| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** | |
| Author:  World Health Organization, 1994  Country:  Indonesia, Thailand, and Malaysia  System:  Eight maternity hospitals  Baseline period: 01/1990 to 06/1990  Evaluation period: 06/1990 to 04/1991  Routine use period: 04/1991 to 09/1991  Funding: World Health Organization (WHO) and ministries of health of Indonesia, Thailand, and Malaysia  **Author industry relationship disclosure:**  NR  **Design:**  Cluster randomized trial (4 matched pairs of hospitals selected; one of each randomly selected to implement use of partogram) | Cesarean reduction intervention:  Use of the WHO partogram to inform active management of labor and decisions about need for cesarean | Inclusion criteria:   * District general hospitals in urban settings * Current use of active management of labor   Exclusion criteria:   * See inclusion criteria | Births, n:  Baseline period:  18,254  Evaluation period:  17,230  Births to normal1 women, n:  Baseline period:  10,049  Evaluation period: 9,130  Births to normal1 nulliparous women:  Baseline period:  4,212  Evaluation period:  3,924  Age, mean yrs ± SD:  Baseline period:  27.23 ± 5.72  Evaluation period:  27.17 ± 5.75  EP/BL: *P* = 0.55  Parous, %:  Baseline period:  61.0  Evaluation period:  60.8  EP/BL: *P* = 0.87  **Medicaid:** Not applicable  **Private insurance coverage:** Not applicable  Multiple gestations, n (%):  Baseline period: 239 (1.3)  Evaluation period: 247 (1.4) | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth  Vaginal, spontaneous, n (%):** Total singleton births:  Baseline period: 13,186 (72.4)Evaluation period:12,704 (73.9) **EP/BL:***P* = 0.201  Normal1 women:  Baseline period:  8,428 (83.9)  Evaluation period:  7,869 (86.3)  EP/BL: *P* < 0.001  Normal1 nulliparous women:  Baseline period:  3,129 (74.3)  Evaluation period:  3,069 (78.3)  **EP/BL:***P* < 0.001  **Vaginal, assisted, n (%):** Total singleton births:  Baseline period: 1,793 (9.8)Evaluation period: 1649 (9.6) **EP/BL:***P* = 0.110  Normal1 women:  Baseline period:  995 (9.9)  Evaluation period: 841 (9.2)  **EP/BL:***P* = NR  Normal1 nulliparous women:  Baseline period:  668 (15.9)  Evaluation period: 578 (14.7)  EP/BL: *P* = NR  **Cesarean birth, n (%):** Total singleton births: Baseline period: 2,278 (12.5) Evaluation period: | |
| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| World Health Organization, 1994 (continued) |  |  |  |  | 1,926 (11.2) **EP/BL:***P* = 0.841  Normal1 women: Baseline period:  621 (6.2)  Evaluation period: 409 (4.5)  EP/BL: *P* = 0.056  Normal1 nulliparous women:  Baseline period:  414 (9.8)  Evaluation period: 271 (6.9)  EP/BL: *P* = 0.060  Maternal outcomes  **Maternal mortality, n:**  Baseline period:  23  Evaluation period: 24  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission, %:** Baseline period: 6.3 Evaluation period: 5.0 **EP/BL:***P* = 0.49  **Stillbirths, n (%):** Baseline period: 516 (2.8) Evaluation period: 43 (2.4) | |

1 A normal woman is a woman who is less likely to require intervention.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Althabe et al., 2004  Country:  Argentina, Brazil, Cuba, Guatemala, and Mexico  System:  36 hospitals  Argentina (18) Brazil (8) Cuba (4) Mexico (4) Guatemala (2)  Baseline period: 6 months baseline data; followed by 1 month staff training and implementation practice in intervention sites  Evaluation period: 6 months use of the intervention in intervention sites  Funding:  European Union, Pan American Health Organization, WHO and World Bank Special Programme of Research, multiple national contributions.  **Author industry relationship disclosure:**  None  **Design:**  Cluster randomized trial  (hospitals matched by country, type of hospital, and baseline rates) | Cesarean reduction intervention:  Implementation of policy of mandatory second opinion from person of equal or higher clinical qualifications to the attending physician. Consultations informed by use of evidence-based guidelines for reviewing cesarean birth indications.  Groups:  G1: Intervention  G2: Control  N (hospitals) at randomization:  G1: 18  G2: 18  N at baseline:  G1: 17  G2: 17 | Inclusion criteria:   * Hospital baseline cesarean rate ≥ 15% * Hospitals with  > 1,000 births per year * Able to implement protocol * Successful completion of run-in period   Exclusion criteria:   * See inclusion criteria | Births per year, n: Baseline:  G1: 34,735  G2: 39,175  Evaluation:  G1: 35,675  G2: 39,638  Parous, %:  Baseline:  G1: 62.2  G2: 66.5  **Medicaid:** Not applicable  **Private insurance coverage:** Not applicable  **Prior cesarean, %:** Baseline period:  **G1:** 13.5  **G2:** 13.8 | Total providers/ staff:  NR  Total providers/ staff formally trained:  Not applicable  Specialty:  NR  **Compliance with second opinion, non-emergent cesarean, %:** 88 | **Mode of birth Vaginal, spontaneous:** NR  Vaginal, assisted, %: Baseline period:  G1: 4.4  G2: 2.8  Evaluation period:  G1: 4.9  G2: 3.4  G1/G2: *P* = 0.85  Total cesarean births, %: Baseline period:  G1: 26.3  G2: 24.6  Evaluation period:  G1: 24.7  G2: 24.9  G1/G2: *P* = 0.044  **Maternal outcomes**  **Maternal mortality, rate per 10,000 live births:** Baseline period:  **G1:** 3.2  **G2:** 5.9  Evaluation period:  **G1:** 4.3 **G2:** 7.5  **Neonatal outcomes  Neonatal mortality, mean rate:** Baseline period: **G1:** 1.1  **G2:** 1.1  Evaluation period: **G1:** 0.9 **G2:** 1.0 **G1/G2:** *P* = 0.756  **Perinatal mortality, mean rate:** Baseline period: **G1:** 2.6 **G2:** 2.8 |
| Althabe et al., 2004 (continued) |  |  |  |  | Evaluation period:  **G1:** 2.4 **G2:** 2.9 **G1/G2:** *P* = 0.273  Apgar score: NR  NICU admission, mean rate:  Baseline period:  G1: 8.4  G2: 8.1  Evaluation period:  G1: 8.0  G2: 8.3  G1/G2: *P* = 0.340 |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Berglund et al., 2010  Country:  Ukraine  System:  Three maternity units:1  **S1:** Donetsk  **S2:** Lutsk  **S3:** Lviv  Baseline period:  S1: 4 months prior to training  S2: 4 months prior  S3: 2 months prior  Evalutation period:  S1: 05/2004 to 12/2006  S2: 05/2004 to 12/2006  S3: 05/2004 to 11/2006  Funding:  WHO, national and university  **Author industry relationship disclosure:**  None  **Design:** Pre-post assessment | Cesarean reduction intervention:  National Mothers and Infant Health Project to train maternity staff and providers implemented in nine provinces. Detailed data collected at selected maternity sites.  Training provided by a non-governmental organization (NGO) based on the WHO Making Pregnancy Safer tools and framework focused on implementation of evidence-based routines as standard care.  Topics included:   * Avoiding Induction * Use of partograms * Augmentation * AROM * Labor pain management * Labor support | Inclusion criteria:  NR  Exclusion criteria:  NR | Births per year, n:  Baseline period:  S1: 652  S2: 742  S3: 302  2004:  S1: 1,021  S2: 2,283  S3: 1,756  2005:  S1: 1,720  S2: 3,578  S3: 2,881  2006:  S1: 1,820  S2: 4,004  S3: 2,590  Last three month period:  S1: 425  S2: 998  S3: 1,016  Age, median yrs (range):  Baseline period:  S1: 24 (16-42)  S2: 25 (14-44)  S3: 22 (14-46)  Evaluation period:  S1: 25 (15-45)  S2: 25 (15-48)  S3: 23 (16-40)  Parous, %:  Primiparae:  Baseline period:  S1: 52.0  S2: 47.4  S3: 49.7  Evaluation period:  S1: 65.0  S2: 51.8  S3: 58.6  **Medicaid:** Not applicable  **Private insurance coverage:** Not applicable | Total providers/ staff, n:  S1: 108  S2: 171  S3: 90  Total providers/ staff formally trained, n (%):  S1: 108 (100)  S2: NR (36)  S3: NR (49)  **Specialty:**  NR2 | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted, %:**  Baseline period:  S1: 3.7  S2: 2.0  S3: 0.0  Evaluation period:  S1: 0.0  S2: 2.0  S3: 0.0  Cesarean birth, %:  Baseline:  S1: 30.0  S2: 33.0  S3: 22.0  Total: 29.9\*  Evaluation period:  S1: 17.0  S2: 12.3  S3: 19.6  Last three month period:  S1: 18.4  S2: 12.7  S3: 16.9  Total: 15.4\*  S1/BL: *P* < 0.0001  S2/BL: *P* < 0.0001  S3/BL: *P* < 0.0606  **Maternal outcomes Maternal mortality:** NR  **Neonatal outcomes  Early neonatal death, %:**  Baseline period:  **S1:** 13.6  **S2:** 4.6  **S3:** 6.4  Evaluation period:  **S1:** 10.9  **S2:** 2.4  **S3:** 1 |
| Berglund et al., 2010 (continued) |  |  |  |  | **Apgar score:** NR  **NICU admission, %:** Baseline period:  S1: 11.2 S2: 7.3 S3: 6.4  Evaluation period: S1: 10.7 S2: 4.3 S3: 3.3  S1/BL: *P* = 0.4153  S2/BL: *P* = 0.0015  S3/BL: *P* = 0.0015 |

\* Calculated by reviewer.

1 Three sites selected from among 20, method not reported.

2 Those trained included obstetricians, neonatologists, midwives, pediatricians, pediatric nurses, and anesthesiologists.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Bickell et al., 1996  Dillon et al., 1992†  Country:  US  System:  New York State hospitals  S1: 45 reviewed hospitals  **S2:** 120 non- reviewed hospitals  Baseline period:  1988  Evaluation period:  1989 to 1990†  1989 to 1993  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Task force developed guidelines for in-house peer review of obstetric care. Presented educational programs across the state to assist hospitals in implementation. Included a Dictionary of Terms to standardize terminology.  External peer reviews by ACOG trained teams of 3-4 physicians and nurse. Reviewed 100 labor and delivery records to assess quality of care.  Teams provided summary report to hospital for distribution to staff. Reviewed hospital was requested to provide implementation changes to Task Force 6-12 months later. | Inclusion criteria:   * Participation was voluntary * First 24 hospitals selected for geographic diversity by strata of cesarean section rates† * Second set of hospitals randomly selected from those with high cesarean rates   Exclusion criteria:   * See inclusion criteria | Births per year, mean (SE):  Baseline period:  S1: 1,430 (141.4)  S2: 1,720 (125.9)  Evaluation period:  S1: 1,503 (152.8)  S2: 1,720 (119.2)  Hospitals by 1988 cesarean rate, n:  < 20:  S1: 8  S2: 25  20-24:  S1: 3  S2: 30  25-29:  S1: 11  S2: 43  ≥ 30:  S1: 23  S2: 22  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  Vaginal, assisted:  NR  Cesarean birth, mean rate (SE):  Total: 1988:  S1: 29.1 (1.2)  S2: 25.1 (0.5)  S1/S2: *P* < 0.01  1993:  S1: 25.8 (0.9)  S2: 24.0 (0.4)  S1/S2: *P* = NS1  Change in total cesarean rate, by 1988 cesarean rate:  < 20:  S1: 2.5 (1.0)  S2: 2.3 (0.7)  20-24:  S1: -1.0 (2.5)  S2: 0.0 (0.6)  25-29:  S1: -2.4 (1.6)  S2: -2.5 (0.6)  ≥ 30:  S1: -6.2 (0.9)  S2: -3.8 (0.9)  Repeat cesarean:  1988:  S1: 10.9 (0.5)  S2: 9.8 (0.3) S1/S2: *P* = NS  1993:  S1: 24.8 (2.0)  S2: 24.8 (1.1) S1/S2: *P* = NS  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes Neonatal mortality:** NR |
| Bickell et al., 1996  Dillon et al., 1992† (continued) |  |  |  |  | **Apgar score:** NR  **NICU admission:** NR |

1 Although there was a significant crude difference in overall cesarean rate (P < 0.01), when 1988 cesarean rates were controlled for, there was no statistically significant impact of the intervention.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Boylan et al., 1991  Country:  US  System:  Hermann Hospital in Houston, TX (affiliated with the University of Texas)  Baseline period: 07/1/1984 to 06/30/1985  Evaluation period: 07/1/1985 to 06/30/1986  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Introduction of active management of labor (AML), including: AROM if laboring without SROM for more than two hours. IV oxytocin augmentation if dilation < 1 cm per hour. | **Inclusion criteria**:   * Nulliparous women * Singleton * Vertex pregnancy * Presenting in labor without fetal distress * Labor defined by painful contraction at least every ten minutes with 80% efface-ment and 1 cm dilation.   Exclusion criteria:   * See inclusion criteria | Births, n:  Baseline period: 1,843 Evaluation period: 2,057  Age, mean yrs ± SD: Baseline period: First six months: 23.9 ± 5.1 Last six months: 24.3 ± 5.1  Evaluation period: First six months: 24.1 ± 5.3 Last six months: 23.6 ± 5.4  Race/ethnicity, %:  Baseline period: First six months: White: 44.8  Black: 36.6  Hispanic: 13.1  Other: 5.5  Second six months:  White: 47.8 Black: 34.7 Hispanic: 12.9 Other: 4.5  Evaluation period: First six months:  White: 42.7  Black: 39.7  Hispanic: 14.1  Other: 3.5  Second six months:  White: 39.3  Black: 42.1  Hispanic: 14.0  Other: 4.6  Parous, n:  Total: 0  **Medicaid:** NR | Total providers/ staff: 10 obstetricians 11 University of Texas faculty members 5 autonomous private practitioners 6 residents per year subervised by faculty  Total providers/ staff formally trained:  NR  **Specialty:**  NR(those trained included obstetricians, neonatologists, midwives, pediatricians, pediatric nurses, and anesthesi-ologists) | **Mode of birth Vaginal, spontaneous, n (%):** Baseline period: 735 (39.9) Evaluation period: 1,049 (51.0)  **Vaginal, assisted, n (%):**  Baseline period: 660 (35.8)  Evaluation period: 621 (30.2)  Cesarean birth, n (%):  Baseline period: 448 (24.3)  Evaluation period: 387 (18.8)  EP/BL: Δ = 5.5 (95% CI: 2.9-8.1), *P* < 0.05  Maternal outcomes  **Maternal mortality:** NR  **Neonatal outcomes Neonatal mortality, n (%):**  Asphyxia:Baseline period:  1 (1.1) Evaluation period: 0  Apgar score: NR  NICU admissions, for asphyxia, n:  Baseline period:  36  Evaluation period: 37 |
| Boylan et al., 1991 (continued) |  |  | **Private insurance coverage:** NR  **Prior cesarean, n:**  **Total:** 0 |  |  |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Calvo et al., 2009  Country:  Spain  System:  Two public maternity hospitals:  **S1:** Son Llàtzer  **S2:** Menorca  Baseline period:  01/2006 to 06/2006  Evaluation period:  11/2006 to 04/2007  Funding:  NR  **Author industry relationship disclosure:**  None  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Using a consensus policy for cesarean indications in a multifaceted feedback program.  Program included:  weekly “debate” of cesareans performed in clinical meetings; appropriateness review of all cesareans every two months; dissemination of results, and introduction of methods for improvement by the units. | Inclusion criteria:  NR1  Exclusion criteria:  NR | Births:  NR  **Medicaid:**  All public patients  **Private insurance coverage:** Not applicable | Total providers/ staff:  NR  Total provider/ staff formally trained: NR  Specialty:  NR | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted:** NR  Cesarean birth, %:  Baseline period:  S1: 17.5  S2: 29.0  Evaluation period: S1: 15.8  S2: 22.0  S1/BL: *P* = NS  S2/BL: *P* = NS  Appropriate by study criteria, %:  Baseline period:  S1: 68.3  S2: 80.0  Evaluation period: S1: 84.3  S2: 92.0  S1/BL: *P* < 0.05  S2/BL: *P* < 0.05  Maternal outcomes  **Maternal mortality:** NR  **Neonatal outcomes** **Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission:** NR |

1 Voluntary participation based on positive results at similar regional hospitals.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Elferink-Stinkens et al., 2004  Country:  Netherlands  System:  85 of 116 Dutch obstetric departments participating in national database  Baseline period:  1994  Evaluation period:  04/1995 to 09/1998  Funding:  Praeventiefonds Nederland  **Author industry relationship disclosure:**  NR  **Design:**  RCT with hospitals stratified by size of department, academic vs. non-academic status, and initial cesarean rates | Cesarean reduction intervention:  Report contextualizing departmental data in tabular and graphic form including:   * No spontaneous onset (induction or planned cesarean) * Planned cesarean * No spontaneous birth (vacuum, forceps, or cesarean) * Cesarean   Data also subdivided by very preterm, preterm, term, and postterm.  1995 sent to depart-ment contacts for distribution; 1996 through 1998 sent to individual obstetricians within the intervention departments. Mailing followed up with repeat report and brief question-naire shortly after first mailing.  Groups:  **G1:** Intervention  **G2:** Control | Hospitals Inclusion criteria:   * Participation in national perinatal database * Medical ethics committee approval for newborn follow-up exams   Exclusion criteria:   * Data excluded in a case of merger of intervention and control departments   **Infants**  1% random sample of births obtained by contacting four randomly selected hospitals per day and sampling as below for new-born neurological exam  **Inclusion criteria:**   * All 32 - < 37 week births * 50% of term births * All ≥ 42 weeks * Maternal consent   **Exclusion criteria:**   * Less than 32 weeks at birth | Births: NR  Neonatal examinations, n: Baseline period:  32 - < 37 weeks: G1: 78 G2: 116  37 - < 42 weeks: G1: 406 G2: 425  ≥ 42 weeks: G1: 59 G2: 47  Evaluation period:  32 - < 37 weeks: G1: 130 G2: 130  37 - < 42 weeks: G1: 575 G2: 554  ≥ 42 weeks: G1: 85 G2: 88  **Medicaid:** Not applicable  **Private insurance coverage:** Not applicable | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  Vaginal, assisted: NR  Total cesarean births, % range:  Total: 10 to 31  G1/G2: *P* = NS  **Maternal outcomes**  **Maternal mortality:** NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission:** NR  Abnormal neurological exam, %: Baseline period:  32 - < 37 weeks: G1: 17.9 G2: 23.3  37 - < 42 weeks: G1: 13.1 G2: 19.8  ≥ 42 weeks: G1: 22.0 G2: 6.4  Evaluation period:  32 - < 37 weeks: G1: 26.9 G2: 24.6  37 - < 42 weeks: G1: 13.2 G2: 10.3  ≥ 42 weeks: G1: 5.9 G2: 19.3  **G1/G2:** OR = 1.3 (95% CI: 0.89-2.00) |

The spread of the cesarean rates between hospitals (as measured by the mean distance of the percentiles to the median) was significantly (7%) lower in the intervention group for term births (37 to 42 weeks). The difference in the spread was not significant for other gestational ages.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Gilstrap et al., 1984  Country:  US  System:  Wilford Hall Medical Center  Baseline period:  1974 to 1977  Evaluation period:  1978 to 1981  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Preliminary review of cesarean section policy in 1976, with special regard to the most common indications.  Informal criteria and policies were established and directed toward assuring an adequate trial of labor, or ensuring fetal distress was persistent and ominous, and toward using established criteria to allow selected term frank breech presentations a trial at vaginal delivery.  Assessment included mandatory intrauterine pressure monitoring with oxytocin usage and selected usage of scalp pH determinations. | Inclusion criteria:  NR  Exclusion criteria:  NR | Total births, n:  Baseline period: 6,693  Evaluation period: 6,162  Parity, women delivered by cesarean section, n (%):  Primigravidas:  Baseline period: 633/1,125 (56)  Evaluation period: 469/940 (50)  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, assisted, %:  Baseline period: 6.7  Evaluation period: 6.1  Cesarean birth, n (%):\*  Total:  Baseline period: 1,125 (16.8)  Evaluation period: 940 (15.2)  EP/BL: *P* < 0.02  Primary:  Baseline period: 855\*\* (12.8)  Evaluation period: 592\*\* (9.6)  EP/BL: *P* < 0.0001  Repeat:  Baseline period: 270 (4.0)  Evaluation period: 348 (5.6) EP/BL: *P* < 0.0001  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar score:** NR  **NICU admissions:** NR |

\* The total, primary, and repeat cesarean rates by year from 1970 to 1981 are only displayed graphically.

\*\* Calculated by reviewer.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Gregory et al., 1999  Country:  US  System:  Cedars Sinai Medical Center  Baseline period: 04/1993 to 12/1993  Evaluation period:  1994 to 1998  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Prospective observational | Cesarean reduction intervention: 17 sequential interventions at the administrative, clinical education, and clinical protocol/guidelines levels | Inclusion criteria:  NR  Exclusion criteria:  NR | Births per year, n:  Baseline: 5,134  1994: 6,960  1995: 6,987  1996: 6,528  1997: 6,595  1998: 6,427  Age, mean yrs ± SD:  Baseline: 29.61 ± 6.2  1994: 29.4 ± 6.3  1995: 29.4 ± 6.3  1996: 29.7 ± 6.2  1997: 29.9 ± 6.3  1998: 30.1 ± 6.3  **Race/ethnicity, %:** Caucasian:  Baseline: 47  1994: 45  1995: 43  1996: 45  1997: 46  1998: 46  Latina:  Baseline: 19  1994: 19  1995: 19  1996: 20  1997: 20  1998: 21  African American:  Baseline: 25  1994: 27  1995: 26  1996: 27  1997: 25  1998: 24  Other:  Baseline: 9  1994: 8  1995: 12  1996: 9  1997: 9  1998: 9  **Medicaid, %:**  Baseline: 15  1994: 17  1995: 18  1996: 17 | Total providers/ staff:  9 full-time faculty 100 private physicians with obstetrical privileges  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:**  NR  **Vaginal, assisted**: NR  **Cesarean birth, %:**  Baseline: 26.0  1994: NR  1995: NR  1996: NR  1997: 20.5  1998: NR Post evaluation: 23.5  **Maternal outcomes**  **Maternal mortality:** NR  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission:** NR |
| Gregory et al., 1999 (continued) |  |  | 1997: 16  1998: 16  **Private insurance coverage:**  Baseline: 10  1994: 6  1995: 3  1996: 3  1997: 2  1998: 2 |  |  |

1 Mean age reported as 19.6 at baseline, apparently in error as the change in mean age was not mentioned among those that were statistically significant.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Hamilton et al., 2004  Country:  US and Canada  System:  Seven university hospitals  Baseline period: 12/1/1998 to 01/30/1999  Evaluation period: 02/1/1999 to 03/31/2001  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  RCT and  Pre-post assessment | Cesarean reduction intervention:  Computer assistance in evaluation of labor progress. Output given to providers in the intervention group of the RCT displayed individual  labor curve plotted with addition of reference ranges (95th, 50th, and 5th percentile) that take into account contraction frequency, parity, and epidural use.  Groups:  **G1:** Intervention  **G2:** Control  N at randomization:  G1: 2,478  G2: 2,515 | Inclusion criteria:   * Nulliparous   Exclusion criteria:   * See inclusion criteria | Births, n:  Baseline period:  Total: 5,753 Evaluation period:  Total: 4,993 (RCT participants)  **Parous, %:** Primaparous:  **Total:** 100  **Medicaid:** NR  **Private insurance coverage:** NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, n (%):** Evaluation period: **G1:** 2,038 (82.3) **G2:** 2,089 (83.1) **G1/G2:** *P* = 0.53  **Vaginal, assisted:** NR  Cesarean birth, n (%):  Evaluation period:  G1: 436 (17.6)  G2: 425 (16.9)  G1/G2: *P* = 0.53  Cesarean rates, eligible women at all hospitals, n (%):  Baseline period: Total: 1,124/5,753 (19.5)  Evaluation period, 6th month: Total: 551/3,234 (17.0) EP/BL: *P* = 0.004  Evaluation period, 12th month:  Total: 923/5,554 (16.6)  EP/BL: *P* = 0.0006  **Maternal outcomes**  **Maternal mortality:** NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar score, 5 minutes, n (%):** Evaluation period:  0-2: **G1:** 7 (0.3) **G2:** 8 (0.3) 3-4: **G1:** 5 (0.2) **G2:** 4 (0.2) 5-6: **G1:** 37 (1.5) |
| Hamilton et al., 2004 (continued) |  |  |  |  | **G2:** 35 (1.4) 7-8:  **G1:** 186 (7.5) **G2:** 201 (8.0) 9-10: **G1:** 2,239 (90.5) **G2:** 2,261 (90.1)  **NICU admission:** NR |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Iglesias et al., 1991  Country:  Canada  System:  Hinton General Hospital, Alberta  (44 bed community hospital)  Baseline period:  01/1985  Evaluation period:  01/01/1985 to 12/31/1989  Funding:  Hinton General Hospital, George Cedric Metcalf Charitable Foundation  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Guidelines from National Consensus Conference on Aspects of Cesarean Birth (NCCACB) for VBAC, manage-ment of breech presentation and diagnosis of dystocia requiring cesarean introduced at hospital in 1985.  Cesarean section rate discussed annually at grand rounds. Consultation mandatory before primary cesarean section but not before a repeat section. | Inclusion criteria:   * All births at the hospital from 01/01/1985-12/31/1989   Exclusion criteria:   * See inclusion criteria | Births, n:  Nulliparous:  1985: 237  1986: 227  1987: 218  1988: 237  1989: 242  Parous, n (%):  Nulliparous:  1985: 102 (43.0)  1986: 91 (40.1)  1987: 90 (41.3)  1988: 84 (35.4)  1989: 89 (36.8)  **Medicaid:**  Not applicable  **Private insurance coverage:**  NR  Prior cesarean, n (%):1  1985: 27 (11.3)  1986: 28 (12.3)  1987: 24 (11.0)  1988: 25 10.5)  1989: 33 (13.6) | Total providers/ staff:2  Total: 12  (4 performed cesareans)  Total providers/ staff formally trained:  NR  **Specialty:**  Family physicians that all practice obstetrics, and several that are trained in anesthesia and surgery | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean birth, n (%):  Total: 1985: 55 (23)  1986: 43 (19)  1987: 38 (17)  1988: 37 (16)  1989: 31 (13)  EP/BL: *P* = 0.001  Nulliparous: 1985: 23 (23)  1986: 19 (21)  1987: 21 (23)  1988: 14 (17)  1989: 11 (12) EP/BL: *P* = 0.0693  **Maternal outcomes**  **Maternal mortality n:**  **Total:** 0  **Neonatal outcomes**  **Neonatal mortality, n (%):**  **Total:** 1 (0.09)  **Apgar score:**  NR  Neonatal transfer, n:  Total: 1985: 3 (1.3)  1986: 5 (2.2)  1987: 4 (1.8)  1988: 6 (2.5)  1989: 2 (0.8) |

1 Includes only the women who were eligible for VBAC.

2 Medical staff started with nine physicians. During the study period two physicians left and three joined the staff.

3 The decreased cesarean rate for nulliparous women was due to a drop in the number that were dystocia-related.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Kazandjian and Lied, 1998  Country:  US, Canada, UK, and Japan  System:  Maryland’s Quality Indicator (QI) Project member hospitals  S1: 110 hospitals (continuously reporting)  S2: 957 hospitals (non-continuous reporting)  Baseline period:  1991  Evaluation period:  1992 to 1996  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  QI Project: continuous reporting of total, primary, and repeat cesarean section rates. | Inclusion criteria:   * Hospitals participating in the QI Project * Continuous reporting of cesarean measures for 24 quarters of 6 years   **Exclusion criteria:**   * Joining QI Project late in the evaluation period * Failure to report cesarean measures continuously | Births per year, most recent fiscal year, mean ± SD:  S1: 1,427 ± 1,287  S2: 1,238 ± 1,311  S1/S2: *P* = 0.16  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous**:  NR  Vaginal, assisted:  NR  Cesarean birth, mean % ± SD:  Total: 1991:  S1: 22.5 ± 7.1  S2: 21.2 ± 7.8  1992:  S1: 21.7 ± 6.0  S2: 21.2 ± 7.4  1993:  S1: 20.9 ± 6.0  S2: 21.3 ± 7.4  1994:  S1: 20.0 ± 5.5  S2: 21.2 ± 6.7  1995:  S1: 19.3 ± 5.4  S2: 21.0 ± 6.9  1996:  S1: 19.4 ± 5.2  S2: 20.7 ± 6.6  ANOVA: Year  S1: *P* < 0.001  S2: *P* = NS  Primary: 1991:  S1: 15.8 ± 6.2  S2: 15 ± 7.2  1992:  S1: 15.3 ± 4.8  S2: 15.1 ± 6.6  1993:  S1: 14.6 ± 4.9  S2: 15.1 ± 6.7  1994:  S1: 14.2 ± 4.4  S2: 14.7 ± 5.5  1995:  S1: 14.1 ± 5.9  S2: 14.8 ± 5.7  1996:  S1: 13.9 ± 4.2  S2: 14.6 ± 5.5  ANOVA: Year  S1: *P* < 0.001  S2: *P* = NS |
| Kazandjian and Lied, 1998 (continued) |  |  |  |  | Maternal  **outcomes Maternal mortality:**  NR  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:** NR  NICU admission: NR |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Kiwanuka and Moore, 1993  Country:  UK  System:  Central Manchester Health District  **S1:** Saint Mary’s Hospital  **S2:** Other hospital in district or home confinement  Baseline period:  1982  Evaluation period:  1986  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Audit and feedback of specific information, imparted in a non-directive way to resident obstetricians at Saint Mary’s Hospital responsible for performing cesarean sections. | Inclusion criteria:   * Women resident in the Central Manchester Health District who delivered in 1986   Exclusion criteria:   * See inclusion criteria | Births per year, n:  1982:  Total: 1,895  1986:  S1: 1,881  S2: 327  Total: 2,216  **Parous, n:** Primigravidas at term:  1986: **S1:** 703  **S2:** 219  **Medicaid:**  Not applicable  **Private insurance coverage:**  Not applicable  Prior cesarean, n:  1986: 128 | Total providers/ staff:  Resident obstetricians  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth  Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean birth, n (%):  1982:  Total: 302 (15.9)  1986:  S1: 230 (12.2)  S2: 51 (15.6)  Total: 281 (12.7)  EP/BL: *P* < 0.005  Primagravidas at term:  1986:  S1: 82 (11.7)  S2: 19 (14.7)  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar scores:** NR  **NICU admissions:** NR |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Lagrew and Morgan, 1996  Country:  US  System: Saddleback Memorial Medical Center  Baseline period:  Evaluation began in 1988  Evaluation period:  05/15/1988 to 06/30/1994  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post analysis | Cesarean reduction intervention:  Clinic guideline changes including oxytocin administration for induction and augmentation of labor, cervical ripening protocols, education of nursing staff in active labor management and evaluation of fetal monitoring. Prenatal VBAC class. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  1988: 7051  1989: 1,600  1990: 2,254  1991: 2,273  1992: 2,248  1993: 1,934  1994: 1,0051  Age, n (%): ≤ 19 years:  1998: 16 (2.3)  1989: 51 (3.2)\*  1990: 83 (3.5)\*  1991: 88 (3.9)\*  1992: 67 (3.0)\*  1993: 61 (3.1)\*  1994: 50 (4.9)  ≥ 35 years:  1998: 103 (14.6)  1989: 251 (15.7)\*  1990: 346 (14.7)\*  1991: 353 (15.5)\*  1992: 367 (16.3)\*  1993: 277 (14.3)\*  1994: 162 (16.1)  Nulliparous,n (%):  1998: 328 (46.6)  1989: 778 (48.6)\*  1990: 1,186 (50)\*  1991: 1,111 (48.9)\*\*  1992: 1,048 (46.6)\*\*  1993: 961 (49.7)\*  1994: 485 (48.3)  **Medicaid:**  Low incidence of Medicaid deliveries  **Private insurance coverage:**  NR  Multiple gestations, n (%):  1988: 11 (1.6)  1989: 26 (1.6)\*  1990: 38 (1.6)\*  1991: 39 (1.7)\*  1992: 47 (2.1)\* | Total providers/ staff:  NR  Total providers/ staff formally trained:  Nurses Physicians  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  Vaginal, assisted: NR  Cesarean birth, %:  Total:  1988: 31.1  1989-1993: NR\*\*  1994: 15.4  EP/BL: *P* < 0.000001  Primary:  1988: 17.9  1989-1993: NR\*\*  1994: 9.8  EP/BL: *P* < 0.000001  Repeat:  1988: 13.2  1989-1993: NR\*\*  1994: 5.7  EP/BL: *P* < 0.000001  Nulliparous:  1988: 28.1  1989-1993: NR\*\*  1994: 16.9  EP/BL: *P* < 0.00001  **Maternal outcomes  Maternal mortality:**  NR  **Neonatal outcomes**  Neonatal mortality, deaths per 1000 live births, n (%):  1988: 3 (4.26)  1989: 1 (0.63)  1990: 3 (1.34)  1991: 5 (2.20)  1992: 6 (2.67)  1993: 4 (2.07)  1994: 2 (2.0)  Apgar score < 7, 5 minutes, n:  1988: 15 (2.1)  1989: 27 (1.7)\* |
| Lagrew and Morgan, 1996 (continued) |  |  | 1993: 34 (2.3)\* 1994: 15 (1.5) |  | 1990: 53 (2.3)\* 1991: 37 (1.6)\* 1992: 46 (2.1)\*  1993: 48 (2.5)\*  1994: 21 (2.1)  NICU admission: NR  Stillbirths, n (%):  (deaths per 1000 births) > 500 gm:  1988: 2 (1.42)  1989: 2 (1.25)  1990: 9 (3.11)  1991: 3 (1.32)  1992: 5 (1.78)  1993: 6 (2.07)  1994: 6 (2.99) |

\* Calculated by reviewer.

\*\* Results only displayed graphically.

1 The evaluation period included 7.5 months in 1988 and 6 months in 1994.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Liang et al, 2004  Country:  Taiwan  System:  Taipei Veterans General Hospital1  Baseline period: 1993 to 1996  Evaluation period:  1997 to 2000  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Established a cesarean surveillance system, held weekly departmental cesarean indication conferences to review data for all cesarean sections. Required second opinion from consultant obstetrician for all cesarean sections. Physician’s section rates presented at conference.  Guidelines for dystocia, fetal distress and breech were unchanged from 1993-2000. | Inclusion criteria:   * One low transverse uterine scar * Singleton pregnancy * Vertex presentation * No medical or surgical illness * Patient consent   Exclusion criteria:   * No food or drink was allowed until the baby was born | Births, n: Baseline period: 9,864  Evaluation period: 7,937  1997: 2,082 1998: 1,776 1999: 1,928 2000: 2,151  **Medicaid:**  NR  **Private insurance coverage:**  NR  Prior cesarean, n: Evaluation period: 1,169  1997: 328  1998: 280  1999: 264  2000: 297 | Total providers/ staff:  NR  Total providers/ staff formally trained:  2 board certified-obstetricians  **Specialty:**  Obstetrics Pediatricians | **Mode of birth  Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean births, n (%):2  Total:  Baseline period: 3,647 (37)  Evaluation period: 2,436 (30.7)  EP/BL: *P* < 0.001  Primary:  Baseline period: 2,099 (21.3)  Evaluation period: 1,412 (17.8)  EP/BL: *P* < 0.001  Repeat:  Baseline period: 1,548 (15.7)  Evaluation period: 1,024 (12.9)  EP/BL: *P* < 0.001  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar scores:** NR  **NICU admissions:** NR |

1 Authors also present data for the entire country.

2 Total, primary, and repeat cesarean rates are reported for each year from 1993 to 2000.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Maher et al., 1994  Country:  Australia  System:  Toowoomba Base Hospital  Baseline period:  1991 to 1992  Evaluation period:  1992 to 1993  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  In July 1992, active management of labor protocol and  systematically incorporating VBAC into the management of previous-cesarean patients in the resident service.  Rigorous peer review. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  Baseline period: 1,112 Evaluation period: 1,167  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, assisted: NR  Cesarean birth, n (%):  Total: Baseline period: 228 (20.6) Evaluation period: 129 (11.0)  EP/BL: OR = 0.48 (95% CI: 0.37-0.59), *P* < 0.0001  Elective: Baseline period: 107 (9.6) Evaluation period: 59 (5.0)  EP/BL: OR = 0.50 (95% CI: 0.34-0.66), *P* < 0.0001  Emergency: Baseline period: 121 (10.9) Evaluation period: 70 (6.0)  EP/BL: OR = 0.52 (95% CI: 0.36-0.68), *P* < 0.0001  **Maternal outcomes Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality, n (%):**  Baseline period:  5 (0.4) Evaluation period:  8 (0.7)  **Apgar score ≤ 7, 5 minutes, n:** Baseline period: 93 Evaluation period: 61 |
| Maher et al., 1994  (continued) |  |  |  |  | **NICU admissions:** NR  **Stillbirths, n (%):** Baseline period: 8 (0.7) Evaluation period: 8 (0.7) |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Main, 1999  Country:  US  System:  **S1:** Children’s Hospital of San Francisco (1980-1995)  S2:1 Pacific Presbyterian Medical Center; (control group from 1989-1992; intervention from 1992-1995)  Baseline period:  1980 to 1988  Evaluation period:  1989 to 1995  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Intensive outcomes feedback using a computerized information system. First 3 years: daily reports and coded group comparison statistics at depart-ment meetings. Those in worst quartile were bolded, and guidance provided on how to “be like” the best quartile.  Starting in 1993, “open label” feedback: intra-departmental release of everyone’s key statistics with names. Computer algorithm introduced to review the electronic portion of cesarean births records. Standardized nuliparous and multiparous cesarean birth rates reported to facilitate comparisons between individual providers. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births per year, 1980s, range:  S1: 3,200 to 3,600 S2: NR  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  Obstetrics | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean birth, %:  Baseline period:  Total:\* 23 to 25  1989:  S1: NR\*  S2: NR\*  1990:  S1: NR\*  S2: NR\*  1991:  S1: 20.7  S2: 25.1  1992:  S1: NR\*  S2: 24.6  1993:  S1: NR\*  S2: 20.3  1994:  Total: 18.3  1995:  Total: 18.1  Primary cesarean: Baseline period: S1: 15.6 to 16.9 S2: 15.2 to 17.8 Post evaluation:  Total: 13.6  Repeat cesarean: Baseline period: S1: 8.0 to 8.6 S2: 6.8 to 8.1 Post evaluation:  Total: 4.4  **Maternal outcomes Maternal mortality:**  NR  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:** NR |
| Main, 1999 (continued) |  |  |  |  | **NICU admissions:** NR |

1 In 1987, three groups of obstetricians left the Children’s Hospital of San Francisco and opened a new obstetric service at Pacific Presbyterian Medical Center. In 1993, the two hospitals rejoined with a single obstetric unit.

\*Data only presented graphically.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Myers and Gleicher, 1988  Myers and Gleicher, 1993†  Country:  US  System:  Mount Sinai Hospital Medical Center  Baseline period:  1985  Evaluation period:  1986-1987  1987-1991†  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Stringent implementation of existing departmental guidelines and implementation of new ones, including (1) a second opinion, (2) philosophy that vaginal delivery was preferred for those who had prior cesarean, (3) diagnosis of dystocia required no progress of labor with contractions of appropriate strength by intrauterine pressure catheter, (4) fetal distress, based on monitoring of the fetal heart rate, had to be corroborated by sampling of blood from the fetal scalp when feasible, (5) vaginal birth recommended for most breech fetuses, (6) comprehensive peer review of adherence to guidelines.  All attending physicians were informed of their personal cesarean rates at quarterly intervals, and were told whether they were within two SD of the departmental rate. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births per year, n:1  1985: 1,697  1986: 2,101  1987: 2,301  1988: 2,340†  1989: 2,688†  1990: 2,817†  1991: 3,218†  **Parous, n (%):**  Primigravidae:  1985: 399 (22.9)  1986: 606 (28.8)  1987: 683 (29.7)  1988: 761 (31.3)†  1989: 806 (29.9)†  1990: 785 (27.8)†  1991: 941 (29.2)†  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  Teaching service supervised by full-time faculty and private attending physicians  Total providers/ staff formally trained:  NR  **Specialty:**  Obstetricians and perinatology staff | **Mode of birth Vaginal, spontaneous, n (%):** 1985: 1,223 (72.1) 1986: 1,685 (80.2) 1987: 1,937 (82.1) **EP/BL:** *P* < 0.05  1988: 1,997 (82.1)† 1989: 2,262 (84.1)† 1990: 2,431 (84.8)† 1991: 2,756 (85.6)†  Vaginal, assisted, n (%):  1985: 177 (10.4)  1986: 154 (7.3)  1987: 99 (4.3)  EP/BL: *P* < 0.05  1988: 78 (3.1)†  1989: 73 (2.6)†  1990: 79 (2.7)†  1991: 76 (2.4)†  Cesarean birth, n (%):  Total:  1985: 297 (17.5)  1986: 262 (12.5)  1987: 265 (11.5) EP/BL: *P* < 0.05  1988: 298 (12.2)†  1989: 279 (10.3)†  1990: 293 (10.4)†  1991: 382 (11.9)†  Primary:  1985: 204 (12)  1986: 175 (8.3)  1987: 156 (6.8) EP/BL: *P* < 0.05  Repeat:  1985: 93 (5.5)  1986: 87 (4.1)  1987: 109 (4.7) EP/BL: *P* < 0.05  Cesarean birth, teaching staff, %:  1985: 15.0  1986: 11.0  1987: 11.7  EP/BL: *P* < 0.05 |
| Meyers and Gleicher, 1988  Meyers and Gleicher, 1993 (continued) |  |  |  |  | Cesarean birth, private staff, %:1985: 20.0  1986: 15.0  1987: 12.4  **EP/BL:** *P* < 0.05  **Maternal outcomes**  **Maternal mortality:**  A single maternal death occured in 1986  **Neonatal outcomes Neonatal mortality, n (%):2**  1985: 22 (12.8) 1986: 23 (10.7)  1987: 26 (11.2)  1988: 18 (10.7)† 1989: 29 (14.5)†  1990: 46 (16.0)†  1991: 29 (9.0)†  Apgar score, 5 minutes, n (%):  < 7:  1985: 50  1986: 82 (3.8)  1987: 116 (4.9)  1988: 70 (2.8)†  1989: 54 (1.9)†  1990: 62 (2.1)†  1991: 57 (1.7)†  < 3:  1985: NR  1986: 8 (0.5)  1987: 17 (0.7)  1988: 12 (0.4)†  1989: 10 (0.3)†  1990: 12 (0.4)†  1991: 13 (0.4)†  NICU admission: NR |

1 1985 data based on total deliveries; 1986 and 1987 data based on mothers giving birth

2 An analysis of birth weight specific neonatal mortality fails to demonstrate any statistical benefit from cesarean delivery.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Oleske et al., 1992  Country:  US  System:  Illinois hospitals  1986 to 1987: 198 hospitals  1988: 187 hospitals  Baseline period: 1985  Evaluation period:  1986 to 1988  Funding:  Partial from Illinois Health Care Cost Containment Council  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Illinois Health Care Cost Containment Council (IHCCCC) distributed information to patients and providers on average hospital charge, average length of stay and cesarean birth rate in each hospital. Over 50,000 informational brochures distributed annually. Also annual press releases to media on state-wide cesarean birth patterns. | Inclusion criteria:   * Non-federal, short-stay hospital deliveries in Illinois (from hospital discharge abstract form for uniform billing) * ICD9 codes 650-699, V27 or procedure codes 72-74 * Aged 10-50   Exclusion criteria:   * See inclusion criteria | Births per year, n: 1986: 130,249  1987: 147,257 1988: 167,654  **Age, mean yrs:**  1988: 26.4 | Total providers/ staff:  NR  Total providers/ staff formally trained:  Council of Teaching Hospitals member  **Specialty:**  NR | **Mode of birth  Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean birth, %: Baseline period: 21.2 Evaluation period: 22.4  EP/BL: *P* = NS  Cesarean birth rate by age, %: < 20:  1986: 16.6 1987: 17.7 1988: 17.3  20-24:  1986: 20.5 1987: 20.9 1988: 20.6  25-29:  1986: 23.0 1987: 23.9 1988: 22.5  30-34:  1986: 25.1 1987: 25.2 1988: 24.8  > 35:  1986: 27.7 1987: 28.8 1988: 28.7  Cesarean birth rate by expected primary payer, %: Medicaid:  1986: 20.6 1987: 20.9 1988: 20.6  Self-pay:  1986: 16.8 1987: 17.2 1988: 16.7  Commercial:  1986: 23.8 1987: 24.3 1988: 23.9 |
| Oleske et al., 1992 (continued) |  |  |  |  | HMO: 1986: 25.1 1987: 23.7 1988: 22.5  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar score:** NR  **NICU admissions:** NR |

Subgroup analysis showed that the cesarean rate declined for women with a history of uterine scar or dystocia (*P* < 0.05), and increased for breech or fetal distress (*P* < 0.05).

The VBAC rate increased by 58.4% from 10.1 to 16.0 during the study (*P* < 0.001).

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Poma, 1998  Country:  US  System:  Ravenswood Hospital (Loyola University affiliated community hospital)  Baseline period: 1991 to 1993  Evaluation period: 1994 to 1996  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Departmental goal of 15% total cesarean rate supported by case review of cesareans using ACOG guidelines with feedback to individual providers.  During this timeframe the departmental also implemented 24-hour in-hospital attending coverage. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  1991: 2,231  1992: 2,259  1993: 2,372  1994: 2,239  1995: 2,028  1996: 1,783  Age, n (%): < 15: Baseline period: 6 (0.1) Evaluation period:  12 (0.2)  15-19: Baseline period: 1,109 (16.2) Evaluation period: 983 (16.2)  20-35: Baseline period: 5,298 (77.2) Evaluation period 4,619 (76.4)  36-40: Baseline period: 402 (5.8) Evaluation period:  379 (6.3)  > 40:  Baseline period: 47 (0.7) Evaluation period:  57 (0.9)  Race/ethnicity, n (%): Hispanic: Baseline period: 3,430 (50.0) Evaluation period: 3,086 (51.0)  Parous, n (%): Baseline period: 4,770 (69.5) Evaluation period: 4,142 (68.5)  **Medicaid, n (%):**  Baseline period: 3,280 (47.8) Evaluation period: 2,638 (43.6) | Total providers/ staff: NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted, n (%):**  Forceps:1 Baseline period: 147 (2.1) Evaluation period:  104 (1.7)  Vacuum: Baseline period: 103 (1.5) Evaluation period: 212 (3.5)  EP/BL: *P* < 0.001  Cesarean, n (%):  Total: 1991: 518 (23.2)  1992: 492 (21.8)  1993: 535 (22.5)  1994: 460 (20.5)  1995: 379 (18.7)  1996: 285 (16)  EP/BL: *P* < 0.0012  Total cesarean, %:  Baseline period: 22.5  Evaluation period:  18.6  EP/BL: *P* = 0.001  Primary cesarean, %:  1991: 13.8  1992: 13.4  1993: 13.4  1994: 11.2  1995: 10.8  1996: 9.7  EP/BL: *P* < 0.0012  Baseline period: 13.5  Evaluation period:  10.6  EP/BL: *P* = 0.001  Repeat cesarean, %:  1991: 9.4  1992: 8.4  1993: 9.1 |
| Poma, 1998 (continued) |  |  | EP/BL: *P* = 0.0001  Private insurance coverage, n (%):  Baseline period: 1,277 (18.6) Evaluation period: 1,162 (19.2)  EP/BL: *P* = 0.016  **HMO, n (%):**  Baseline period: 1,866 (27.2) Evaluation period: 1,791 (29.6)EP/BL: *P* = 0.002  Prior cesarean, n (%): Baseline period: 617 (39.9) Evaluation period: 481 (42.8) |  | 1994: 9.3 1995: 7.9 1996: 6.3  EP/BL: *P* < 0.0012  Baseline period: 9.0  Evaluation period:  7.9  EP/BL: *P* = 0.03  **Maternal outcomes Maternal mortality:** NR  **Neonatal outcomes Neonatal mortality, n (%):** Baseline period: 25 (3.6)Evaluation period: 14 (2.3)  **Apgar score < 7, %:**  1 minute:  Baseline period: 4.3Evaluation period: 5.0  **EP/BL:** *P* = 0.08  5 minutes:  Baseline period: 1.5Evaluation period: 1.2 **EP/BL:** *P* = 0.12  **Neonatal admissions, n (%):** Baseline period: 106 (1.5)Evaluation period:85 (1.4) |

1 One mid-forceps delivery

2 First compared to last year

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Porreco, 1990  Country:  US  System:  Eight hospitals in the Denver metropolitan area  Baseline period: Intervention began in 1982  Earliest data: 1984  Evaluation period: 1986  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Five year community education strategy initiated in 1982 designed to reach:  physicians, nurses, and interested lay group with educational presentations about:  1) management of patients with prior cesarean;  2) diagnosis and management of fetal distress in labor,  3) indications and strategies for labor induction,  4) approach to failed progress in labor;  5) alternative management of breech and twin births;  6) increasing risk-free interval for women with genital herpes | Inclusion criteria:   * Hospitals with ≥ 1,500 births per year   Exclusion criteria:   * See inclusion criteria | Births, n:  1984: 22,624 1986: 23,642  **Medicaid:** NR  **Private insurance coverage:** NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR1  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted:**  NR  Cesarean, %:  Total:  1984: 17.3  1986: 19.3  Primary:  1984: 11.8  1986: 13.7  Repeat:  1984: 5.5  1986: 5.6  Maternal outcomes  **Maternal mortality:** NR  **Neonatal outcomes** **Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission:** NR |

1 30 presentations to physicians, 22 presentations to nurses and health professionals, and 15 presentations to community organizations.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Pridjian et al., 1991  Country:  US  System:  Chicago Lying-In Hospital  Baseline period:  1982  Evaluation period:  1983 to 1988  Funding:  Mother’s Aid Research Fund, Chicago Lying-In Hospital  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Systematically incorporating VBAC into the management of previous-cesarean patients in the resident service. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births per year, n:  1982: 2,827  1983: 3,009  1984: 2,919  1985: 2,612  1986: 2,555  1987: 2,840  1988: 3,049  Age ≥ 35 years, %:  1982: 5.6  1983: 5.7  1984: 5.3  1985: 6.2  1986: 6.3  1987: 5.6  1988: 6.4  Χ2: *P* = 0.515  Race/ethnicity, %: Black:  1982: 91.0  1983: 93.0  1984: 90.0  1985: 87.7  1986: 89.3  1987: 89.9  1988: 86.6  Χ2: *P* < 0.001  Parous, %:  Primaparous:  1982: 34.2  1983: 38.4  1984: 38.8  1985: 39.1  1986: 38.7  1987: 39.2  1988: 39.9  Χ2: *P* < 0.001  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  20 residents, 6 faculty members and 2 fellows  Total providers/ staff formally trained:  NR  **Specialty:**  Maternal-fetal medicine | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, operative, %:  1982: 15.7  1983: 14.5  1984: 14.7  1985: 13.1  1986: 14.2  1987: 11.9  1988: 10.2  Cesarean birth, %:  Total:  1982: 12.5  1983: 14.7  1984: 16.1  1985: 17.1  1986: 17.6  1987: 17.0  1988: 15.9  EP/BL: *P* < 0.001\*  Primary:  1982: 7.5  1983: 8.8  1984: 9.9  1985: 10.2  1986: 11.9  1987: 11.5  1988: 10.6  EP/BL: *P* < 0.001\*  Repeat:  1982: 5.0  1983: 5.9  1984: 6.2  1985: 6.9  1986: 5.7  1987: 5.5  1988: 5.3  EP/BL: *P* = 0.776\*  **Maternal outcomes Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar scores:**  NR |
| Pridjian et al., 1991 (continued) |  |  |  |  | **NICU admission:** NR |

\* Logistic regression, with year as the independent variable.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Robson et al., 1996  Country:  UK  System:  Pembury Hospital  Baseline period:  1984 to 1988  Evaluation period:  09/1989 to 08/1992  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Introduction and completion of the medical audit cycle. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  Baseline period:  12,628  Evaluation period:  8,497  Parous:  Nulliparous:  Baseline period:  5,622  Evaluation period:  3,585  Multiparous:  Baseline period:  7,006  Evaluation period:  4,912  **Medicaid:**  NR  **Private insurance coverage:**  NR  Multiple gestations, n: Baseline period: 157 Evaluation period: 127 | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous**:  NR  Vaginal, assisted:  NR  Cesarean birth, n (%):  Baseline period: 1,518 (12.0)  Evaluation period: 1810 (9.5)  Nulliparous:  Baseline period: 744 (13.2)  Evaluation period: 344 (9.6)  Multiparous:  Baseline period: 774 (11.0)  Evaluation period: 466 (9.5)  **Maternal outcomes Maternal mortality:**  NR  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:** NR  **Admission rate to special care baby unit, spontaneous-ly laboring nulli-parous women with singleton, cephalic, n (%):**  Baseline period: 169/3,977 (4.2)  Evaluation period: 88/2,589 (3.4) |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Rust et al., 1993  Country:  US  System:  93rd Strategic Hospital at Castle Air Force Base, California  Baseline period:  07/1987 to 06/1988  Evaluation period:  07/1988 to 06/1989  Funding:  NR  **Author industry relationship disclosure:** NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Implemented protocols including:  1) policy for VBAC, including counseling and encouraging trial of labor  2) policy for management of non-vertex presentation by external cephalic version  3) protocol to document an adequate trial of labor  4) established criteria for diagnosis and documentation of fetal distress | Inclusion criteria:   * Delivery after 24 weeks gestation   Exclusion criteria:   * See inclusion criteria | Births per year, n:  Baseline period: 472  Evaluation period:  430  Parous, n (%):  1985: 1309 (77.1)  1986: 1495 (71.2)  1987: 1618 (70.3)  **Medicaid:**  NR  **Private insurance coverage:** NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  **NR** | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted, n (%):**  Baseline period: 27 (5.8)  Evaluation period: 20 (4.7)  Cesarean birth, n (%):  Total: Baseline period: 99 (21.2)  Evaluation period: 44 (10.3)  EP/BL: *P* < 0.0001  Primary: Baseline period: 59 (12.5)\*  Evaluation period: 19 (4.4)\*  EP/BL: *P* < 0.0001  **Maternal outcomes:**  **Maternal mortality:**  NR  Postpartum hemorrhage, n (%): Baseline period: 10 (2.1) Evaluation period: 14 (3.3)  **Neonatal outcomes Neonatal mortality:** NR  **Apgar score:**  NR  **NICU admission:**  NR |

\* Calculated by reviewer.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Sanchez-Ramos et al., 1990  Country:  US  System:  University Medical Center, Jacksonville FL  Baseline period:  1986  Evaluation period:  1987 to 1989  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  New guidelines focused on intrapartum management of women with prior cesarean section.  New guidelines were also introduced for:   * Primary cesarean * Induction * Fetal scalp pH sampling * Breech * Twins | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  1986: 4,336  1987: 4,270  1988: 4,470  1989: 5,157  **Medicaid:**  NR  **Private insurance coverage:**  NR | Total providers/ staff:  Resident physicians and nurse midwives, supervised by faculty members  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:**  NR  Vaginal, assisted %:  1986: 16.2  1989: 18.5  Cesarean birth, n (%):  Total:  1986: 1,198 (27.5)  1987: 952 (22.4)  1988: 598 (13.3)  1989: 542 (10.5)  EP/BL: *P* < 0.0001  Primary:  1986: 849 (19.5)  1987: 643 (15.0)  1988: 424 (9.4)  1989: 374 (7.2)  EP/BL: *P* < 0.0001  Repeat:  1986: 349 (8.0)  1987: 319 (7.4)  1988: 174 (3.9)  1989: 168 (3.3)  EP/BL: *P* < 0.0001  Trial of labor, women with prior cesarean, n (%):  1986: 139 (31.7)  1987: 193 (41.9)  1988: 381 (76.5)  1989: 487 (83.9)  EP/BL: *P* < 0.0001  VBAC, women with prior cesarean, n (%):  1986: 90 (20.5)  1987: 142 (30.8)  1988: 342 (65.1)  1989: 403 (69.4)  EP/BL: *P* < 0.0001  **Maternal outcomes**  **Maternal mortality:**  NR |
| Sanchez-Ramos et al., 1990 (continued) |  |  |  |  | Neonatal outcomes Neonatal mortality, per 1000 births, n (%): 1986: 71 (16.4)  1987: 41 (9.6)  1988: 35 (7.8)  1989: 33 (6.4)  EP/BL: *P* < 0.001  Perinatal mortality rate per 1000 births: 1986: 31.8  1987: 19.7  1988: 17.4  1989: 14.9  EP/BL: *P* < 0.0001  Apgar score < 7, n (%):  1 minute:  1986: 457 (10.5)  1987: 357 (8.4)  1988: 476 (10.6)  1989: 571 (11.0)  5 minutes:  1986: 79 (1.8)  1987: 65 (1.5)  1988: 83 (1.9)  1989: 90 (1.7)  NICU admission, n (%):  1986: 447 (10.3)  1987: 420 (9.8)  1988: 432 (9.7)  1989: 453 (8.8)  NICU length of stay, days, mean:  1986: 19  1987: 15  1988: 15  1989: 16  Neonatal seizures, n (%):  1986: 108 (2.5)  1987: 120 (2.8)  1988: 116 (2.6)  1989: 114 (2.2) |

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Sloan et al., 2000  Country:  Ecuador  System:  Maternidad Isidro Ayora (public hospital serving lower to middle income women)1  **Baseline period:** 1995 to 04/1996  Evaluation period:  05/15/1996 to 12/15/1996  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Implemented policy requiring “second opinion” from supervising obstetrician or resident for all cesarean candidates (excluding mandatory situations).  Consultant obstetrician trained two senior physicians one of whom subsequently trained two more physicians.  Groups:  (among women for whom detailed data was collected2)  G1: Co-managed G2: Not co-managed Ga: Vaginal delivery Gb: Cesarean delivery | Inclusion criteria:   * Co-managed deliveries   Exclusion criteria:   * See inclusion criteria | Births, n: Evaluation period: Total: 7,381  G1: 1,217  G1a: 503  G1b: 714  G2: 367 G2a: 1 G2b: 366  **Age, mean ± SD:** Evaluation period:  **Total:** NR  **G1a:** 22.6 ± 6.1 **G1b:** 25.0 ± 6.3 **G2b:** 25.4 ± 5.7 **G1a/G1b:** *P* < 0.001  **G1a/G2b:** *P* < 0.001  **Parity, mean ± SD:**  Evaluation period:  **Total:** NR  **G1a:** 0.75 ± 1.21 **G1b:** 0.85 ± 1.25 **G2b:** 1.01 ± 1.06 **G1a/G2b:** *P* < 0.05  **Medicaid:**  NR  **Private insurance coverage:**  NR  Prior cesarean, %: Evaluation period:  Total: NR  G1a: 10.7 G1b: 29.3 G2b: 55.2  **G1a/G1b:** *P* < 0.001  **G1a/G2b:** *P* < 0.001  **G1b/G2b:** *P* < 0.001  Multiple gestations, %:  Evaluation period:  Total: NR  G1a: 0 | Total providers/ staff:  NR  Total providers/ staff formally trained:  Three trained obstetricians provided the mandatory second opinion during a six week period.  **Specialty:**  Obstetrics | **Mode of birth  Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean births, mean % ± SD:  Baseline period: 26.6 ± 4.4  Evaluation period: 22.1 ± 4.2  EP/BL: *P* < 0.001  **Maternal outcomes**  **Maternal mortality:**  NR  **Maternal postpartum infection/fever, %: G1a:** 1.0 **G1b:** 5.2 **G2b:** 4.6 **G1a/G1b:** *P* < 0.001  **G1a/G2b:** *P* < 0.001  **Neonatal outcomes  Neonatal mortality, %:  Total:** 24 **G1a:** 1.0 (n=501) **G1b:** 2.0 (n=712) **G2b:** 1.4 (n=363)  **Apgar score < 7, 5 minutes, %:** **G1a:** 1.4 (n=501) **G1b:** 2.5 (n=712) **G2b:** 2.5 (n=362)  **NICU admissions, %:** **G1a:** 10.4 (n=501) **G1b:** 20.8 (n=712) **G2b:** 18.2 (n=363) **G1a/G1b:** *P* < 0.001  **G1a/G2b:** *P* < 0.001  **Neonatal length of stay, mean days ± SD: G1a:** 3.37 ± 2.69  (n=499) |
| Sloan et al, 2000 (continued) |  |  | G1b: 0.4 G2b: 0 |  | **G1b:** 4.57 ± 3.39  (n=709) **G2b:** 4.68 ± 4.07  (n=360)  **Stillbirth, %: G1a:** 0.4 **G1b:** 0.3 **G2b:** 0.8 |

1 The paper also reports cesarean rates for other major maternity hospitals in Ecuador without the intervention.

2 2111 women were identified as candidates for cesarean sections. Data were not collected on 506 women for whom cesarean was considered mandatory, and on 21 women eligible for co-management but accidently not included.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Smith et al., 2000  Country:  US  System:  BryanLGH Medical Center, Lincoln, NE  Baseline period: 01/1998 to 06/1998  Evaluation period: 07/1998 to 01/1999  Post-evaluation period: 01/1999 to 03/1999  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Interdisciplinary team focused on educating nurses, physicians, and community about labor support measures.  Electronic data performance measurement system adopted as part of hospital quality improvement activities  Quality improve-ment team charged with decreasing total and primary cesarean rates  Feedback of individual cesarean data to physicians | Inclusion criteria:  NR  Exclusion criteria:  NR | Births:  NR  **Medicaid:** NR  **Private insurance coverage:** NR | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted:**  NR  Cesarean birth, %:\*  Baseline period: 27.0  Evaluation period: 19.0  Post-evaluation: 24.5  EP/BL: *P* = NR  Maternal outcomes  **Maternal mortality:** NR  **Neonatal outcomes  Neonatal mortality:** NR  **Apgar score:** NR  **NICU admission:** NR |

\* Quarterly total and primary cesarean birth rates only presented graphically.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Socol et al., 1993  Country:  US  System:  Northwestern Memorial Hospital  Baseline period: 1986  Evaluation period:  1987 to 19911  Funding:  NR  **Author industry relationship disclosure:**  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  1987 to 1988 vaginal birth after prior low transverse cesarean encour-aged; 1988 forward cesarean birth rate of each obstetrician circulated annually to attending obstetricians;  RCT of active management of labor completed and protocol recommended for routine practice. | Inclusion criteria:   * All providers and births included   Exclusion criteria:   * See inclusion criteria | Births, n:  1986: 4,240  1987: 4,219  1988: 4,271  1989: 4,391  1990: 4,829  1991: 4,669  Race/ethnicity, n (%):  White: 1986: 2,718 (64.1) 1987: 2,799 (66.3) 1988: 2,759 (64.6) 1989: 2,849 (64.9) 1990: 3,031 (62.8) 1991: 2,942 (63.0)  Black: 1986: 894 (21.1) 1987: 850 (20.2) 1988: 932 (21.8) 1989: 916 (20.9) 1990: 1,009 (20.9) 1991: 888 (19.0)  Other:  1986: 628 (14.8) 1987: 570 (13.5) 1988: 580 (13.6) 1989: 626 (14.2) 1990: 789 (16.3) 1991: 839 (18.0)  Parous, n (%):  1986: 2,231 (52.6)  1987: 2,250 (53.3)  1988: 2,234 (52.3)  1989: 2,310 (52.6)  1990: 2,502 (51.8)  1991: 2,426 (52.0)  **Medicaid/ Indigent, n (%):**  1986: 1,330 (31.4)  1987: 1,269 (30.1)  1988: 1,235 (28.9)  1989: 1,356 (30.9)  1990: 1,446 (29.9)  1991: 1,305 (28.0)  **Private insurance coverage, n (%):**  1986: 2,910 (68.6)  1987: 2,950 (69.9)  1988: 3,036 (71.1)  1989: 3,035 (69.1)  1990: 3,383 (70.1) | Total providers/ staff:  Private practice and academic obstetricians attending on labor and delivery  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous:** NR  **Vaginal, assisted:**  NR  Cesarean birth, %:  Total:  1986: 27.3  1987-1990: NR\*  1991: 16.9  EP/BL: *P* < 0.0001  Primary:  1986: 18.2  1987-1990: NR\*  1991: 10.6  EP/BL: *P* < 0.0001  Repeat:  1986: 9.1  1987-1990: NR\*  1991: 6.4  EP/BL: *P* < 0.0001  **Maternal outcomes Maternal mortality:** NR  **Neonatal outcomes  Neonatal mortality, n (%):** 1986: 44 (1.0) 1987: 29 (0.7) 1988: 28 (0.6) 1989: 24 (0.5) 1990: 16 (0.3) 1991: 18 (0.4)  **Apgar score, 5 minutes, n (%):** ≤ 3: 1986: 20 (0.4) 1987: 23 (0.5) 1988: 18 (0.4) 1989: 21 (0.5) 1990: 19 (0.4) 1991: 15 (0.3) < 7: 1986: 98 (2.2) 1987: 107 (2.5) 1988: 93 (2.1) 1989: 73 (1.6) 1990: 75 (1.5) |
| Socol et al., 1993 (continued) |  |  | 1991: 3,364 (72.0) |  | 1991: 84 (1.8)  **NICU admission, n (%):** 1986: 441 (10.3) 1987: 373 (8.7) 1988: 417 (9.6) 1989: 497 (11.2)  1990: 454 (9.3) 1991: 457 (9.7) |

1 Data provided for all years, statistical comparisons between 1986 and 1991.

\* Results only displayed graphically.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Studnicki et al., 1997  Country:  US  System:  Florida  Baseline period: 1990 to 1992  Evaluation period:  1990 to 1993  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  State passed a law in 1991 requiring the Department of Health and Rehabilitative Services to adopt rules to establish practice parameters in provider hospitals. Provider hospitals (defined as having 30 or more births per year fully paid by state or federal funds) required to provide copies of guidelines to staff credentialed to perform cesarean section deliveries, establish peer review board to review cesareans, incorporate peer review into hospital quality assurance monitoring.  Guidelines comprised of fetal evaluation, definitions of labor and labor diagnosis. | Inclusion criteria:   * Medical discharge data DRG codes 370-375 obtained from nonfederal acute care hospitals in Florida   Exclusion criteria:   * See inclusion criteria | Births, n: 1990: 187,054 1991: 182,896 1992: 182,385 Baseline period: 552,335  1993: 183,291  **Medicaid:**  NR  **Private insurance coverage:**  NR  Prior cesarean, n (%):  1990: 22,064 (11.8) 1991: 21,655 (11.8) 1992: 22,938 (12.6)  Baseline period: 66,657 (12.1) 1993: 23,127 (12.6) | Total providers/ staff:  NR  Total providers/ staff formally trained:  Obstetricians  **Specialty:**  NR | **Mode of birth  Vaginal, spontaneous:**  NR  Vaginal, assisted:  NR  Cesarean births, n (%):1  Total:  1990: 49,543 (26.5) 1991: 46,176 (25.2) 1992: 45,793 (25.1) Baseline period: 141,512 (25.6)  1993: 44,082 (24.1)  Primary:  1990: 32,295 (17.3) 1991: 30,061 (16.4) 1992: 28,988 (15.9) Baseline period: 91,344 (16.5)  1993: 28,106 (15.3)  Repeat:  1990: 17,248 (9.2) 1991: 16,115 (8.8) 1992: 16,805 (9.2) Baseline period: 50,168 (9.1)  1993: 15,976 (8.7)  **Maternal outcomes**  **Maternal mortality:**  NR  **Neonatal outcomes  Neonatal mortality,** NR  **Apgar scores:** NR  **NICU admissions:** NR |

1 The authors report cesarean rates among all women, women with a prior cesarean, and women without a prior cesarean for each quarter in the study.

| **Evidence Table C2. Strategies to reduce cesarean birth—systems-level interventions (continued)** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **Study Description** | **Intervention & Population** | **Inclusion & Exclusion Criteria** | **Clinical Population** | **Provider**  **Population** | **Outcomes** |
| Author:  Tay et al., 1992  Country:  Singapore  System:  Singapore General Hospital  Baseline period:  1987  Evaluation period:  1988 to 1990  Funding:  NR  Author industry relationship disclosure:  NR  **Design:**  Pre-post assessment | Cesarean reduction intervention:  Critical review of indications for cesarean delivery.  Departmental audit of all cesareans. | Inclusion criteria:  NR  Exclusion criteria:  NR | Births, n:  1987: 3,156  1988: 4,658  1989: 3,823  1990: 5,238  Parous, %:  Primaparae:  1987: NR  1988: NR  1989: 52  1990: NR  **Medicaid:**  Not applicable  **Private insurance coverage:**  Not applicable | Total providers/ staff:  NR  Total providers/ staff formally trained:  NR  **Specialty:**  NR | **Mode of birth Vaginal, spontaneous, n (%):**  1987: 2,244 (71.1) 1988: 3,667 (78.7)  1989: 2,759 (72.2)  1990: 3,787 (72.5)  Vaginal, assisted, n (%):  1987: 525 (16.6)  1988: 473 (10.2)  1989: 634 (16.6)  1990: 835 (15.9)  Cesarean birth, n (%):  1987: 387 (12.3)  1988: 518 (11.1)  1989: 430 (11.2)  1990: 616 (11.7)  **Maternal outcomes Maternal mortality:**  NR  **Neonatal outcomes**  Perinatal mortality, rate per 1000 births: > 500 grams:  1987: 8.25  1988: 7.05  1989: 9.39  1990: 5.83  > 1000 grams:  1987: 7.58  1988: 5.77  1989: 6.25  1990: 4.89  Apgar scores: NR  NICU admission: NR |