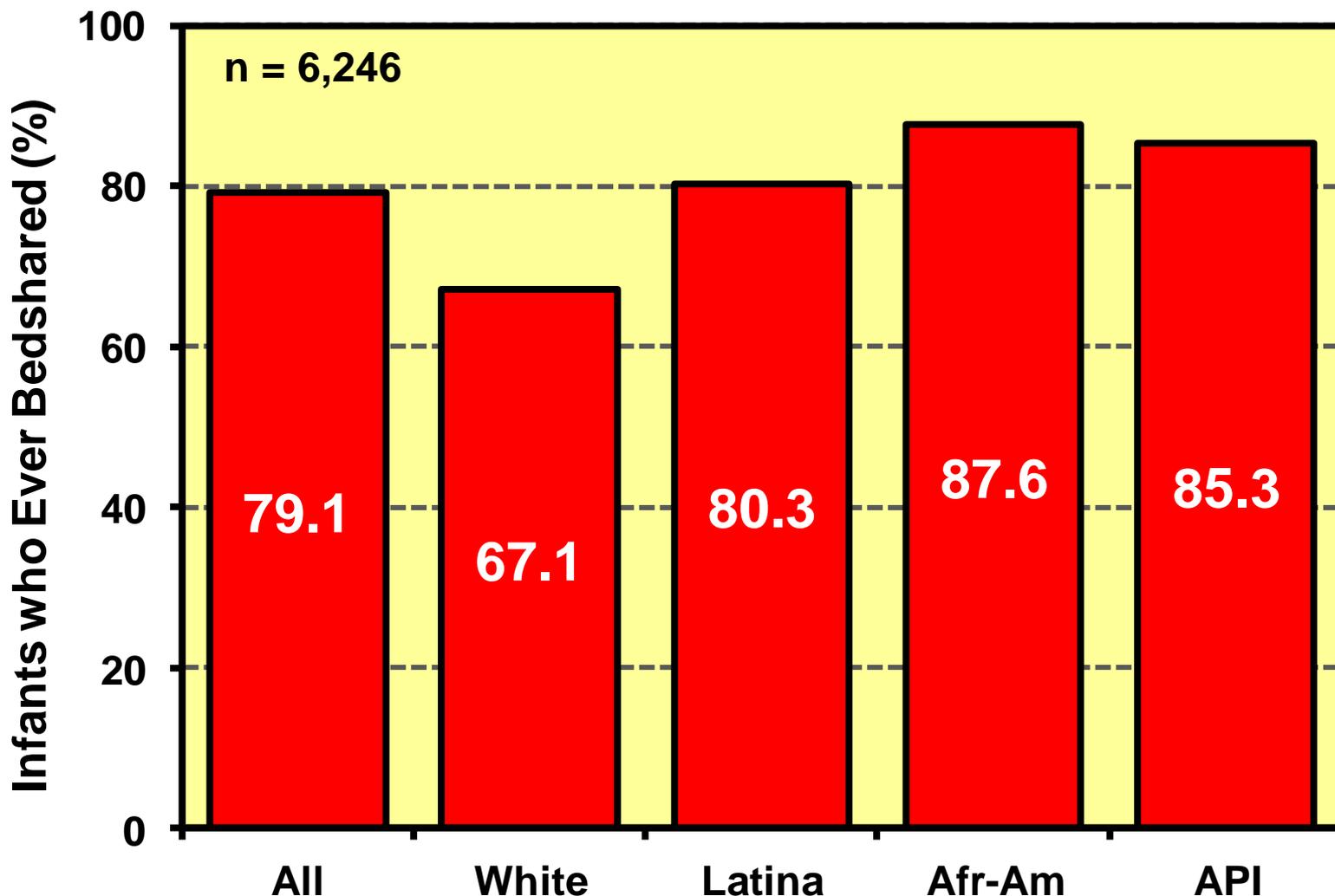
AAP Policy Statement. *Pediatrics*, 128: 1030-1039, 2011.

Early Study of Maternal Overlaying

- In 1892, a Scottish police surgeon, Templeman, was the first to draw attention to the potential role of excessive alcohol consumption and overlaying.
- 258 cases of suffocation in infants.
- More than half of deaths occurred Saturday night.
- Postulated that intoxication impaired arousal responses of parents sleeping with infants, thus increasing the risk of accidental suffocation.

Templeman, C. *Edinburgh Med. J.*, 38: 322-329, 1892.

Infant Bedsharing in Los Angeles County



Los Angeles Mommy and Baby (LAMB) Project, 2007

National Child and Adolescent Health Research, Evaluation, and Planning Unit

Los Angeles County Department of Public Health

Health Resources and Services Administration (HRSA) R40MC06635





**James J.
McKenna, Ph.D.**

**Professor and Chair.
Department of
Anthropology.**

**University of Notre
Dame.**

South Bend, Indiana.

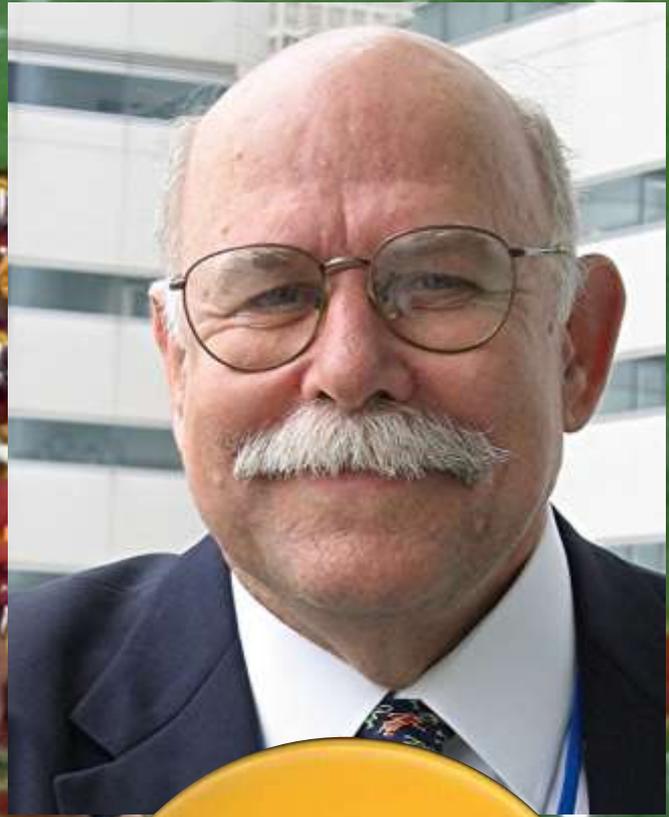




James J. McKenna, Ph.D.
Professor and Chair, Anthropology.
University of Notre Dame



Thomas G. Keens, M.D.
Professor of Pediatrics,
Physiology and Biophysics, USC.





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Notre Dame

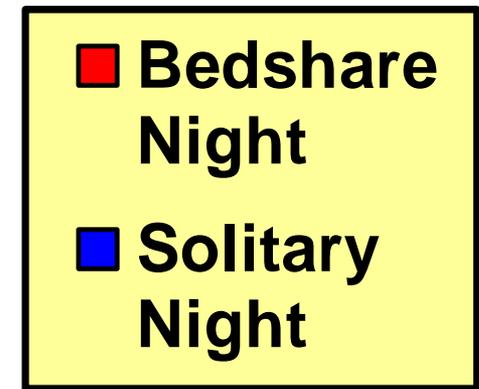
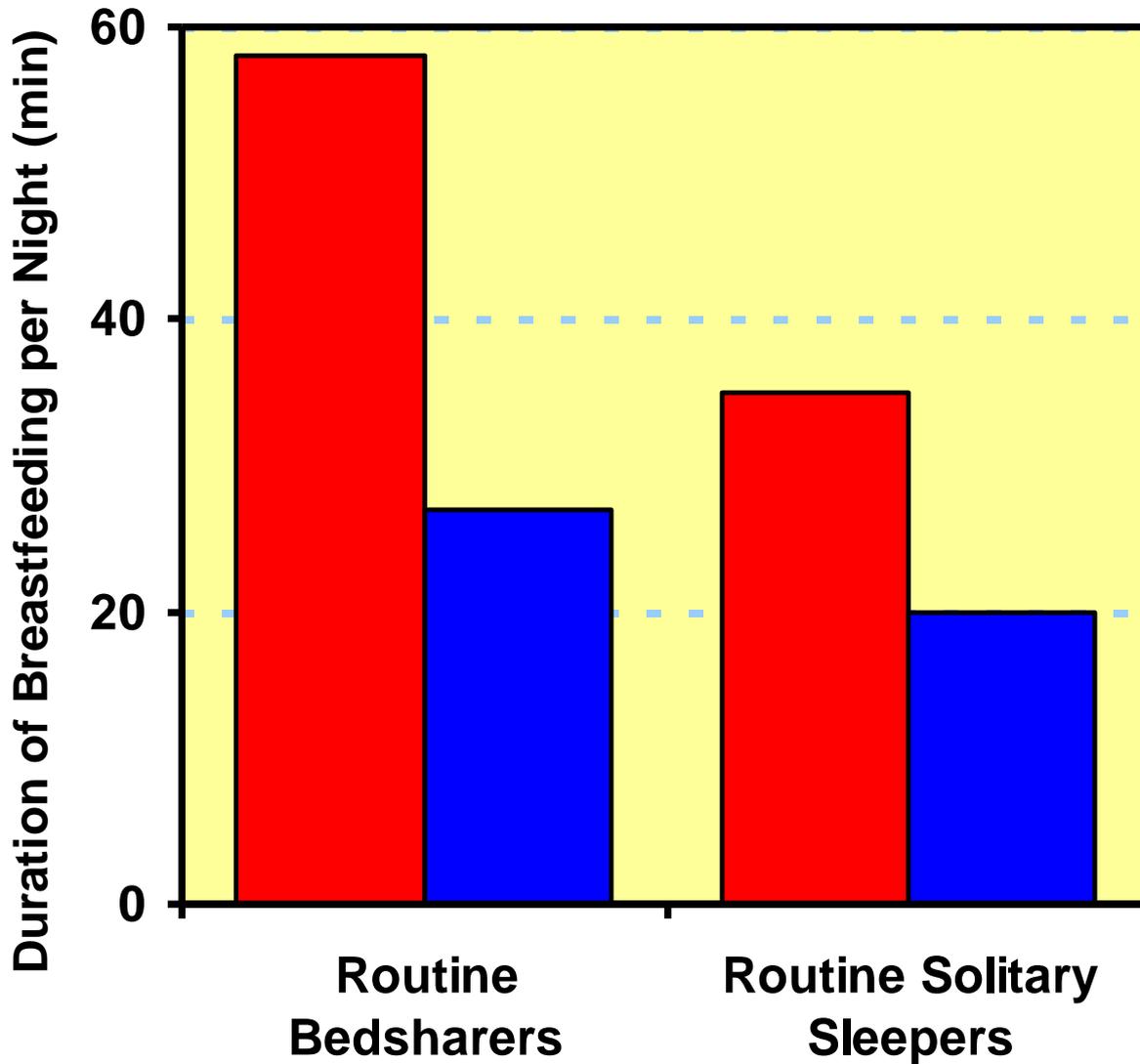
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**October 19, 2013
Notre Dame Stadium
The University of Notre Dame
South Bend, Indiana.**

Mother-Infant Bedsharing Increases Breastfeeding vs Sleeping in a Different Room



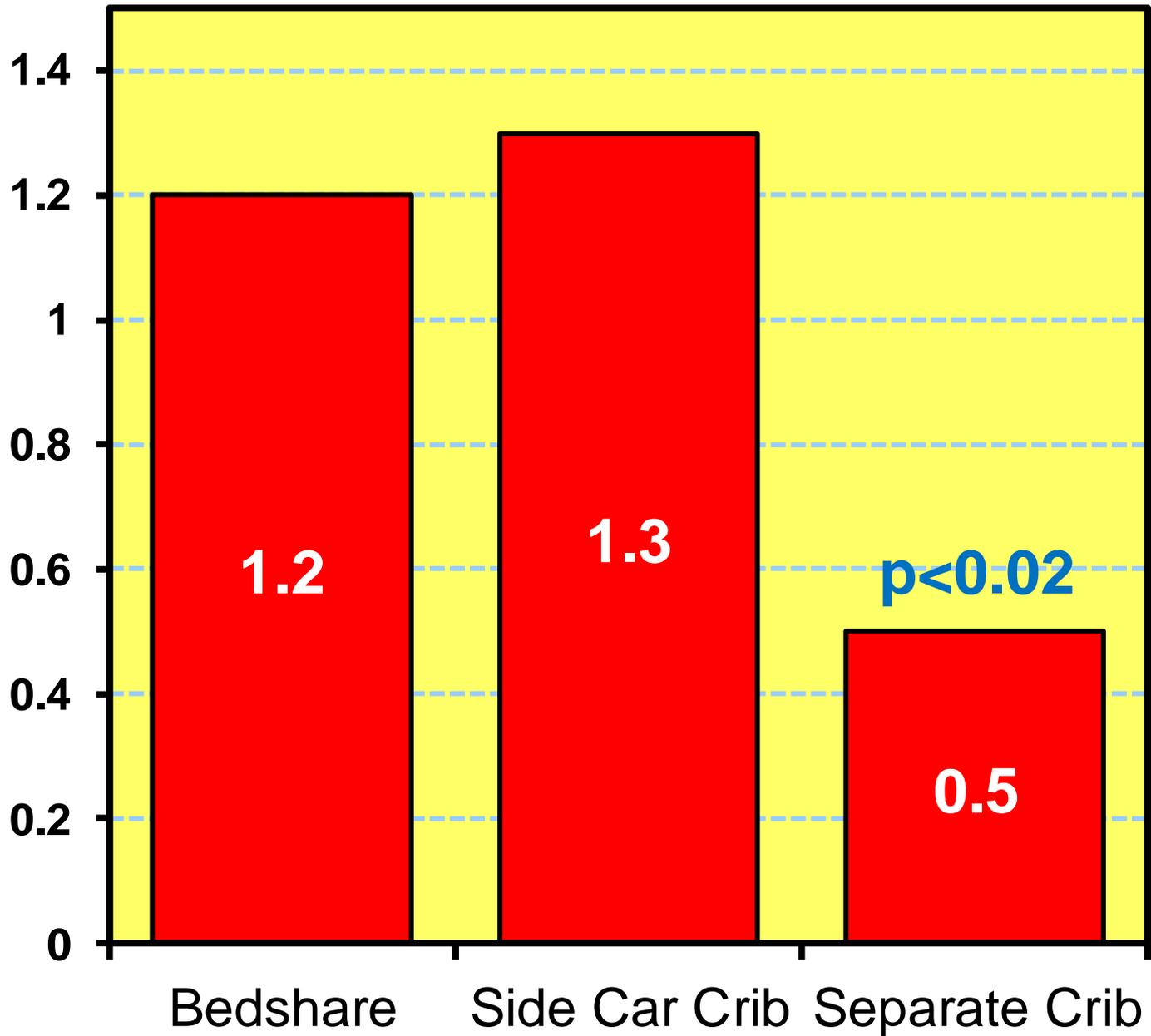
James J. McKenna, Ph.D.
Professor and Chair
Department of
Anthropology
University of Notre Dame





Helen L. Ball

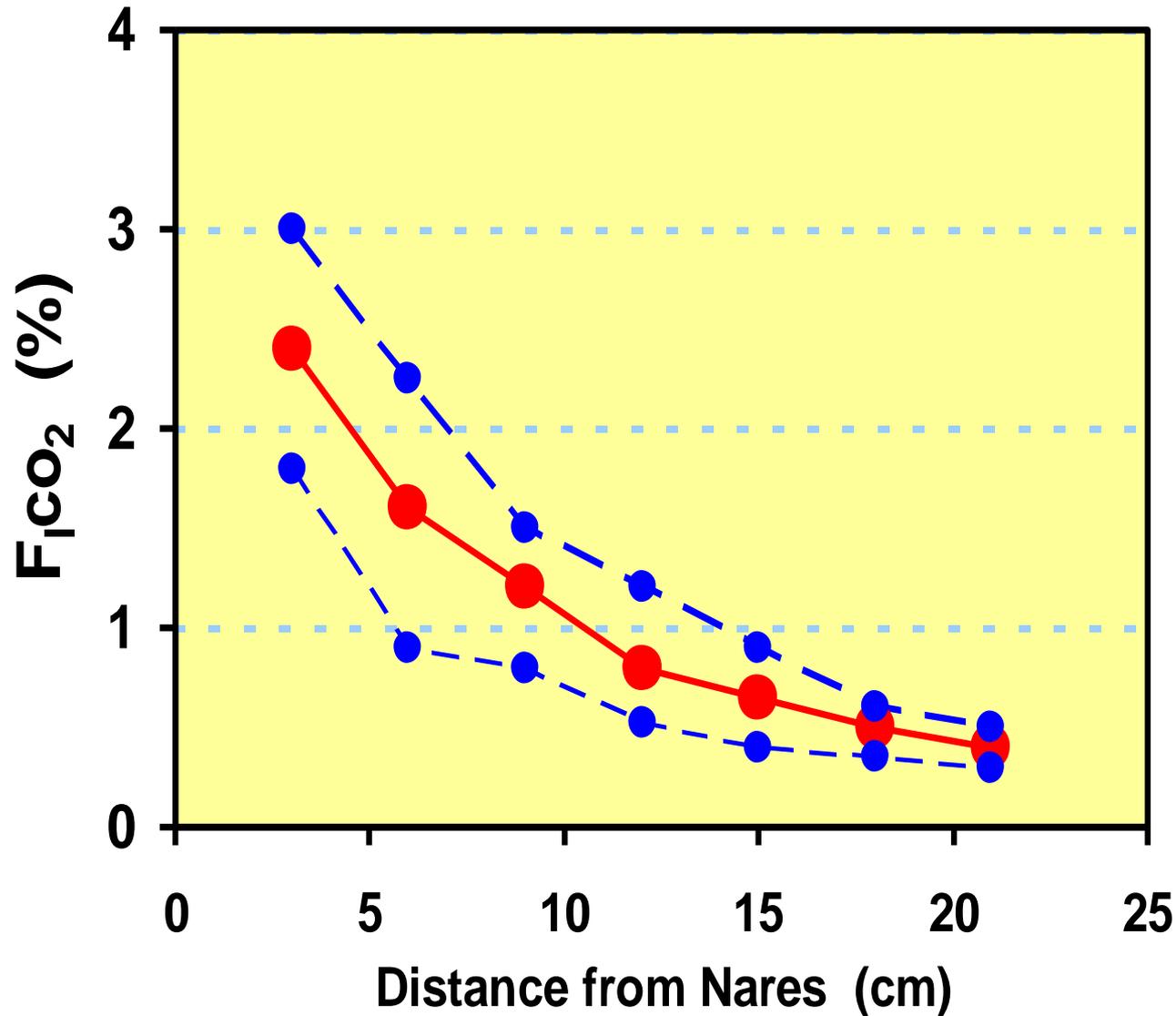
Episodes of Successful Breastfeeding per hour



Ball, H.L., et al. *Arch. Dis. Child.*, 91: 1005-1010, 2006.



Mother-Infant Bedsharing



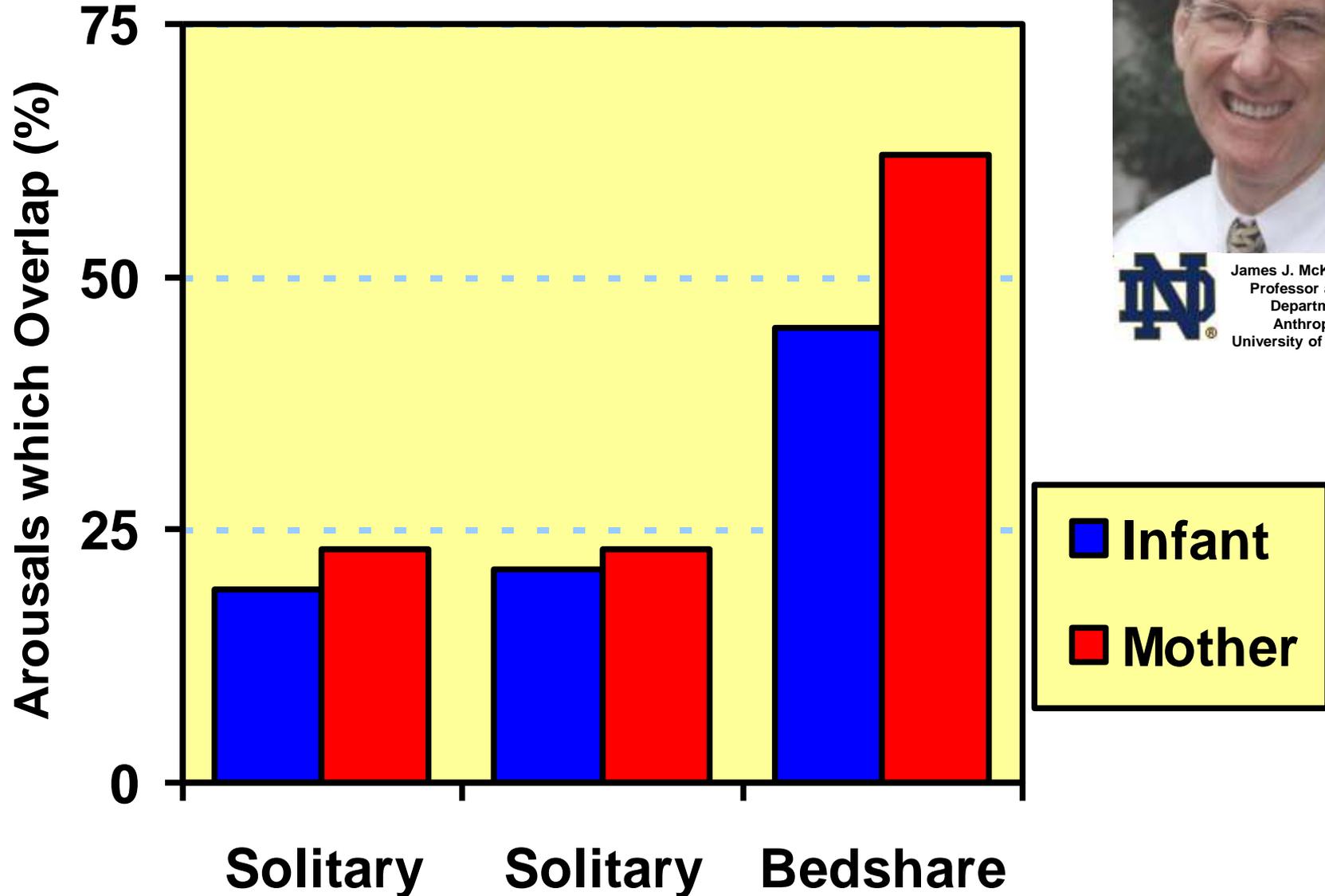
James J. McKenna, Ph.D.
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Department of
Anthropology
University of Notre Dame

Mosko, S., et al. *Am. J. Physical Anthropol.*, 103: 315-328, 1997.

Mother-Infant Bedsharing



James J. McKenna, Ph.D.
Professor and Chair
Department of
Anthropology
University of Notre Dame



Mosko, S., et al. *J. Behav. Med.*, 16: 589-610, 1993.

Bedsharing, Breathing, and Infant Sleep

- Increased breastfeeding, but not when compared to room-sharing.
- No decrease in apnea.
- No stimulation of breathing.
- Increased arousals (baby wakes mother).
- Decrease in deep sleep.
- No apparent physiological protection.

Richard, C., et al. *Sleep*, 19: 685-690, 214-219, 1996.

McKenna, J.J., et al. *Pediatrics*, 100: 214-219, 1997.

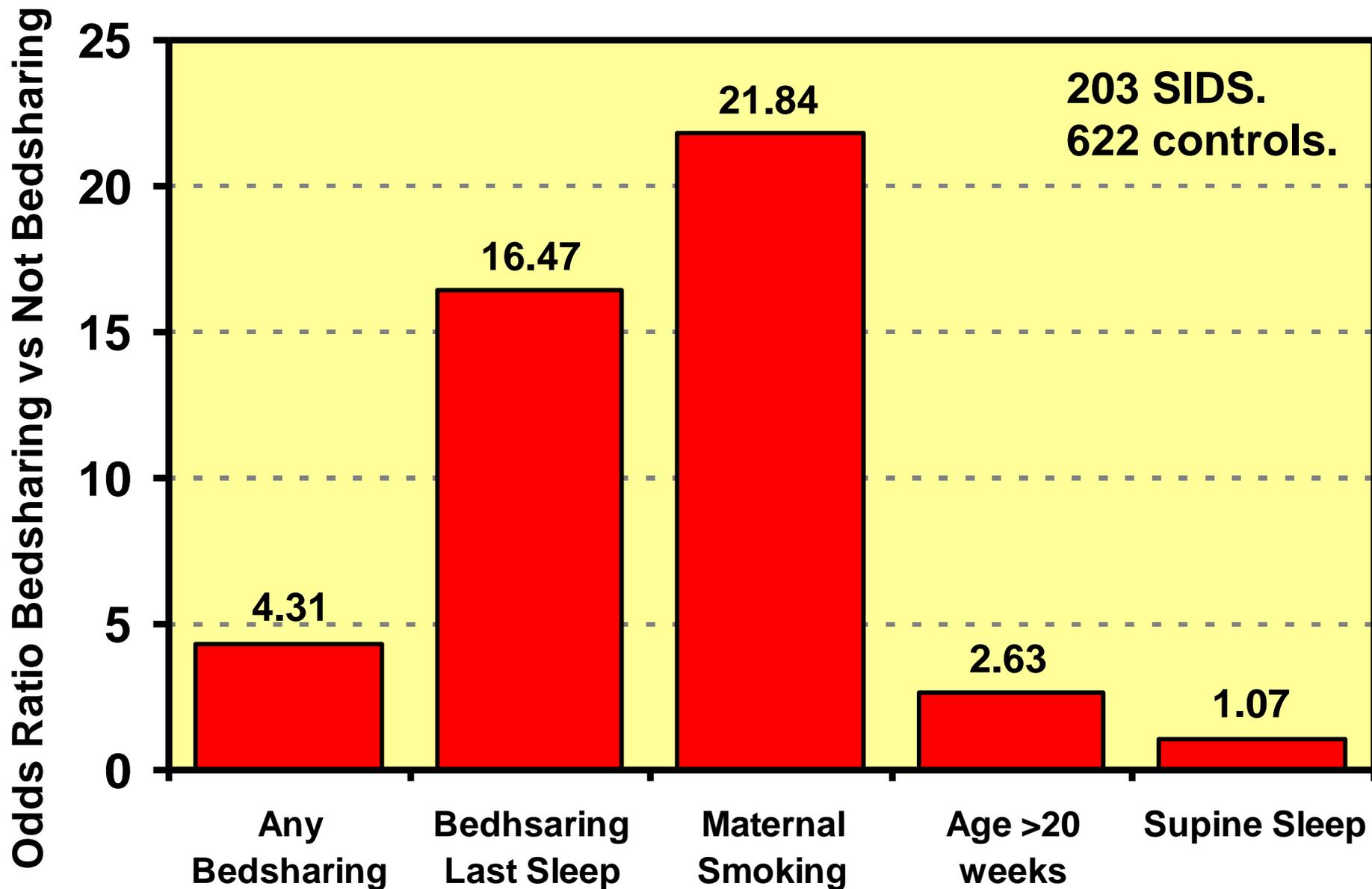
Mosko, S., et al. *Am. J. Physical Anthropol.*, 103: 315-328, 1997.

Richard, C.A., et al. *J. Appl. Physiol.*, 84: 1374-1380, 1998.

McKenna, J.J., and T. McDade. *Paediatr. Respir. Rev.*, 6: 134-152, 2005.

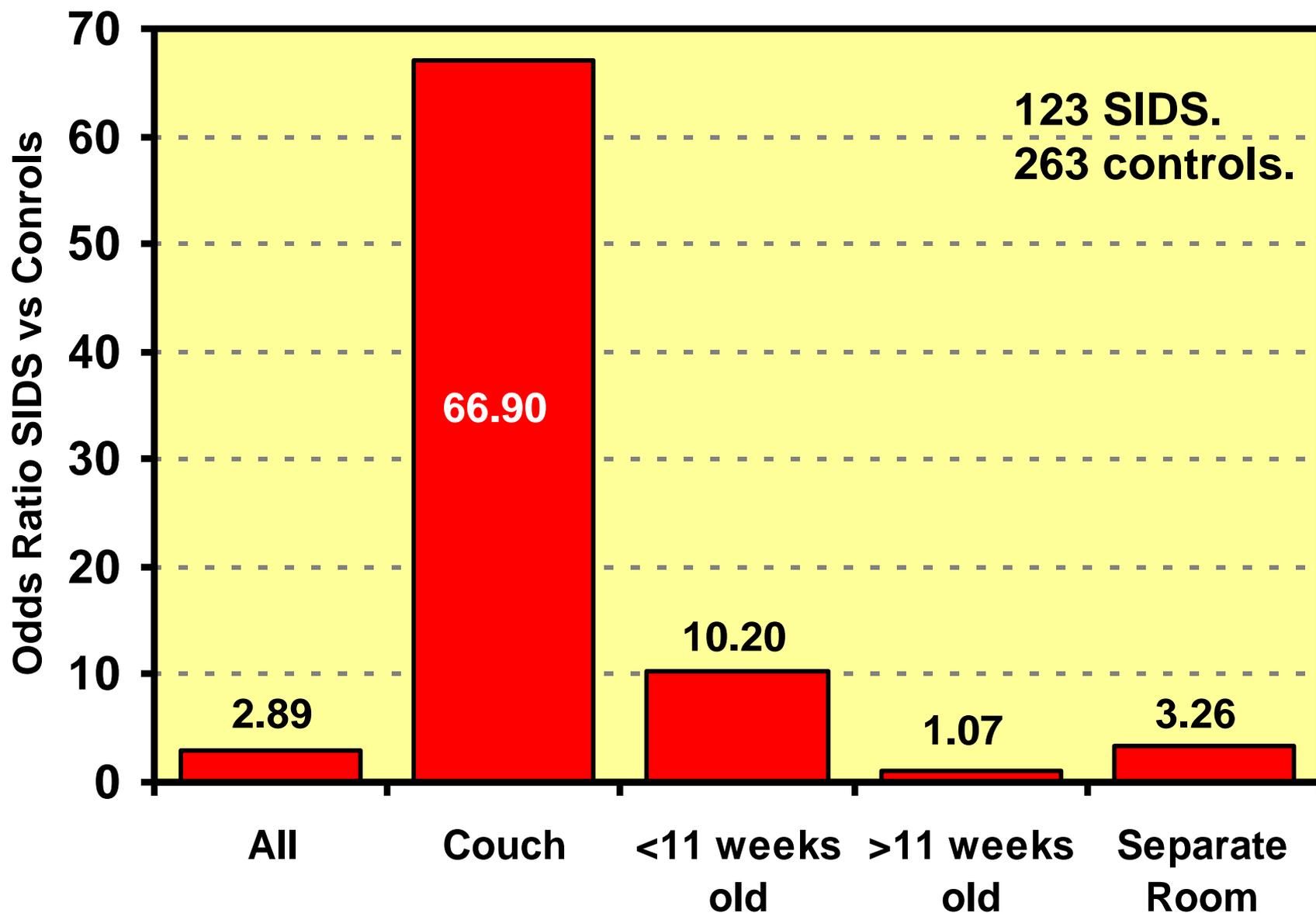
Ball, H.L., et al. *Arch. Dis. Child.*, 91: 1005-1010, 2006.

Bedsharing and SIDS in Ireland, 1994-1998



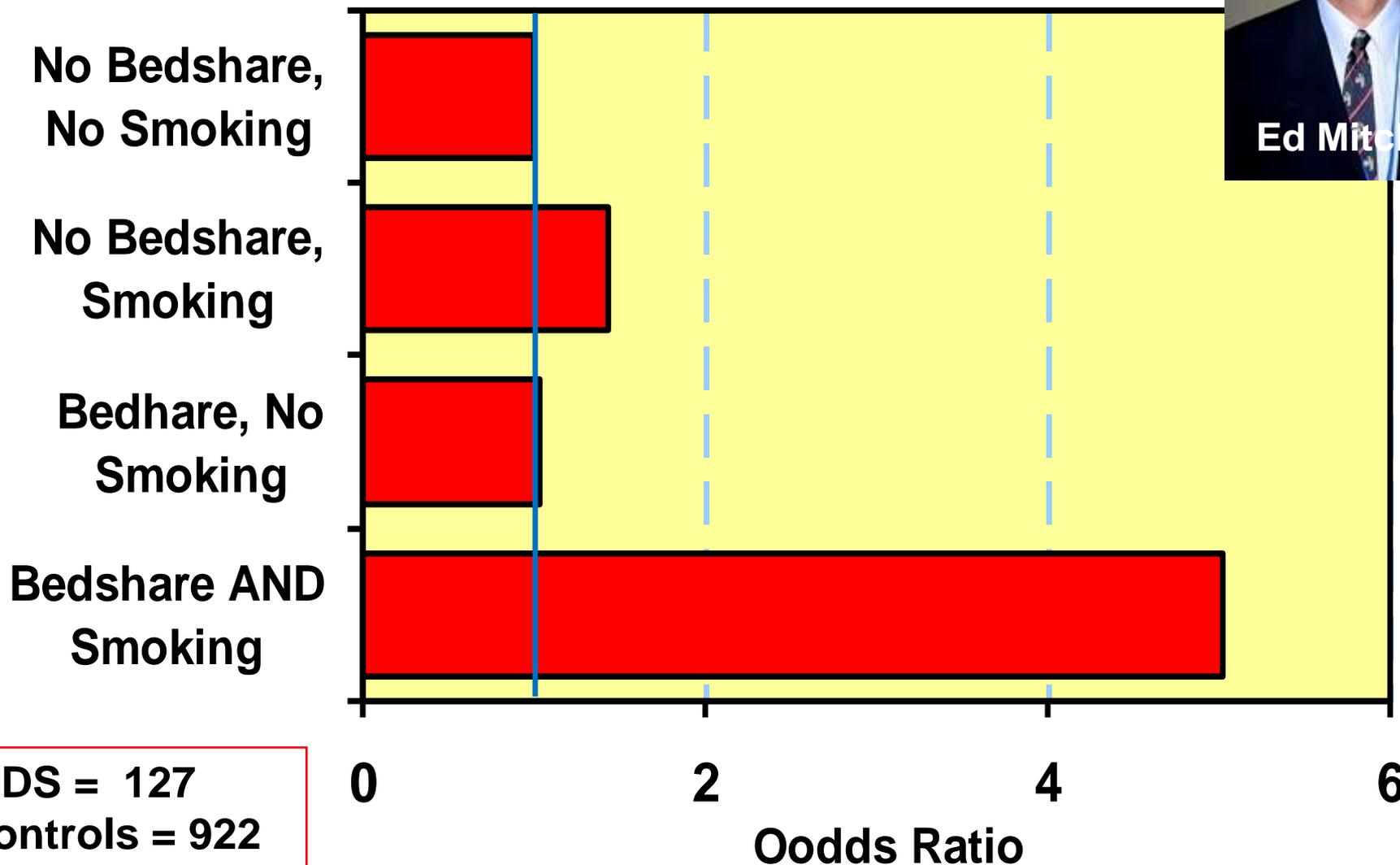
McGarvey, C., et al. *Arch. Dis. Child.*, 88: 1058-1064, 2003.

Bedsharing and SIDS in Scotland, 1996-2000



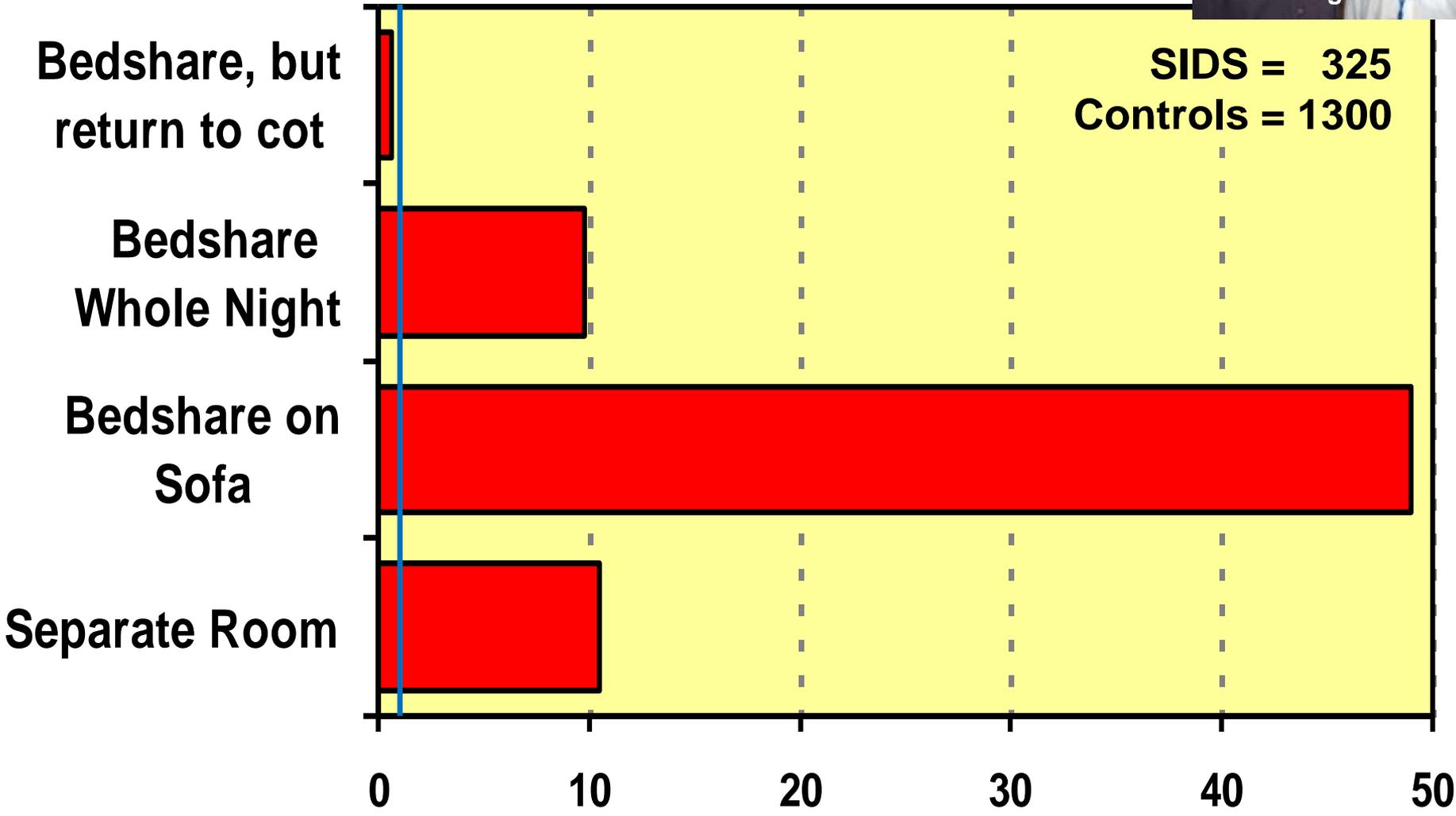
Tappin, D, et al. *J. Pediatr.*, 147: 32-37, 2005.

Bedsharing, Maternal Smoking, and SIDS: New Zealand, 1991-1993



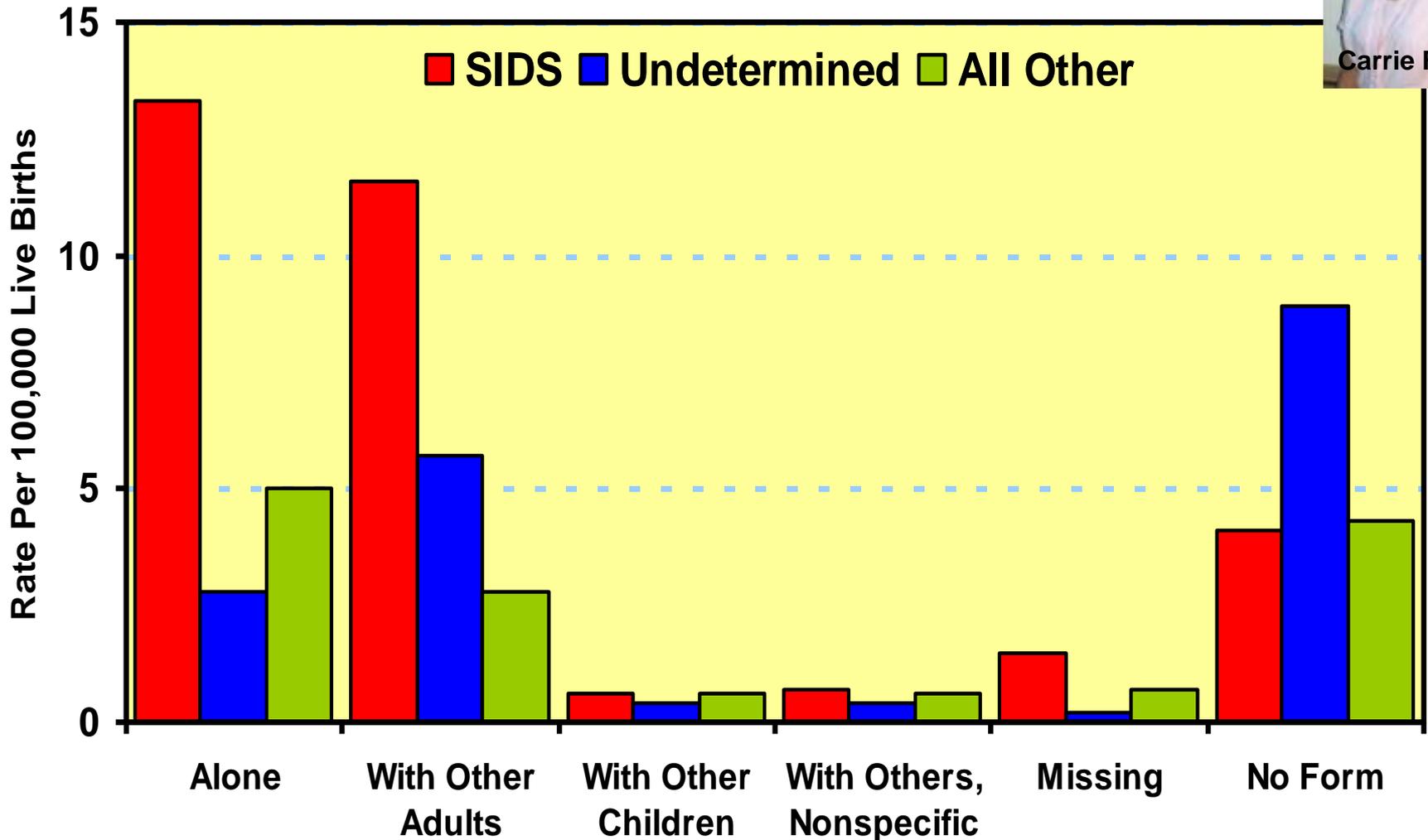
Mitchell, E.A., et al. *Pediatrics*, 100: 835-840, 1997.

Bedsharing and SIDS Risk: CESDI Study (Odds Ratios vs did not sleep with an adult)



Blair, P.S., et al. *Br. Med. J.*, 319: 457-462, 1999.

Infant Deaths by “Sleeping Alone or With Others” California 2003 SUID Data



Two Distinct Bedsharing Subgroups

Elective:

Breast feeders
Non-smokers
Firm mattress

Less Risk?

Non-Elective:

Bottle fed
Smokers
Risk factors

High Risk

Roomsharing



- **Place infant's crib or bassinet in the parents' room close to parents' bed.**
- **Removes the possibility of suffocation, strangulation, or entrapment which may occur with the infant in an adult bed.**
- **Allows close parent proximity to facilitate feeding, comforting, and monitoring the infant.**

Pediatrics, 128: 1030-1039, 2011.



Roomsharing

- **Infant can be brought to bed for breastfeeding, but then returned to the crib.**
- **Devices promoted to make bedsharing “safe” are not recommended.**
- **Because of the extremely high risk of bedsharing on a sofa or armchair, infants should not be fed on a sofa or armchair when the parent may fall asleep.**

Pediatrics, 128: 1030-1039, 2011.



Roomsharing

- **No studies have shown bedsharing to be safe or protective against SIDS.**
- **All risks associated with bedsharing, can not be controlled.**
- **AAP does not recommend any bedsharing situations as safe.**
- **Provide separate sleep areas for twins, triplets,**

Pediatrics, 128: 1030-1039, 2011.

Bedsharing is *Especially Unsafe with:*



- **Infant <3-months of age.**
- **Parent cigarette smoking.**
- **Parent is excessively tired; such as sleep deprivation (<4-hours sleep the previous night).**
- **Parent depressant medication or alcohol use.**
- **With non-parent or multiple persons.**
- **Soft or unsafe bed.**
- **Duvets, pillows, or soft covers.**
- **Sleeping on a sofa, armchair, or couch.**

Sleeping with Your Baby

A Parent's Guide to Cosleeping

Whether you do it occasionally
or every night, do it safely

James J. McKenna, Ph.D.

Director, Mother-Baby Behavioral Sleep Laboratory
University of Notre Dame

With contributions from:
William Sears, M.D.
Meredith Small, Ph.D.
Peter Fleming, M.D., Ph.D.

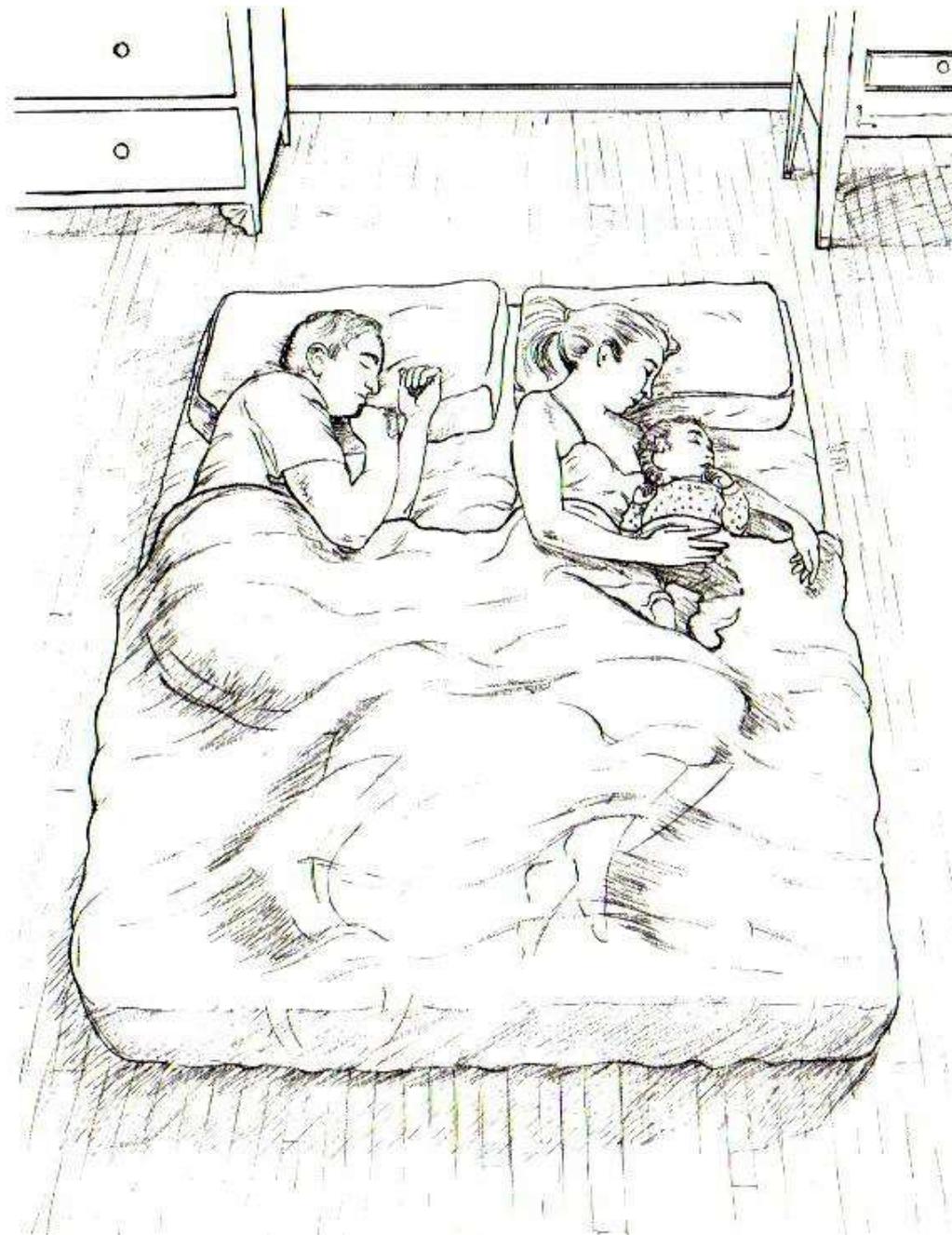
Platypus Media®

Cosleeping
product information
inside—recommended
by pediatricians!

McKenna's Bedsharing Recommendations

- All other risk factors should be eliminated.
- Bed in the middle of the floor away from walls or furniture.
- Mattress out of its frame covered with simple, lightweight blankets, tight fitting sheets, and firm pillows.
- Do not bedshare with other children.
- Do not bedshare if parents ever smoked cigarettes.

McKenna, J.J. *Sleeping with Your Baby*. 2007.



McKenna, J.J. *Sleeping with Your Baby: A Parent's Guide to Cosleeping*. Platypus, Media, 2007.

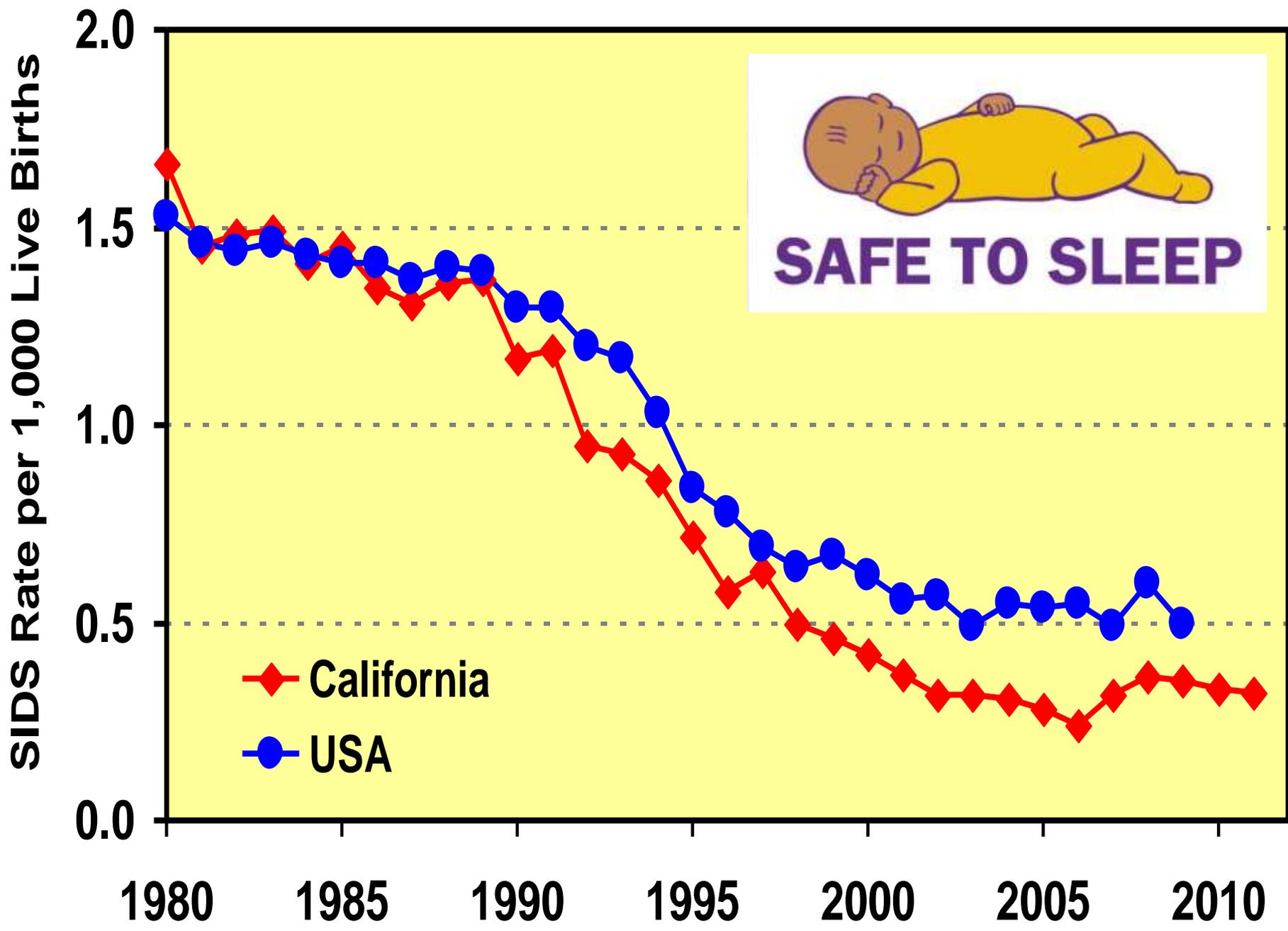


AAP Recommendations

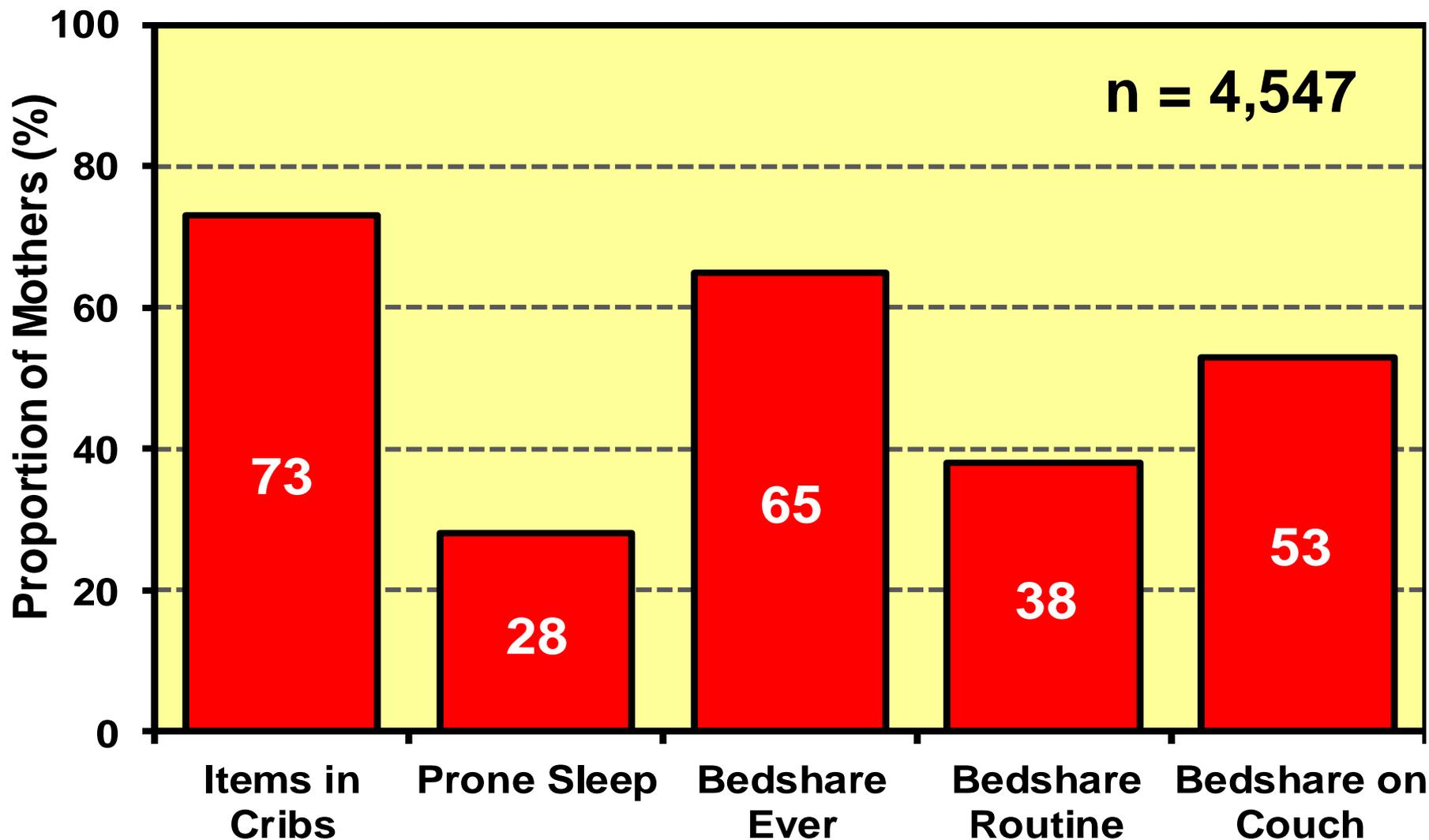


- **Room-sharing, with the infant in a crib in the parents' room next to the adult bed, is safest, and is safer than bedsharing.**
- **Infants brought to bed for breastfeeding should return to a separate crib.**
- **Do not bedshare if parents smoke cigarettes.**
- **Do not bedshare if the parents' arousal is depressed (alcohol, drugs, sleep deprived <4-hours sleep the night before).**
- **Do not sleep with an infant on a sofa or chair.**

AAP Policy Statement. *Pediatrics*, 128: 1030-1039, 2011.



Parents Ignore Safe Infant Sleep Recommendations



Dreisbach, S. *American Baby Magazine*, March, 2014, issue.

<http://www.parents.com/baby/safety/nursery/how-safe-is-your-babys-sleep/?page=3>



Supine

Alone

Firm mattress

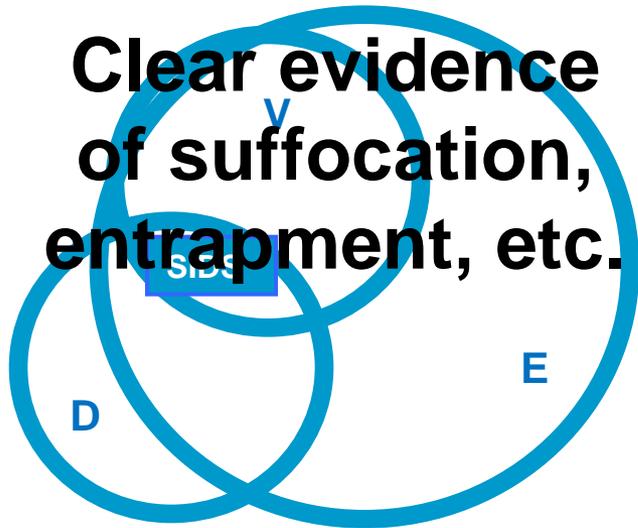
Empy crib

**Known
Cause of
Death**

**Biology
Interacts
with
Environment**

**“True”
SIDS**

**Clear evidence
of suffocation,
entrapment, etc.**



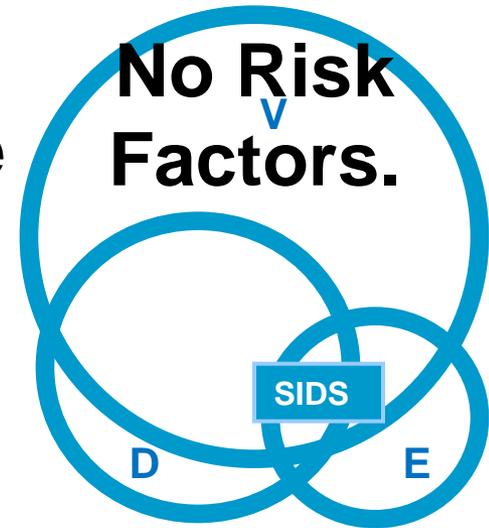
Dx: Accidental

**Some Risk Factors,
but would not cause
death in all infants.**



Dx: Variable

**No Risk
Factors.**



Dx: SIDS



**Coroners' Curriculum
Development Committee
California State Coroners Association**





SIDS Summit 2011



- **32 Coroners and Pathologists from around California attended.**
- **Working conference to explore whether or not it is possible to achieve better consistency between counties on diagnosing the cause and manner of death in babies dying suddenly and unexpectedly.**
- **Attendees voted on cause of death and manner of death on a number of cases, to bring out areas of common ground and of difference.**

**SIDS Summit 2011. California State Coroners' Association.
Studio City, California. October 19, 2011.**



SIDS Summit 2011



“Pristine SIDS” Case

Cause of Death	%
SIDS	56
Undetermined	22
SUID	16
Asphyxia	6

Manner of Death	%
Accidental	0
Homicide	0
Natural	63
Undetermined	38

Some pathologists were persuaded to use “SUID” because it is recommended by the Center for Disease Control and Prevention.

SIDS Summit 2011. California State Coroners' Association.
Studio City, California. October 19, 2011.



SIDS Summit 2011



- **Other cases were reviewed which had a variety of findings.**
 - **Complete consensus was not achieved on any case, but those with a positive finding had better agreement.**
- **The conference illustrated the complexity of cases Coroners currently see.**
 - **Increased observations revealed more questions.**
 - **Difficult to come to a definitive diagnosis.**
 - **Achieve “probable cause” or “certainty**

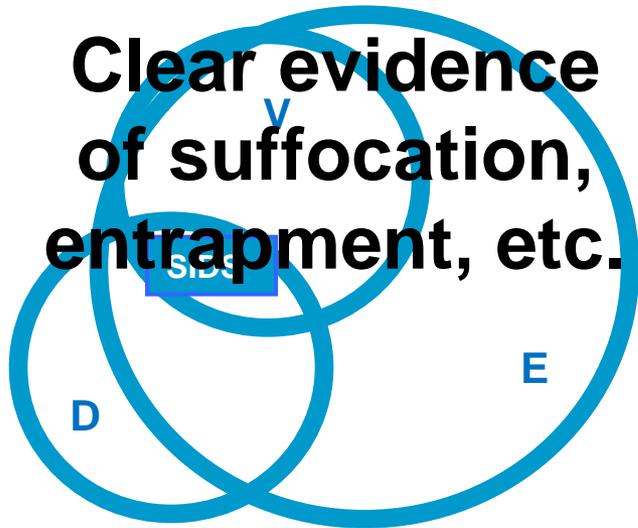
**SIDS Summit 2011. California State Coroners' Association.
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Dx: SIDS

Diagnosis of SUDI in California

- **Coroners and Medical Examiners in different counties use different diagnoses (names) for unexplained infant deaths which are sudden and unexpected.**
- **SIDS, Undetermined, SUID, SUDI, etc.**
- **These all mean the same thing.**
- **Public health services should be provided to all.**
- **Parents should be counseled that these diagnoses all mean the same thing.**

**SIDS Summit 2011. California State Coroners' Association.
Studio City, California. October 19, 2011.**

SUDI: Challenge to the California SIDS Community

- **As authorities in health care, we need to convey the message that these differing diagnoses are equivalent!**
- **Support should be provided to all families.**
- **Coroners and Medical Examiners should voluntarily refer all families to MCAH/Public Health Nurses.**
- **MCAH should provide grief and education services to families of all SIDS, SUID, undetermined, etc.**
- **Support services help families work through the death of their infant and are critical and beneficial.**

California SIDS Advisory Council, August 14, 2012.

California Department of Public Health, December 17, 2012.

WARNING

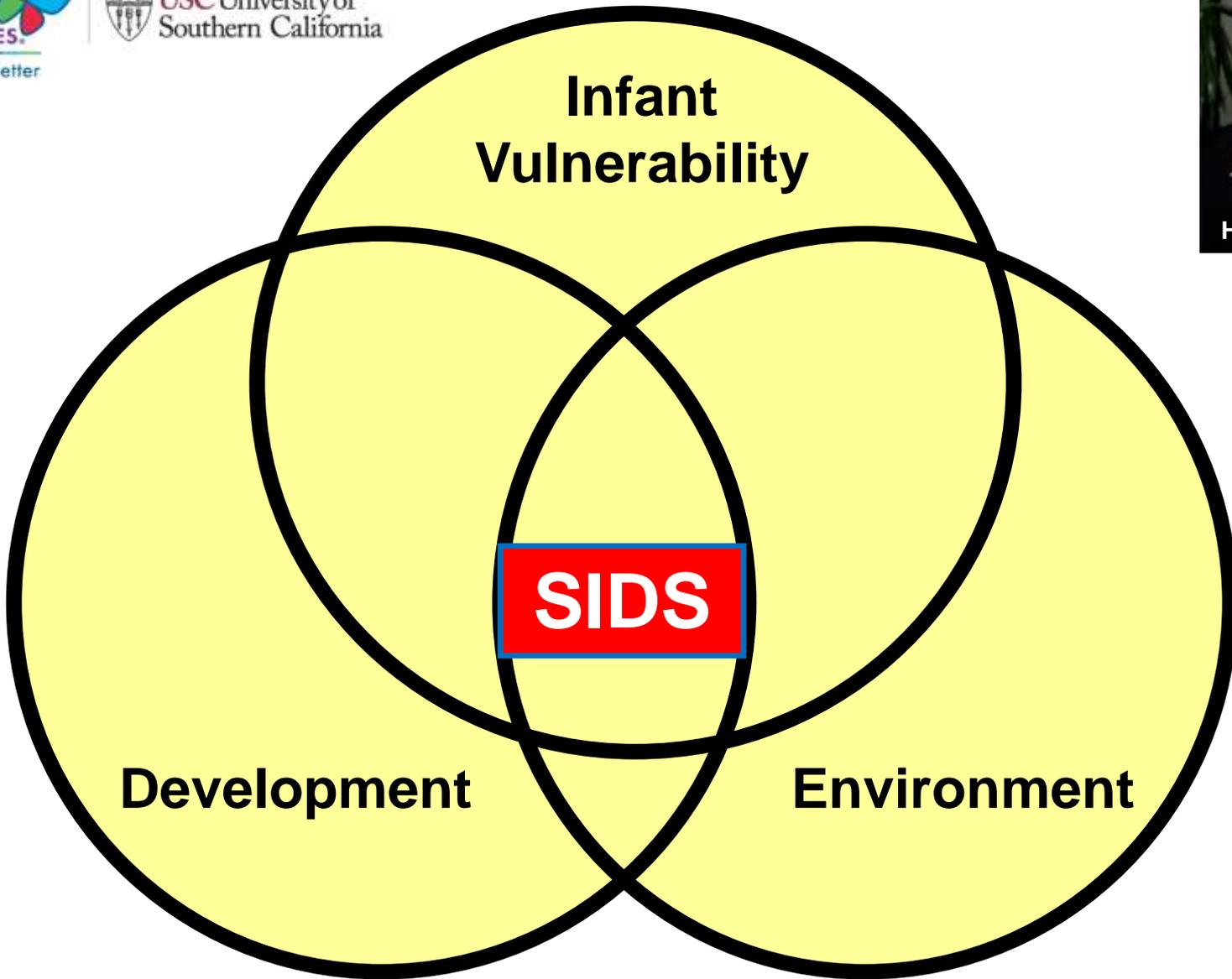
The cause of SIDS is not yet known.

This information has not been proved to be the cause of SIDS.

However, I have attempted to give you some idea about some current directions of SIDS research.



Hannah Kinney



Sudden Infant Death Syndrome

- **Most common cause of sudden infant death between the ages of 1-month and 1-year.**
- **Cause remains unknown.**
- **Can not be predicted in infants prior to death.**
- **Reduction in SIDS in populations through public health intervention.**

Bedsharing

- **Bedsharing is associated with an increased risk of infant death.**
- **Bedsharing is increasingly common, despite known risks.**
- **No study shows that bedsharing is protective.**
- **Roomsharing, but not bedsharing, is the safest infant sleep environment.**



SIDS