

Perinatal Telehealth Services											
Title	Author(s)	Year	Source	Sample Size (N)	Sample Composition	Data Source	Independent Variable(s)	Dependent Variable(s)	Summary of Findings	Limitations to Causal Inference	Exclusion Criteria
Telehealth and patient satisfaction: A systematic review and narrative analysis	Kruse, C.S., Krowski, N., Rodriguez, B., Tran, L., Vela, J., & Brooks, M.	2017	<i>BMI Open</i>	44	Included articles that assessed telehealth and patient satisfaction and used a measure of effectiveness or efficiency, in English only.	Cumulative Index of Nursing and Allied Health Literature (CINAHL) via EBSCOhost and PubMed (MEDLINE)	• Use of telehealth	• Patient satisfaction, efficiency, effectiveness	• Found that telehealth can improve outcomes and save costs • Telehealth can decrease travel time, missed appointments, wait times, and readmissions	Not all of the studies included were RCTs; many of them had flaws such as small sample size or limited generalizability for other reasons.	
Telemedicine collaboration improves perinatal regionalization and lowers statewide infant mortality	Kim, E.W., Teague-Ross, T.J., Greenfield, W.W., Williams, D.K., Kuo, D., & Hall, R.W.	2013	<i>Journal of Perinatology</i>	767	5 hospitals in Arkansas that did not offer specialized newborn care.	Medicaid data, birth and death certificates	• Use of the Arkansas telemedicine collaboration	• Very low birthweight births in hospitals without a Neonatal Intensive Care Unit; infant mortality	• After the implementation of the telemedicine collaboration, the percentage of VLBW neonates delivered in hospitals without a NICU decreased from 13.1% to 7.0%. Statewide infant mortality decreased from 8.5 to 7.0 per 1000 deliveries	Pre-post design.	
Randomized comparison of a reduced-visit prenatal care model enhanced with remote monitoring	Butler Tobah, Y., LeBlanc, A., Branda, M., Inselman, J., Morris, M., Ridgeway, J., Finnie, D., Theiler, R., Torbenson, V., Brodrick, E., Meylor de Mooij, M., Gostout, B., & Famuyide, A.	2019	<i>American Journal of Obstetrics and Gynecology</i>	300	Low-risk pregnant women ages 18 to 36, at <13 weeks of gestation, recruited from an outpatient obstetric tertiary academic center in the Midwest US.	Patient satisfaction surveys, validated maternal stress scales, data on maternal and fetal clinical outcomes	• Use of OB Nest, a reduced-frequency prenatal care model enhanced with remote home monitoring devices and nursing support	• Satisfaction with care, perception of the quality of prenatal care, pregnancy-related stress, adherence to prenatal care guidelines	• Higher satisfaction with care, lower stress • No difference in perceived quality of care, or C-sections, preterm births, birthweight, or Apgar scores		
A comparison of patient satisfaction with telehealth and on-site consultations: A pilot study for prenatal genetic counseling	Abrams, D., & Geier, A.	2006	<i>Journal of Genetic Counseling</i>	80	Patients referred for prenatal genetic counseling because of advanced maternal age or other risk factors.	Patient satisfaction surveys	• Prenatal care delivered via videoconferencing or in-person	• Patient satisfaction	• For both the on-site and videoconferencing groups, satisfaction averaged between 4 and 5 on the Likert scale	Qualitative; small sample size.	
Telehealth interventions to improve obstetric and gynecologic health outcomes	DeNicola, N., Grossman, D., Marko, K., Sonalkar, S., Butler Tobah, Y., Ganju, N., Witkop, C., Henderson, J., & Butler, J.	2020	<i>Obstetrics and Gynecology</i>	47 (studies)	Studies published in English examining telehealth among countries high on the United Nations Human Development Index.	Data from individual studies (systematic review)	• Various telehealth interventions	• Smoking cessation, breastfeeding, management of diabetes during pregnancy, safety outcomes after medication abortion, continuation of oral contraception	• Outcomes and results varied depending on the study.	Not all studies were from the US. More of a literature review than a rigorous meta-analysis.	
Remote patient monitoring and telemedicine in neonatal and pediatric settings: Scoping literature review	Sasangohar, F., Davis, E., Kash, B., & Shah, S.	2018	<i>Journal of Medical Internet Research</i>	56 (studies)	Peer-reviewed studies published after January 1, 2008 related to telehealth in pediatric populations.	Data from individual studies (systematic review)	• Various telehealth interventions	• Outcomes varied by study	• Overall, the review found that there were limited applications of telemedicine in pediatric and neonatal settings, but they show promise.	Most studies were limited by small sample size.	
The use of and experiences with telelactation among rural breastfeeding mothers: Secondary analysis of a randomized controlled trial	Kapinos, K., Kotzias, V., Bogen, D., Ray, K., Demirci, J., Rigas, M., & Uscher-Pines, L.	2019	<i>Journal of Medical Internet Research</i>	94	Women were eligible if they were over 18, had an infant with gestational age of greater than 35 weeks, had initiated breastfeeding and planned to continue after hospital discharge.	Survey data and electronic medical records	• Characteristics of women who used telelactation services	• Use of telelactation services	• Participants who took advantage of the telelactation were more likely to be working at 12 weeks postpartum (descriptive relationship, not causal), were less likely to have prior breastfeeding experience, and were less likely to have breastfed exclusively prior to discharge from the hospital.	Looks at characteristics of those who took advantage of the intervention, not outcomes resulting from the intervention. Original RCT was "underpowered" according to the author.	
Telehealth with remote blood pressure monitoring for postpartum hypertension: A prospective single-cohort feasibility study	Hoppe, K., Williams, M., Thomas, N., Zella, J., Drewry, A., Kim, K., Havighurst, T., & Johnson, H.	2019	<i>Pregnancy Hypertension</i>	55	Women admitted to the labor and delivery unit of a Wisconsin academic hospital who were 18+, with one of the following hypertension-related diagnoses during pregnancy: chronic, gestational, pre-eclampsia, or eclampsia, or a new hypertension diagnosis postpartum.	A satisfaction questionnaire as well as blood pressure measurements and other vital statistics measured daily through the tablet and remote monitoring equipment provided	• Postpartum telehealth intervention for blood pressure management	• Recruitment and retention through 6 weeks postpartum, incidence of severe postpartum hypertension and/or need for blood pressure treatment after discharge, participant satisfaction, and 6-week hospital readmission	• The study found that 84% of those who responded to the satisfaction survey preferred telehealth to going to a hospital or clinic, 93% would recommend telehealth to other women, and 87% were "very" or "extremely" satisfied with the remote monitoring. They were able to eliminate hypertension-related hospital readmissions over 42 days postpartum.	Single clinical site, small sample size, not RCT.	
Neuroprotective Core Measure 2: Partnering with families - exploratory study on web-camera viewing of hospitalized infants and the effect on parental stress, anxiety, and bonding	Rhoads, S., Green, A., Mitchell, A., & Lynch, C.	2015	<i>Newborn and Infant Nursing Reviews</i>	42	Mothers and fathers with infants in the NICU	Parental Stressor Scale: Neonatal Intensive Care Unit, State-Trait Anxiety Inventory-Subscale State, Mother-to-Infant Bonding Scale	• Web-camera monitoring in the NICU environment	• Stress, anxiety, and bonding between the parents and infants	• The results of the stress, anxiety, and bonding scores over time were not statistically significant. The open-ended questions revealed that parents would have rather been there in person with the infants, but they felt the telehealth intervention had an overall positive impact on stress and anxiety.	No control group, small sample size.	
The Continuing Antenatal Management Program (CAMP): Outpatient monitoring of high-risk pregnancies	Hughes, D.S., Ussery, D.J., Woodruff, D.L., Sandlin, A.T., Kinder, S.R., Magann, E.F.	2015	<i>Sexual and Reproductive Health Care</i>	426	High-risk OB patients with a diagnosis of preterm labor, fetal anomalies, hypertensive disorders, placental abruption and other conditions	Administrative and cost data through the CAMP program	• Outpatient monitoring of high-risk pregnancies	• Cost savings and any adverse events/patient safety	• There were no fetal losses or any events requiring emergency transport back to the hospital, and there was a savings of around \$21,000 per patient.	No control group, main outcome was cost.	
Improving perinatal regionalization for preterm deliveries in a Medicaid covered population: Initial impact of the Arkansas ANGELS intervention	Bronstein, J.M., Ounpraseuth, S., Jonkman, J., Lowery, C.L., Fletcher, D., Nugent, R.R., & Hall, R.W.	2011	<i>Health Services Research Journal</i>	5,150	Pregnant women covered by Medicaid in Arkansas who delivered infants between April 2001 and December 2006	Set of Medicaid claims for pregnancy linked to birth certificates for women covered by Medicaid in Arkansas who delivered infants between April 2001 and December 2006	• Impact of the ANGELS intervention (perinatal regionalization through telemedicine)	• Place of delivery for Medicaid-covered infants	• Overall, the study did not find an increased likelihood of delivery in any NICU setting, but did see a modest positive increase in the likelihood that a preterm delivery would occur in the university setting. The authors note that "the likelihood of delivery in any NICU setting did in fact increase over this time period, but this was due to changes in the population rather than to the program intervention" (p. 1099).	Not randomized, not a quasi-experimental design.	
Using an innovative telehealth model to support community providers who deliver perinatal HIV care	Ness, T., Annese, M., Martinez-Paz, N., Unruh, K., Scott, J., Wood, B.	2017	<i>AIDS Education and Prevention</i>	41	Perinatal HIV care providers	Qualitative survey data and case records	• Project ECHO intervention - a model in which health care providers in rural and under-resourced areas link to academic specialists through regular interactive distance videoconferences	• Prevention of mother-to-child HIV transmission	• All 13 of the cases reviewed had the successful outcome of prevention of mother-to-child HIV transmission.	Small sample size, descriptive/qualitative.	

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Are state telehealth policies associated with the use of telehealth services among underserved populations?	Park, J., Erikson, C., Han, X., Iyer, P.	2018	<i>Health Affairs</i>	22,294	Each survey wave included 2,000-3,500 respondents ages 18+ with oversampling of rural, uninsured, Medicaid, Black, Hispanic, and low-income populations in every other wave	Four years of data from a nationally-representative consumer survey	• State policies related to telehealth (focused on live video communication)	• Use of telehealth (in past 12 months) by underserved populations	• The study found no significant differences in use of live video telehealth based on state restrictiveness of policies. The study also found that telehealth was used less by Medicaid beneficiaries and low-income and rural populations, compared to the rest of the study population.	Logistic regression, no randomization.	
The effect of a newborn telehealth program on transfers avoided: A multiple baseline study	Albritton, J., Maddox, L., Dalto, J., Ridout, E., Minton, S.	2018	<i>Health Affairs</i>	44,643	Eight hospitals that had implemented neonatal telehealth in the period Nov. 2014 through Dec. 2015. Data were collected on infants born from Jan. 1, 2013 through Dec. 31, 2017.	Data from Intermountain Healthcare's electronic data warehouse	• Telehealth intervention for newborn health to reduce transfers from community hospitals to tertiary care centers	• Number of newborn transfers per facility-month	• The telehealth intervention was associated with a significant reduction in transfers; a reduction of 0.70 per facility-month. Overall, this translated to 67.2 fewer transfers per year across the 8 hospitals, leading to a predicted savings of \$1,220,352 per year.	There may have been other changes that coincided with the introduction of telehealth; not an RCT.	
A pregnancy and postpartum lifestyle intervention in women with gestational diabetes mellitus reduces diabetes risk factors	Ferrara, A., Hedderson, M., Albright, C., Ehrlich, S., Quesenberry, C., Peng, T., Feng, J., Ching, J., Crites, Y.	2011	<i>Diabetes Care</i>	197	Women with a diagnosis of gestational diabetes mellitus. Exclusion criteria included: age <18 years; multiple gestation; diagnosis of diabetic retinopathy; high-risk pregnancy (i.e., drug or alcohol abuse, chronic health problems, or pregnancy complications); thyroid diseases diagnosed in the last 30 days; and non-English speaker.	Measurements of height and weight at 4 clinic visits (blind measurements taken by research assistants), phone interviews	• Telephone intervention with the goal of helping women return to the pre-pregnancy weight, if it was normal, or a 5% reduction from pre-pregnancy weight if it was overweight. The intervention also included a lactation consultant and overall health counseling.	• Postpartum weight and breastfeeding	• The proportion of women who reached their postpartum weight goal was higher in the intervention condition but the difference was not statistically significant. However, among only those women who did not exceed the guidelines for gestational weight gain, there was a statistically significant difference favoring the intervention group. Treatment group showed a statistically significant decrease in dietary fat intake, a nonsignificant increase in physical activity, and a higher but not significantly higher likelihood of breastfeeding.		
A telehealth lifestyle intervention to reduce excess gestational weight gain in pregnant women with overweight or obesity (GLOW): A randomised, parallel-group, controlled trial	Ferrara, A., Hedderson, M., Brown, S., Ehrlich, S., Tsai, A., Feng, J., Galarce, M., Marcovina, S., Catalano, P., Quesenberry, C.	2020	<i>The Lancet Diabetes & Endocrinology</i>	394	5 antenatal clinics in California, women at 8-15 weeks gestation with singleton births, pre-pregnancy BMI of 25-40, and 18 or older.	Data on gestational weight gain and perinatal complications	• The intervention consisted of usual care plus 2 in-person and 11 telephone sessions regarding behavioral strategies to improve weight, diet, physical activity, and stress management. The control group received an antenatal visit at 7-10 weeks gestation, seven additional antenatal visits, and health education newsletters.	• Rate of excess gestational weight gain	• The intervention significantly reduced the weekly rate of gestational weight gain and reduced caloric intake and sedentary behaviors.		
Referral to telephonic nurse management improves outcomes in women with gestational diabetes	Ferrara, A., Hedderson, M., Ching, J., Kim, C., Peng, T., Crites, Y.	2012	<i>American Journal of Obstetrics and Gynecology</i>	11,435	Women with gestational diabetes at 12 Kaiser Permanente medical centers	Infant birthweight obtained from electronic medical records, postpartum screenings	• Telephonic nurse management program	• Risk of macrosomia (infant weighing over 4,500 grams at birth) or low birthweight (<2,500 grams) and postpartum glucose testing	• Women who delivered at centers with an annual referral rate of greater than 70% to the telephonic nurse management program were significantly less likely to have a macrosomic infant (not significant for likelihood of low birthweight) and more likely to have postpartum glucose testing.	Evaluated at center level rather than individual level; factors that may affect referral rates may not have been controlled for.	
Telemedicine in the management of pregnancy in Type 1 diabetic women	Frost, D., Beischer, W.	2000	<i>Diabetics Care</i>	21	Pregnant women with Type 1 diabetes	Time between visits, blood glucose levels	• Telemedicine system allowing patients to easily transmit their blood glucose values from home to a computer in the hospital's diabetes center. The patients performed blood glucose self-monitoring at least 4-6 times a day and usually transmitted their glucose values once a week. Compared to standard care during the same time period without the addition of telemedicine.	• Mean blood glucose and variation in glucose	• Statistically significant differences (in positive direction) for treatment group on mean blood glucose and variation in glucose. No significant difference in the number of instances of severe hypoglycemia.	Sample size too small.	
Impact of a telemedicine system with automated reminders on outcomes in women with gestational diabetes mellitus	Homko, C., Deeb, L., Rohrbacher, K., Mulla, W., Mastrogiannis, D., Gaughan, J., Santamore, W., Bove, A.	2012	<i>Diabetes Technology and Therapeutics</i>	80	Low-income pregnant women in urban settings who had gestational diabetes (in Tallahassee, FL, and Philadelphia, PA). Women had to be between the ages of 18 and 45 and had to be at 33 weeks of gestation or less at study entry. Singleton pregnancies only.	Data collection took place over 26 months - from Sept. 2007 to Nov. 2009. Data included self-reported blood glucose levels recorded in logbook format (control group) or by telemedicine transmissions (intervention group), as well as infant birthweight.	• Internet-based telemedicine system to allow interactive communication between patients and providers	• Infant birthweight and maternal glucose control	• There were no significant differences between the two groups (telemedicine vs. controls) in regard to maternal blood glucose values or infant birthweight.		
A multicenter randomized controlled trial of home uterine monitoring: Active versus sham device	The Collaborative Home Uterine Monitoring Study (CHUMS) Group	1995	<i>American Journal of Obstetrics and Gynecology</i>	842	Patients considered at high risk for preterm birth based on a list of risk factors	Uterine activity data obtained from home uterine activity monitoring	• Efficacy of a home uterine activity monitoring system for early detection of preterm labor and reduction of preterm birth	• Early detection of preterm labor and reduction of preterm birth	• Uterine activity data obtained from home uterine activity monitoring, when added to daily nursing contact, were not linked to earlier diagnosis of preterm labor or lower rates of preterm birth or neonatal morbidity in pregnancies at high risk for preterm labor and birth. The primary outcome measure was cervical dilatation and change in cervical dilatation.		Published prior to 2000.
A randomized multicenter trial assessing a home uterine activity monitoring device used in the absence of daily nursing contact	Wapner, R., Cotton, D., Artal, R., Librizzi, R., Ross, M.	1995	<i>American Journal of Obstetrics and Gynecology</i>	187	Pregnant women with a history of preterm delivery	Measurement of cervical dilatation at time of diagnosis of preterm labor	• An intervention involving prenatal care with twice-daily home uterine activity monitoring without daily nursing support	• Early detection of preterm labor - measured by cervical dilatation at time of diagnosis of preterm labor	• No significant differences found in preterm labor, but there was a positive significant difference for the treatment group for early detection of preterm labor		Published prior to 2000.
Multicenter randomized clinical trial of home uterine activity monitoring: Pregnancy outcomes for all women randomized	Corwin, M., Mou, S., Sunderji, S., Gall, S., How, H., Patel, V., Gray, M.	1996	<i>American Journal of Obstetrics and Gynecology</i>	339	Pregnant women at high risk for preterm labor and delivery	Data on the percentage of women who remained undelivered at each week of gestation for all women with singleton gestations	• An intervention involving prenatal care with twice-daily home uterine activity monitoring without daily nursing support	• Early detection of preterm labor, low birthweight, admission to NICU, length of pregnancy	• Women in the monitored group had prolonged pregnancy survival and were less likely to experience a preterm delivery. Infants born to monitored women with singleton gestations were less likely to be of low birthweight and were less likely to be admitted to a neonatal intensive care unit.		Published prior to 2000.
A randomized comparison of home uterine activity monitoring in the outpatient management of women treated for preterm labor	Brown, H., Britton, K., Brizendine, E., Hiett, A.K., Ingram, D., Turnquest, M., Golichowski, A., Abernathy, M.	1999	<i>American Journal of Obstetrics and Gynecology</i>	162	Women treated in the hospital with magnesium sulfate for preterm labor	Compliance data, readmissions, and cervical dilatation	• Home uterine activity monitoring	• Outcomes including rate of preterm delivery	• No significant differences between the groups in preterm delivery		Published prior to 2000.

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Effectiveness of SmartMoms, a novel eHealth intervention for management of gestational weight gain: an RCT pilot trial	Redman, L.M., Gilmore, L.A., Breaux, J., Thomas, J.M., Elkind-Hirsch, K., Stewart, T., Hsia, D.S., Burton, J., Apolzan, J.W., Cain, L.E., Altazan, A.D., Ragusa, S., Brady, H., Davis, A., Tilford, J.M., Sutton, E.F., Martin, C.K.	2017	<i>JMIR mHealth and uHealth</i>	54	Pregnant women ages 18-40 who were classified as overweight or obese	Clinical assessments that measured maternal weight, total gestational weight gain and gestational weight gain per week	• Lifestyle intervention (SmartMoms) delivered via mobile health or in-person to prevent women from exceeding the gestational weight gain guidelines during pregnancy, vs. no intervention at all (a total of 3 groups)	• Gestational weight gain	• A significantly smaller proportion of women exceeded the GWG guidelines in the intervention / SmartMoms group (in-person: 56%, remote: 58%) as compared to the control/no-intervention group (85%). The remote SmartMoms intervention was lower cost to participants (\$97 vs. \$347) and lower cost to clinics (\$215 vs. \$419 per participant) and had higher interventional adherence (76.5% vs. 60.8%) than the in-person SmartMoms group.	Small sample size.	
Randomized comparison of home uterine activity monitoring and routine care in patients discharged after treatment for preterm labor	Nagey, D.A., Bailey-Jones, C., Herman, A.A.	1993	<i>Obstetrics and Gynecology</i>	56	Women between 20-34 weeks gestation who had been treated successfully for preterm labor	Data on preterm birth	• Home uterine activity monitoring versus routine high-risk care	• Incidence of preterm birth	• No significant differences between the groups.		Published prior to 2000.
Does usage of an eHealth intervention reduce the risk of excessive gestational weight gain? Secondary analysis from a randomized controlled trial	Graham, M.L., Strawderman, M.S., Demment, M., Olson, C.M.	2017	<i>Journal of Medical Internet Research</i>	1,335	Pregnant women who met the following criteria: participants had to (1) consent at or before 20 weeks' gestation, (2) be available for a 24-month intervention, (3) plan to carry their pregnancy to term, (4) read and understand English, and (5) have an email address.	GWG data were obtained through an audit of the participants' prenatal, labor and delivery, and 6-week postpartum medical records. Total GWG was calculated as the difference between the first weight and the last weight in pregnancy.	• Online intervention: Weekly reminders to use the website and to highlight new content were emailed to participants in both treatment and control groups. In addition, intervention arm participants had access to the weight gain tracker and diet and physical activity goal-setting tools. Intervention participants were emailed weekly with reminders to use the weight gain tracker and diet and physical activity goal-setting tools.	• Gestational weight gain	• Overall null results, although there were some subgroup effects. For example, for higher-income women who consistently used the weight trackers, there was a reduction in gestational weight gain, but only for those with normal BMI to start.	Does not analyze results for treatment group compared to control group, but rather analyzes outcomes for high-users and low-users within each arm.	
Baby CareLink: Using the internet and telemedicine to improve care for high-risk infants	Gray, J.E., Safran, C., Davis, R., Pompilio-Weitzner, G., Stewart, J., Zaccagnini, L., Pursley, D.	2000	<i>Pediatrics</i>	56	Very low birthweight infants born between Nov. 1997 and April 1999. Families were excluded if internet was not available at their house or if the expected NICU stay was less than 14 days.	Picker Institute's Neonatal Intensive Care Unit Family Satisfaction survey was used to assess family perceptions of the quality of care.	• The treatment was the Baby CareLink telemedicine application. A computer and videoconferencing equipment were installed in the family's home within 3 weeks of birth. The control group received typical NICU care only.	• Quality of care measured through a family survey given after discharge, and the effect of Baby CareLink on hospital length of stay and family visitation and interactions with infant and staff	• The CareLink group reported higher overall quality of care and fewer problems with care. Frequency of family visits, telephone calls to the NICU, and holding of the infant did not differ between groups. Duration of hospitalization until discharge was similar between the groups. All infants in the CareLink group were discharged directly to their home, and 20% of control group infants were transferred to community hospitals before going home.	Small sample size.	
Home-based telemedicine for children with medical complexity	Notario, P., Gentile, E., Amidon, M., Angst, D., Lefaiver, C., Webster, K.	2019	<i>Telemedicine and e-Health</i>	24	Children age 1 month to 18 years, within a complex care program, and with at least one English-speaking parent. According to the study, "Children within the complex care program met the following criteria: three or more body systems requiring active management, technology dependent or full support to complete activities of daily living; and moderate to severe neuromotor or intellectual disabilities. Children were excluded if caregivers expressed their inability to comply with study requirements."	Administrative and survey data regarding clinic visits, hospitalization, satisfaction with care, etc.	• Use of an at-home mobile telehealth device that can capture and transmit ear, throat, skin images, heart rate, and temperature	• Primary outcomes were successful device connectivity and data transmission	• Overall, the study found high feasibility of the device and high satisfaction among patients		Feasibility study; not an outcomes study.
Utilization of outpatient telehealth services in parity and nonparity states 2010–2015	Harvey, J., Valenta, S., Simpson, K., Lyles, M., McElligott, J.	2019	<i>Telemedicine and e-Health</i>	Examined 7,478,472 in-person and 36,663 telehealth claims.	State telehealth parity laws from 2010-2015	Nationally representative sample of patient data from the 2010-2015 Truven® MarketScan Commercial Claims dataset	• Whether a state has legislation requiring private insurance companies to provide reimbursement for telehealth services (telehealth parity laws)	• Odds of receiving a telehealth visit in a parity state	• The study found that compared to a nonparity state, the odds of receiving a telehealth visit in a parity state were 29.8% greater.	Quasi-experimental rather than RCT.	Does not examine child/family outcomes.
Policy determinants affect telehealth implementation	Schmeida, M., McNeal, R., Mossberger, K.	2007	<i>Telemedicine and e-Health</i>	233	50 states, 29 medical practice areas	Telehealth Information Exchange database	• Various aspects of telehealth policy: state legislative professionalism, partisanship of state legislators, government resources, and severity of need	• The extent of telehealth implementation, as measured by a count of how many of the 29 medical practice areas in each state were using telehealth	• Legislative professionalism was positively and statistically significantly associated with telehealth implementation, physician rate was negatively associated, nurses were positively associated, Republican party control was negatively associated, gross state product was positively associated, percent urban was negatively associated, percent of households with internet access was positively associated, percent of population 65 and older was negatively associated with telehealth implementation.	Correlational.	Does not examine child/family outcomes.

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Telehealth among US hospitals: Several factors, including state reimbursement and licensure policies, influence adoption	Adler-Milstein, J., Kvedar, J., Bates, D.	2014	<i>Health Affairs</i>	2,891	Acute care, nonfederal hospitals in the US including DC that responded to the IT Supplement	National data from the Information Technology (IT) Supplement to the American Hospital Association (AHA) 2012 Annual Survey of Hospitals	• Factors associated with telehealth adoption among US hospitals (hospital-, market-, and state-level factors associated with telehealth adoption)	• Telehealth adoption in US hospitals	• Study found that 42 percent of the hospitals in the sample had adopted telehealth as of late 2012. Found no significant association between telehealth and a hospital's adoption of electronic health record systems. Hospitals with more high-tech infrastructure, as measured by whether a hospital had a cardiac ICU, were more likely to have adopted telehealth. Teaching hospitals were more likely to have telehealth.	Correlational.	Does not examine child/family outcomes.
Telehealth parent training in the Early Start Denver Model: Results from a randomized controlled study	Vismara, L., McCormick, C., Wagner, A., Monlux, K., Nadhan, A., Young, G.	2018	<i>Focus on Autism and other Developmental Disabilities</i>	24	Children between 18 and 48 months old, with a diagnosis of Autism Spectrum Disorder, with at least one parent fluent in English, and with internet access at home	Parent and child assessments: For the parents' program satisfaction, they used a 20-item, 6-point questionnaire. Trained observers also measured children's social communication behaviors during interaction with their parents and coded it.	• The intervention was a weekly 12-week 1.5 hour videoconferencing training for the parent-implemented Early Start Denver Model treatment, compared to monthly videoconferencing without the P-ESDM treatment and with the existing intervention program	• Group differences in parents' P-ESDM fidelity use, website usage, and program satisfaction followed by secondary changes in children's social communication skills as a result of parent implementation.	• P-ESDM parents reported significantly higher satisfaction and confidence. No significant effects on child outcomes except for higher rates of imitation.	Small sample size.	
Telephone peer counseling of breastfeeding among WIC participants: A randomized controlled trial	Reeder, J., Joyce, T., Sibley, K., Arnold, D., Altindag, O.	2014	<i>Pediatrics</i>	1,885	WIC clients recruited during pregnancy who intended to breastfeed or who were considering breastfeeding; all English or Spanish-speaking women attending a new pregnancy appointment for WIC between July 2005-July 2007 and who indicated they were planning to, or were undecided about, breastfeeding, were invited to participate. No exclusions by age, multiple births, or previous birth history.	Women reported to the WIC office their breastfeeding status at intervals of 1 month, and then 5, 9, 13, 18, 22, 26, 31, 35, 39, 43, 47, 52, and >52 weeks. Peer counselors kept detailed call logs of their calls with clients.	• A telephone peer counseling program aimed at increasing breastfeeding	• Breastfeeding initiation, duration, and exclusivity at 1, 3 and 6 months postpartum	• No association was found between the peer counseling and breastfeeding initiation among the whole sample or the language subgroups. However, the authors found that the intervention increased nonexclusive breastfeeding for at least 3 months among all women by 22%, representing an increase of 11.0 percentage points relative to a mean outcome of 59%. Increases were greater among Spanish-speakers. For increases in nonexclusive breastfeeding for at least 6 months, this was only found among Spanish speakers - an increase of 14 percentage points above the mean of 45%. Overall, the probability of exclusive breastfeeding for at least 3 months was 20% greater for Spanish speakers in the treatment group compared to their counterparts in the control group (8.0 percentage points).		
The effect of interactive Web-based monitoring on breastfeeding exclusivity, intensity, and duration in healthy, term infants after hospital discharge	Ahmed, A., Roumani, A., Suucs, K., Zhang, L., King, D.	2016	<i>Journal of Obstetric, Gynecologic, and Neonatal Nursing</i>	106	Mother-infant pairs in 3 midwestern hospitals; mothers had to read and speak English, be 18+ years old, have an intention to continue breastfeeding after discharge, no serious medical condition that prevents breastfeeding, access to and knowledge of email/internet. Infants had to be singleton full-term, without conditions that required NICU or that interfered with breastfeeding ability.	Data on breastfeeding was collected through follow-up forms and data on postpartum depression was collected through the Edinburgh Postpartum Depression Scale.	• The intervention arm was given access to an online, interactive breastfeeding monitoring system, and they were prompted to record breastfeeding and infant output data for 30 days. The control arm followed standard hospital protocol (this included breastfeeding support and education before discharge, one phone call within the first week after hospital discharge, and a list of community breastfeeding resources). Follow-up online surveys were sent to both groups at 1, 2, and 3 months.	• Primary outcomes: breastfeeding duration, exclusivity, and intensity. Secondary outcome: decreased symptoms of postpartum depression.	• The intervention group had higher exclusive breastfeeding rates at 1, 2, and 3 months. By the end of month 3, 84% of the intervention group was breastfeeding compared to 66% of the control group. Postpartum depression scores decreased for both groups at 1, 2, and 3 months, but there was no significant difference between the groups.		
Cost-benefit of a nursing telephone intervention to reduce preterm and low-birthweight births in an African American clinic population	Muender, M.M., Moore, M.L., Chen, G.J., Sevick, M.A.	2000	<i>Preventive Medicine</i>	1,554	Women enrolled in the study over a 5-year period beginning in 1990, between 22 and 32 weeks gestation. Intervention continued until 37 weeks. Two cohorts: the first cohort consisted of African-American women receiving care in a community public clinic, regardless of age or preterm labor risk status. The second cohort was White women and women of other ethnic groups, with a preterm labor risk score of 7+ on a risk assessment tool. Only singleton pregnancies were included.	Data were collected through a personal visit, a mailed assessment form, prenatal clinical records, and intrapartum and neonatal hospital records.	• Women in the intervention group received telephone calls from a registered nurse from the 24th through the 37th week of gestation. Calls occurred twice weekly and covered 3 main topics: assessment of health status (perception of uterine contraction and other pregnancy changes, number of meals eaten, number of cigarettes smoked, alcohol and drug use, and ingestion of prenatal vitamins), nursing recommendations based on the assessment, and discussion of any other issues the mother wanted to bring up.	• Occurrence of low birthweight and preterm births, as well as costs incurred by the intervention (telephone calls, home visits, operational expenses, and supervisor's time)	• No clinical benefits were found for White participants, but the intervention reduced preterm and low birthweight births, and resulted in cost savings, for African-American participants ages 19 and older. More specifically, the study revealed a 26% decrease in low birthweight rates between the intervention and control groups (p<0.048). African-American participants also saw a 27% reduction in preterm births. For those 19+, there was a 44% reduction in preterm births, and for women 18 or younger, there were no improvements in birth outcomes. Overall, at a cost savings of \$4,238 per preterm birth, there was an economic benefit of \$17,090 for preterm births after factoring in the cost of the intervention for all participants and the outcomes achieved. For low birthweight, there was an economic benefit of \$964.		
A randomized trial of a telecommunications network for pregnant women who use cocaine	Alemi, F., Stephens, R., Javalghi, R., Dyches, H., Butts, J., Ghadiri, A.	1996	<i>Medical Care, Journal of the American Public Health Association</i>	179	Pregnant women who had used cocaine during pregnancy or 1 month before pregnancy (as reported by the woman). Patients were enrolled during the prenatal period and followed for 6 months after the birth of a child.	Self-reported data on subjects' participation in drug treatment programs, addiction severity, and health status. Used General Health Survey to assess patients' overall health. Addiction Severity Index was used to measure patients' use of drugs.	• Intervention using touch-tone telephones that collected data on patients' drug use and offered other services via telephone, including conference calls, "care mail," and follow-up monitoring	• Alcohol and drug use, participation in formal treatment	• Both groups saw improvement and differences were not statistically significant. However, improvement was mediated by whether or not the participant took part in self-care meetings, which led to reduced drug use. Using the telehealth services themselves was not directly related to greater improvement. Dosage was important: experimental clients who used the service more than 3 times per week were 1.5 times more likely to show up for treatment and participated in 1.7 time more self-care meetings than experimental clients who used the services less than that.		Published prior to 2000.

Perinatal Telehealth Services											
Title	Author(s)	Year	Source	Sample Size (N)	Sample Composition	Data Source	Independent Variable(s)	Dependent Variable(s)	Summary of Findings	Limitations to Causal Inference	Exclusion Criteria
Computer-assisted cognitive behavioral therapy for pregnant women with major depressive disorder	Kim, R., Hantsoo, L., Thase, M., Sammel, M., Epperson, C.	2014	<i>Journal of Women's Health</i>	23	Women 18-49 years old, 10-32 weeks gestational age, with a DSM-IV diagnosis of major depressive disorder	Patient Attitudes and Expectations Scale, Beck Depression Inventory, Beck Anxiety Inventory, Hamilton Depression Rating Scale	• The computer-based intervention consisted of 8 sessions over 6-8 weeks (3.75 total hours of direct therapist contact)	• Changes in scales measuring depression and anxiety	• The women who initiated treatment showed significant improvement on most of the scales. The women who did not complete treatment reported a higher number of psychiatric hospitalizations than those who completed treatment	Small sample size.	
Comparing standard office-based follow-up with text-based remote monitoring in the management of postpartum hypertension: A randomised clinical trial	Hirshberg, A., Downes, K., Srinivas, S.	2018	<i>BMJ Quality and Safety</i>	206	Postpartum women with pregnancy-related hypertension diagnosed during the delivery admission between August 2016 and January 2017	Data collected through text messages and through a patient satisfaction survey via telephone	• The intervention consisted of 2 weeks of text-based blood pressure surveillance using a home blood pressure cuff and a previously-tested automated platform, compared to usual/control care, which was a blood pressure check at the patient's prenatal clinic 4-6 days following discharge.	• Primary outcome was a single recorded blood pressure in the first 10 days postpartum.	• The study found a statistically significant increase in the likelihood of obtaining a blood pressure reading in the texting group compared to the control group 10 days postpartum - 92.2% vs. 43.7%.		
Effectiveness of telemedicine in replacing in-person evaluation for acute childhood illness in office settings	McConnochie, K., Conners, G., Brayer, A., Goepp, J., Herendeen, N., Wood, N., Thomas, A., Ahn, D., Roghmann, K.	2006	<i>Telemedicine and e-Health</i>	492	Children presenting with an acute medical problem. Mean age of children was 5.6 years old.	Physicians collected clinical data on children's symptoms and visit completion	• First, all children were seen by the University of Rochester Medical Center's usual physician. Then, they were randomized to either be seen by a physician in person or a physician via telemedicine.	• Completion of visits	• Found that 85% of illness visits presenting to the pediatric practice were able to be successfully completed using a telemedicine model	Descriptive study.	
Telemedicine reduces absence resulting from illness in urban child care: Evaluation of an innovation	McConnochie, K., Wood, N., Kitzman, H., Herendeen, N., Roy, J., Roghmann, K.	2005	<i>Pediatrics</i>	693	Children at 5 child care centers in Rochester, New York, between January 1, 2001, and June 30, 2003. 66% of the children were covered by Medicaid.	Baseline data on absence due to illness (ADI) were collected for 18 weeks. Then, after the implementation of telemedicine, data came from detailed attendance records and staff and parent interviews.	• A telemedicine intervention involving real-time and store-and-forward information exchanges	• Rates of absence due to illness	• ADI during weeks with telemedicine (4.07 absences per 100 child-days) was less than half that during weeks without telemedicine (8.78 per 100). Authors found that a 63% reduction in ADI was attributable to telemedicine.	Pre-post design.	
Impact of telemedicine on hospital transport, length of stay, and medical outcomes in infants with suspected heart disease: A multicenter study.	Webb, C., Waugh, C., Grigsby, J., Busenbark, D., Berdusis, K., Sahn, D., Sable, C.	2013	<i>Journal of the American Society of Echocardiography</i>	674	Patients age <6 weeks with mild or no heart disease, matched by gestational age, weight, and diagnosis, who were referred with the diagnosis of "heart murmur" or "rule out congenital heart disease." Subjects born at hospitals with and without access to telemedicine constituted the study and control groups, respectively. Patients enrolled from July 1, 1999 to Dec. 31, 2001.	Data were collected at 3 time points - questionnaires in an electronic database.	• Whether a hospital where the infant was born had access to telemedicine	• Time to diagnosis, number of hospital transports, length of stay, and exposure to invasive treatments.	• Found that transport to a tertiary care center was lower for telemedicine group (4% vs. 10%), mean time to diagnosis was less (100 vs. 147 min.), mean length of stay was shorter (1.0 vs. 2.6 days), and length of ICU stay was shorter (0.96 vs 2.5 days).	Not an RCT (QED).	
Ambulatory uterine activity monitoring in the post-hospital care of patients with preterm labor	Iams, J.D., Johnson, F.F., O'Shaughnessy, R.W.	1990	<i>American Journal of Perinatology</i>	76	Pregnant women with singleton gestations who had been treated for preterm labor.	Subjects were contacted 5 times per week to report symptoms and frequency of contractions.	• One group received education and self-palpation, and the other group received education and an ambulatory monitor	• Rates of recurrent preterm labor and delivery	• No significant difference found between the groups		Published prior to 2000.
Weight-related SMS texts promoting appropriate pregnancy weight gain: A pilot study	Pollak, K., Alexander, S., Bennett, G., Lyna, P., Coffman, C., Bilheimer, A., Farrell, D., Bodner, M., Swamy, G., Ostbye, T.	2014	<i>Patient Education and Counseling</i>	23	Women recruited from prenatal clinics - 18+ years old, English-speaking, pre-pregnancy BMI of 25-40, 12-21 weeks pregnant, and had a cell phone plan with unlimited texting for 5 months.	Data regarding weight collected from women at baseline and 32 weeks gestation.	• A tailored SMS intervention (Preg CHAT) compared to a generic texting intervention (Txt4baby). Preg CHAT texts "provided personalized feedback based on women's intake of sweetened beverages, fruits and vegetables, fast food, daily steps taken, and weight."	• Weight gain during pregnancy.	• Although those in the Preg CHAT intervention had a mean gain of 6 lbs less than those in the Txt4baby group, the difference was not statistically significant.	Small sample size.	Text-based only.
Influenza vaccine text message reminders for urban, low-income pregnant women: A randomized controlled trial.	Stockwell, M.S., Westhoff, C., Kharbanda, E.O., Vargas, C.Y., Camargo, S., Vawdrey, D.K.	2014	<i>American Journal of Public Health</i>	1,187	Obstetric patients from 5 community-based clinics in New York City	Vaccination data	• Weekly text messages regarding influenza vaccinations and appointments, plus standard telephone reminders, compared to a control group who received telephone reminders only	• Likelihood of pre- and postpartum influenza vaccination	• Women who received the intervention were 30% more likely to be vaccinated, with the greatest effect for women in their third trimester.		Text-based only.
Improving influenza vaccination rates in pregnancy through text messaging: A randomized controlled trial	Moniz, M.H., Hasley, S., Meyn, L.A., Beigi, R.H.	2013	<i>Obstetrics and Gynecology</i>	204	Obstetric patients at less than 28 weeks of gestation recruited during 2010-11 and 2011-12.	Prenatal records review and surveys before and after the intervention.	• The intervention group received text messages regarding general preventive health in pregnancy plus messages about the importance of the flu vaccine. The control group received only text messages regarding general preventive health during pregnancy.	• Rate of flu vaccinations in each group	• The overall influenza vaccination rate was 32% overall, with no significant difference between the intervention and control arms (33% vs. 31% respectively). Participants in both groups overwhelmingly reported that they liked receiving the texts, found them helpful, and wanted to continue receiving texts regarding health care activities.		Text-based only.

Perinatal Telehealth Services											
Title	Author(s)	Year	Source	Sample Size (N)	Sample Composition	Data Source	Independent Variable(s)	Dependent Variable(s)	Summary of Findings	Limitations to Causal Inference	Exclusion Criteria
A randomized trial of text messaging for smoking cessation in pregnant women	Abrams, L., Johnson, P., Leavitt, L., Cleary, S., Bushar, J., Brandon, T.H., Chiang, S.	2017	<i>American Journal of Preventive Medicine</i>	497	Pregnant women already enrolled in the Text4baby program recruited between July 2015 and Feb. 2016 for the smoking cessation study	Women were surveyed at 1 month, 3 months, and 6 months post-enrollment and saliva samples were collected at 3 months for verifying smoking status.	• Quit4Baby text message program (1-8 messages per day) that was added to the Text4baby program that women were already enrolled in. Participants can respond to the texts to ask for further information, distractions to help curb cravings, etc.	• Smoking cessation in the perinatal period. Primary outcome was 7-day biochemically confirmed abstinence from smoking at 3-month follow-up.	• At 1 month and 3 months, there were significant differences in smoking cessation (favoring the intervention group) - at 1 month, 28.8% of the intervention group and 15.73% of the control group reported not smoking in the past 7 days. At 3 months, 35.2% and 22.67% of each group reported not smoking in the past 7 days. However, at 3 months, biochemical verification of smoking status showed no significant differences overall between groups. (15.6% vs. 10.9%, p=0.13).		Text-based only.
Initial outcomes from a 4-week follow-up study of the Text4baby program in the military women's population: Randomized controlled trial	Evans, W.D., Bihm, J.W., Szekely, D., Nielsen, P., Murray, E., Abrams, L., Snider, J.	2014	<i>Journal of Medical Internet Research</i>	943	Pregnant women, ages 18-45, both active duty and family members of servicepeople, first presenting for care at Madigan Army Medical Center in Tacoma, Washington from Dec. 2011 to Sept. 2013. Participants had to be in the first 14 weeks of gestation.	First, participants completed a 24-item online questionnaire using questions derived from validated instruments such as the Behavioral Risk Factor Surveillance Survey and the National Health and Nutritional Examination Survey.	• Participants were randomized to Text4baby plus usual care (intervention) or usual care alone (control). The Text4Baby intervention included messages that were tailored to the date of enrollment and the baby's gestational age.	• Changes in prenatal attitudes and beliefs towards taking prenatal vitamins, increased fruit and vegetable intake, visiting health care providers, and avoiding smoking and drinking. Secondly, changes in behaviors with regard to these habits.	• Although there were some improvements from baseline to follow-up in both groups, there were no statistically significant differences in health behaviors between the two groups at follow-up.		Text-based only.
Effect of modem transmission of blood glucose data on telephone consultation time, clinic work flow, and patient satisfaction for patients with gestational diabetes mellitus	Kruger, D., White, K., Galperin, A., Mann, K., Massiro, A., McLellan, M., Stevenson, J.	2005	<i>Journal of the American Academy of Nurse Practitioners</i>	72	Pregnant patients 18+ who were diagnosed with gestational diabetes and presented at the host clinic for care.	Patients performed blood glucose measurements five times daily, and they called the clinic first daily for two weeks, and then weekly for the remainder of the pregnancy.	• Both groups self-tested for blood glucose levels with an Accu-ChekComplete meter (Roche Diagnostics Corporation; Indianapolis, Indiana). The modem (intervention) group transmitted blood glucose data to the clinic via the Acculink Modem (Roche Diagnostics Corporation; Indianapolis, Indiana), and the control group transmitted blood glucose data to the clinic via telephone calls directly to clinic personnel.	• Communication time for the clinic to receive blood glucose data and the accuracy of the data	• There were no statistically significant differences found between the two groups on mean telephone consult time, length of clinic visit, or weeks of gestation. No differences in the accuracy of the blood glucose data either. However, qualitatively, patients and providers preferred the modem technology for efficiency.		
Dose and timing of text messages for increasing physical activity among pregnant women: A randomized controlled trial	Huberty, L., Buman, M., Leiferman, J., Bushar, J., Hekler, E., Adams, M.	2017	<i>Translational Behavioral Medicine</i>	80	Women who were 18+ years old, between 8 and 16 weeks pregnant, owned a mobile phone with SMS capability, had regular access to a computer, spoke English, and were not yet meeting the recommendations for physical activity during pregnancy (at least 150 min. per week of moderate intensity aerobic activity). Women were excluded if they were considered to have a high-risk pregnancy or had been counseled not to exercise by a physician.	Physical activity was measured using a FitBit device that each participant wore	• There were 4 arms in the study that participants could be randomized to: a) Standard (included only 2 texts regarding physical activity across entire pregnancy), b) Plus One (two texts regarding physical activity per week), c) Plus Six (six texts regarding physical activity per week at noon), and d) Plus Six Choice (six texts re. PA per week at a time of their choosing). For the purpose of the analysis, the latter 3 arms were considered the intervention and their data was pooled and compared to the standard arm.	• Physical activity during pregnancy	• The authors found "no increases in physical activity as a result of the SMS intervention, regardless of frequency or time of delivery" (p. 220). The authors explain that less than a third of similar studies have found any positive results, so this isn't an anomaly. They explain that there are many physiological barriers to physical activity during pregnancy that the texts could not address. They found that the participants who received the most texts actually saw the greatest decline in physical activity over the pregnancy, and they hypothesized that it may have been due to "reactance" - less activity due to feeling as if choices are taken away - or "habituation" - diminishing response with repeated stimulus.		