Figure S1. Infant death rates by interpregnancy interval and age at death.

Figure S2. Infant death rates by interpregnancy interval and cause of death.



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| **eTable 1. Hazard ratios of interpregnancy interval and infant death among singleton, second-born or higher births by ICD-10 grouping: 2003 revised U.S. birth certificate data linked to infant death data, 2011-2015** | | | | | | |
|  | **Interpregnancy Interval (months)** | | | | | |
|  | **< 6** | **6-11** | **12-17** | **18-23** | **24-59** | **60+** |
| **Cause of death** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** |
| **All causes** |  |  |  |  |  |  |
| Unadjusted | 2.12 (2.03, 2.21) | 1.38 (1.32, 1.43) | 1.09 (1.05, 1.13) | 1.00 (Reference) | 1.02 (0.98, 1.05) | 1.27 (1.23, 1.32) |
| Model 1 | 1.61 (1.54, 1.68) | 1.22 (1.17, 1.26) | 1.06 (1.02, 1.11) | 1.00 (Reference) | 0.96 (0.93, 1.00) | 1.12 (1.08, 1.16) |
| Model 2 | 1.58 (1.51, 1.66) | 1.21 (1.16, 1.26) | 1.07 (1.03, 1.12) | 1.00 (Reference) | 0.96 (0.92, 0.99) | 1.10 (1.06, 1.14) |
| Model 3 | 1.29 (1.23, 1.34) | 1.12 (1.08, 1.16) | 1.04 (1.00, 1.09) | 1.00 (Reference) | 0.93 (0.90, 0.97) | 0.96 (0.93, 1.00) |
| **Neonatal** |  |  |  |  |  |  |
| Unadjusted | 1.98 (1.87, 2.09) | 1.26 (1.19, 1.33) | 1.05 (1.00, 1.11) | 1.00 (Reference) | 1.08 (1.03, 1.13) | 1.52 (1.46, 1.59) |
| Model 1 | 1.60 (1.51, 1.69) | 1.13 (1.07, 1.19) | 1.03 (0.98, 1.08) | 1.00 (Reference) | 1.04 (1.00, 1.09) | 1.40 (1.34, 1.47) |
| Model 2 | 1.60 (1.50, 1.70) | 1.13 (1.07, 1.20) | 1.05 (0.99, 1.11) | 1.00 (Reference) | 1.06 (1.01, 1.11) | 1.42 (1.35, 1.49) |
| Model 3 | 1.17 (1.10, 1.24) | 1.01 (0.96, 1.06) | 1.00 (0.95, 1.06) | 1.00 (Reference) | 0.99 (0.94, 1.03) | 1.11 (1.06, 1.17) |
| **Postneonatal** |  |  |  |  |  |  |
| Unadjusted | 2.32 (2.17, 2.47) | 1.54 (1.45, 1.63) | 1.14 (1.08, 1.21) | 1.00 (Reference) | 0.93 (0.89, 0.98) | 0.92 (0.87, 0.98) |
| Model 1 | 1.61 (1.51, 1.72) | 1.32 (1.24, 1.40) | 1.11 (1.05, 1.18) | 1.00 (Reference) | 0.86 (0.81, 0.90) | 0.77 (0.73, 0.82) |
| Model 2 | 1.55 (1.44, 1.66) | 1.29 (1.22, 1.38) | 1.09 (1.03, 1.17) | 1.00 (Reference) | 0.83 (0.78, 0.88) | 0.74 (0.69, 0.78) |
| Model 3 | 1.47 (1.37, 1.56) | 1.27 (1.20, 1.35) | 1.10 (1.04, 1.17) | 1.00 (Reference) | 0.85 (0.81, 0.90) | 0.73 (0.69, 0.78) |
| **All external causes1** |  |  |  |  |  |  |
| Unadjusted | 2.83 (2.49, 3.22) | 1.72 (1.53, 1.94) | 1.31 (1.16, 1.48) | 1.00 (Reference) | 0.87 (0.78, 0.97) | 0.70 (0.62, 0.79) |
| Model 1 | 1.77 (1.55, 2.01) | 1.41 (1.25, 1.59) | 1.25 (1.10, 1.41) | 1.00 (Reference) | 0.78 (0.69, 0.87) | 0.55 (0.48, 0.62) |
| Model 2 | 1.69 (1.48, 1.95) | 1.42 (1.25, 1.61) | 1.26 (1.11, 1.43) | 1.00 (Reference) | 0.74 (0.66, 0.83) | 0.50 (0.44, 0.58) |
| Model 3 | 1.71 (1.50, 1.95) | 1.40 (1.24, 1.57) | 1.24 (1.10, 1.40) | 1.00 (Reference) | 0.77 (0.69, 0.86) | 0.54 (0.47, 0.61) |
| **External causes excluding W752** |  |  |  |  |  |  |
| Unadjusted | 3.29 (2.71, 3.99) | 1.81 (1.50, 2.18) | 1.42 (1.18, 1.71) | 1.00 (Reference) | 0.90 (0.76, 1.07) | 0.70 (0.58, 0.86) |
| Model 1 | 2.11 (1.73, 2.56) | 1.53 (1.27, 1.84) | 1.36 (1.13, 1.64) | 1.00 (Reference) | 0.80 (0.67, 0.95) | 0.54 (0.44, 0.67) |
| Model 2 | 2.05 (1.67, 2.53) | 1.58 (1.30, 1.93) | 1.39 (1.14, 1.70) | 1.00 (Reference) | 0.76 (0.63, 0.91) | 0.50 (0.41, 0.62) |
| Model 3 | 2.03 (1.67, 2.47) | 1.51 (1.25, 1.81) | 1.35 (1.12, 1.63) | 1.00 (Reference) | 0.80 (0.67, 0.94) | 0.53 (0.44, 0.65) |
| **External causes and SUID3** |  |  |  |  |  |  |
| Unadjusted | 2.73 (2.52, 2.95) | 1.69 (1.57, 1.82) | 1.21 (1.13, 1.31) | 1.00 (Reference) | 0.91 (0.85, 1.97) | 0.71 (0.66, 0.77) |
| Model 1 | 1.73 (1.59, 1.87) | 1.40 (1.30, 1.51) | 1.17 (1.08, 1.26) | 1.00 (Reference) | 0.81 (0.76, 0.86) | 0.56 (0.52, 0.60) |
| Model 2 | 1.67 (1.53, 1.81) | 1.39 (1.28, 1.50) | 1.16 (1.07, 1.25) | 1.00 (Reference) | 0.78 (0.72, 0.83) | 0.51 (0.47, 0.56) |
| Model 3 | 1.66 (1.53, 1.80) | 1.38 (1.28, 1.48) | 1.16 (1.08, 1.25) | 1.00 (Reference) | 0.81 (0.75, 0.86) | 0.55 (0.51, 0.59) |
| **SUID only4** |  |  |  |  |  |  |
| Unadjusted | 2.63 (2.41, 2.87) | 1.67 (1.54, 1.81) | 1.18 (1.08, 1.28) | 1.00 (Reference) | 0.91 (0.84, 0.98) | 0.71 (0.66, 0.77) |
| Model 1 | 1.66 (1.52, 1.81) | 1.38 (1.27, 1.49) | 1.13 (1.04, 1.23) | 1.00 (Reference) | 0.81 (0.75, 0.87) | 0.56 (0.52, 0.61) |
| Model 2 | 1.60 (1.46, 1.75) | 1.35 (1.24, 1.47) | 1.12 (1.02, 1.22) | 1.00 (Reference) | 0.78 (0.72, 0.84) | 0.52 (0.47, 0.56) |
| Model 3 | 1.59 (1.46, 1.74) | 1.36 (1.25, 1.47) | 1.13 (1.04, 1.22) | 1.00 (Reference) | 0.81 (0.75, 0.87) | 0.55 (0.51, 0.60) |
| Note: SUID, sudden unexpected infant death. Model 1: adjusted for marital status, maternal race, maternal education, maternal age at the previous birth, birth order of infant, and county poverty level; Model 2: Model 1 + pre-pregnancy BMI, pre-pregnancy smoking, principal source of payment at delivery, and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) use during pregnancy; Model 3: Model 2 + preterm birth. | | | | | | |
| 1. ICD-10 codes: U01, V01-Y84 2. ICD-10 codes: U01, V01-W74, W76-Y84 3. ICD-10 codes: U01, VO1-Y84, R95, R99 4. ICD-10 codes: R95, R99, W75 | | | | | | |

**eTable 2: Hazard ratio estimates (and 95% confidence intervals) for infant mortality due to all cause and all external cause of death by interpregnancy interval length, observed and multiple imputed data**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Interpregnancy Interval (months)** | | | | | |
|  |  | **< 6** | **6-11** | **12-17** | **18-23** | **24-59** | **60+** |
| **Weight** | **Cause of death** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** | **HR**  **(95% CI)** |
|  | **All cause** |  |  |  |  |  |  |
| None | Unadjusted (observed)1 | 2.12  (2.03, 2.21) | 1.38  (1.32, 1.43) | 1.09  (1.05, 1.13) | 1.00 (Reference) | 1.02  (0.98, 1.05) | 1.27  (1.23, 1.32) |
| FW | Unadjusted (observed)1 | 2.12  (2.03, 2.21) | 1.38  (1.32, 1.43) | 1.09  (1.05, 1.13) | 1.00 (Reference) | 1.02  (0.98, 1.05) | 1.27  (1.23, 1.31) |
| FW | Unadjusted (50 imputations)2 | 1.91  (1.80, 2.03) | 1.33  (1.26, 1.39) | 1.07  (1.02, 1.12) | 1.00 (Reference) | 0.97  (0.93, 1.01) | 1.20  (1.15, 1.25) |
| None | Adjusted (observed)3 | 1.61  (1.54, 1.68) | 1.22  (1.17, 1.26) | 1.06  (1.02, 1.11) | 1.00 (Reference) | 0.96  (0.93, 1.00) | 1.12  (1.08, 1.16) |
| FW | Adjusted (observed)3 | 1.60  (1.53, 1.67) | 1.21  (1.17, 1.26) | 1.06  (1.02, 1.11) | 1.00 (Reference) | 0.96  (0.93, 1.00) | 1.13  (1.09, 1.17) |
| FW | Adjusted (50 imputations)2 | 1.50  (1.42, 1.57) | 1.19  (1.13, 1.25) | 1.05  (1.00, 1.10) | 1.00 (Reference) | 0.94  (0.90, 0.98) | 1.09  (1.04, 1.14) |
|  | **All external causes** |  |  |  |  |  |  |
| None | Unadjusted (observed)1 | 2.83  (2.49, 3.22) | 1.72  (1.53, 1.94) | 1.31  (1.16, 1.48) | 1.00 (Reference) | 0.87  (0.78, 0.97) | 0.70  (0.62, 0.79) |
| FW | Unadjusted (observed)1 | 2.78  (2.46, 3.14) | 1.71  (1.52, 1.91) | 1.27  (1.13, 1.43) | 1.00 (Reference) | 0.84  (0.76, 0.94) | 0.69  (0.61, 0.77) |
| FW | Unadjusted (50 imputations)2 | 2.46  (2.17, 2.79) | 1.65  (1.47, 1.85) | 1.26  (1.12, 1.41) | 1.00 (Reference) | 0.85  (0.77, 0.94) | 0.68  (0.61, 0.77) |
| None | Adjusted (observed)3 | 1.77  (1.55, 2.01) | 1.41  (1.25, 1.59) | 1.25  (1.10, 1.41) | 1.00 (Reference) | 0.78  (0.69, 0.87) | 0.55  (0.48, 0.62) |
| FW | Adjusted (observed)3 | 1.72  (1.52, 1.95) | 1.40  (1.25, 1.57) | 1.22  (1.08, 1.36) | 1.00 (Reference) | 0.75  (0.68, 0.84) | 0.54  (0.48, 0.61) |
| FW | Adjusted (50 imputations)2 | 1.64  (1.46, 1.86) | 1.38  (1.24, 1.55) | 1.22  (1.09, 1.39) | 1.00 (Reference) | 0.77  (0.70, 0.86) | 0.56  (0.50, 0.63) |

Note: FW= frequency weighted. Adjusted model is model 2.

1. Observed data, unadjusted models: n= 9,782,029 births with 45,398 all cause deaths and 4,418 external cause deaths
2. Imputed data, unadjusted and adjusted models: n= 10,569,517 births with 51,696 all cause deaths and 4,767 external cause deaths
3. Observed data, adjusted models: n=9,673,426 births with 44,152 all cause deaths and 4,381 external cause deaths