

1 **Newborn and full-term infants' sudden infant death (syndrome) developmental timings**  
2 **overlap, confusing SIDS-risk-reduction's efficacy: perspective**

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8 **Abstract**

9 **Aim:** To show why the current sudden infant death (syndrome) SIDS-risk precautions are not  
10 always successful in preventing SID(S).

11 **Methods:** The toxicologist's Haber's Rule organizes SIDS risks: concentration (respiratory rate  
12 [ $f$ ]), time (arousal threshold), and dose endpoint (corrected QT interval [QTc]) and makes an  
13 infant vulnerable, but are only lethal in the presence of a QT-interval-prolonging gas. The  
14 following sequentially incorporated concepts enlightened the causes of SID(S): Radford's  
15 nomogram, arousal- and QTc-SIDS theories; fetal-hemoglobin (HbF) switch; the "ATP-  
16 depletion" SIDS hypothesis; ketogenesis; metabolic acidosis; urea cycle, ammonia  
17 detoxification, and infant-renal immaturity, are all found in published works.

18 **Results:** SID(S) has two phases; the first phase, SID, occurs while an infant's kidneys are  
19 immature and inadequately processing excess ammonia. The second phase, SIDS, occurs during  
20 the HbF switch when an infant has a period of anemia-caused, long-term hypoxia with its  
21 increased  $f$  and arousal threshold. In SIDS, any cardiac QT interval prolonging gas—such as  
22 ammonia and combustion engine exhaust—will increase its effective concentration during long-  
23 term hypoxia's increased  $f$  and exposure duration. SID, with its inadequate processing of  
24 ammonia, extends beyond the beginning of SIDS, which has brought the confusion on a specific  
25 cause of SIDS. The SID risk of inadequately-processed ammonia, resulting in brain-cell death,  
26 co-exists during SIDS.

27 **Prospective Preventatives:** Ammonia levels, particularly, should be minimized in both phases.  
28 Propranolol, Omega-3's, and a breastfeeding mother with a high BUN taking benzoate/vitamin  
29 B-6 to lower her BUN to WNL are potential measures. Known-SIDS-risk-reduction measures  
30 have meaning and must be continued.

31 **Keywords:** sudden infant death syndrome, Haber's Rule, respiratory rate, arousal threshold,  
32 QTc prolongation, fetal hemoglobin switch, cardiac arrest, immature kidneys, ammonia  
33 detoxification, ATP-depletion

34 **Short Title: Multifactorial Cause of Sudden Infant Death**