### ABSTRACT

More women are postponing pregnancy into the fourth and fifth decades of life for a variety of reasons. Advanced maternal age, traditionally defined as age more than 35 years, has been associated with increased obstetric morbidity and interventions. In addition, perinatal complications are reported to be higher in this patient population,.

#### Uterine Leiomyomata

Women of advanced maternal age have an increased frequency of uterine leiomyomata, which are independently associated with placental abruption, dysfunctional labor, fetal malpresentation, and cesarean delivery.[**[20](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620%22%20%5Cl%20%22R00001-20)**] [[**21**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-21)]

#### Multiple Gestation

The increased utilization of assisted reproductive techniques has resulted in an increased incidence of multiple gestation in this patient population.[[**22**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-22)] Between 1990 and 2001, the twin birth rate to women aged 40 to 44 years nearly doubled.[[**6**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-6)] Triplets born between 1975 and 1998 also increased in women ≥ 35 years from 6.4 to 28.6% and in those ≥ 40 years from 1.5 to 5.8% of all live births.[[**7**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-7)] Multiple gestation is associated with preeclampsia, antepartum and postpartum hemorrhage, preterm delivery, cesarean delivery, low infant birth weight, and increased maternal and perinatal mortality.[[**24**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-24)]

#### Congenital Anomalies

Pregnancy at ≥ 35 and ≥ 40 years of age is thought to add 1% and 2.5% respectively to the risk of nonchromosomal malformations compared with the baseline risk of 3.5% in women < 25 years of age.[[**32**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-32)] Those include cardiac defects (2 ×), clubfoot (3 ×), and diaphragmatic hernia (10.5 ×), spina bifida, cleft palate, syndactyly, limb defects, and male genital malformation.[[**32**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-32)] [[**33**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-33)] [[**34**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-34)] [[**35**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-35)] [[**36**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-36)] [[**37**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-37)] [[**38**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-38)] The National Center for Health Statistics found that older age was associated with increased risk of anomalies but chromosomal anomalies were not excluded.[[**39**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-39)] However, Baird et al found no age-specific increase in nonchromosomal birth defects but a linear decrease in the incidence of patent ductus arteriosus and pyloric stenosis and a bell-shaped curve distribution for congenital hip dislocation with a peak at age 30 years.[[**40**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-40)] Pradat found no increased incidence for congenital heart defects in older mothers,[[**41**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-41)] and other studies suggested that young maternal age was a risk factor for gastroschisis[[**42**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-42)] [[**43**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-43)] [[**44**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-44)] and polydactyly.[[**45**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-45)] In contrast, Abudu et al showed no effect of age on these defects.[[**46**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-46)] The widespread screening for fetal defects in high-risk older women has resulted in fewer infants with congenital anomalies born to these women in recent years.[[**47**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-47)] Thus, one potential explanation for increased malformations in older women is ascertainment bias.[[**32**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-32)] Other explanations include genetic defects that manifest due to the accumulation over time of environmental exposures of gametes to increased oxidative stress.[[**48**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-48)] Oocytes from older women have increased mitochondrial numerical density, mitochondrial volume ratio, and mitochondrial profile area, suggesting subtle but generalized changes in oxidative phosphorylation capacity and contain mitochondrial DNA with “common deletions.”[[**49**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-49)] [[**50**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-50)] Such changes may cause phenotypic expressions in offspring as a 1000:1 ratio of maternal:paternal mitochondrial DNA is present in the zygote.[[**51**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-51)]

#### Hypertension and Preeclampsia

An important adaptation of pregnancy is the institution of a high-flow, low-resistance circulation. More specifically, mean arterial blood pressure decreases by ~5 to 10 mm Hg and cardiac output increases by ~35%, through a rise in stroke volume and heart rate.[[**52**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-52)] The direction of the normal hemodynamic changes in pregnancy seems to be opposite to that noted with aging, which makes adaptation to pregnancy more difficult due to gradual loss of compliance, decline in vascular responsiveness to endothelium-dependent vasodilators, loss of myocardial compliance, and less aortic flow during diastole.[[**53**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-53)]

Chronic hypertension is more common in older than in younger pregnant women[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] [[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] [[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)] [[**54**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-54)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**56**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-56)] [[**57**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-57)] [[**58**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-58)] [[**59**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-59)] and complicates up to 10 to 20% of such pregnancies.[[**60**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-60)] [[**61**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-61)] Gilbert et al found that chronic hypertension was increased fivefold in older nulliparas and ninefold in older multiparas compared with controls.[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] Women with preexisting hypertension are at an increased risk of preeclampsia, placental abruption, and intrauterine growth restriction.[[**11**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-11)] Most of the studies in the literature have reported an increased incidence of preeclampsia in both nulliparas and multiparas > 35 years of age,[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] [[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**62**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-62)] [[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] [[**64**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-64)] complicating ~17% of these pregnancies.[[**62**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-62)] [[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] Gilbert et al reported a 60% increased rate of preeclampsia in older nulliparas compared with control nulliparas and double the rate for older multiparas.[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] The risk of preeclampsia in a second pregnancy increased with maternal age (1.3-fold per 5 years of increased age) and with interval between first and second pregnancy (1.5-fold per 5 years of interval).[[**65**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-65)] On the other hand, the recent study by Cleary-Goldman et al, involving 36,056 patients who were enrolled into the FASTER trial, found that advancing maternal age was not associated with an increased risk for hypertensive complications of pregnancy such as gestational hypertension or preeclampsia.[[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)] Confounding variables including body mass index, race, education, marital status, smoking, preexisting medical condition, history of adverse pregnancy outcome, and use of assisted reproductive care were controlled for.[[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)]

#### Diabetes

Mothers of advanced age are more likely to have some form of diabetes compared with younger women.[[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**57**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-57)] [[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] [[**70**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-70)] Pancreatic B-cell function and insulin sensitivity fall with age,[[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] and up to 16% of women with advanced maternal age have an abnormal glucose tolerance test.[[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] In fact, advanced maternal age is one of the established risk factors for gestational diabetes[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] and for its recurrence in a subsequent pregnancy and is reported to be as high as 36.5%.[[**72**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-72)] This may be secondary to the relationship between aging and progressive vascular endothelial damage[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**73**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-73)] or partly due to the increasing prevalence of obesity with age, a condition associated with diminished insulin sensitivity.[[**11**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-11)] Tan and Tan found that primigravid women aged ≥ 35 years had a sixfold increased risk of developing gestational diabetes compared with their younger counterparts (16.2% versus 2.8%).[[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] Jacobsson et al showed a significantly increased risk of gestational diabetes for women 40 to 44 years (OR 3.43, 95% CI 3.04 to 3.86) and for those ≥ 40 years (OR 4.71, 95% CI 2.87 to 7.73).[[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] Gilbert et al found that gestational diabetes was increased dramatically (fourfold) in both older nulliparas and multiparas compared with controls, suggesting that maternal age, and not parity, might be responsible for the increase in this disease.[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] Similarly, Bianco et al[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] reported ORs for gestational diabetes in women ≥ 40 years of 2.7 (95% CI 1.9 to 3.7) in nulliparas and 3.8 (95% CI 2.7 to 5.4) for multiparas compared with mothers 20 to 29 years. Cleary-Goldman et al demonstrated similar findings in 6294 women aged 35 to 39 years (OR 1.6, 95% CI 1.5 to 2.1) and 1364 women > 40 years old (OR 2.4, 95% CI 1.9 to 3.1).[[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)] Diabetes with its complications including macrosomia, polyhydramnios, and preterm labor, and accelerated nonspecific atherosclerosis may contribute to the increased prevalence of preeclampsia, placental abruption, and fetal growth restriction with advanced maternal age.[[**11**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-11)]

#### Placental Abruption/Placenta Previa

Bleeding complications of pregnancy, namely placental abruption and placenta previa, are more frequent among older women with singleton and twin gestations.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)] [[**22**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-22)] [[**23**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-23)] [[**56**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-56)] [[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] [[**68**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-68)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] [[**73**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-73)]

Premature separation of the placenta is apparently related to the aging of uterine vessels and is also associated with chronic hypertensive disorders.[[**47**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-47)] Ananth et al found that rates of placental abruption increased by 23% for mothers aged 35 to 49 years, particularly for those with twin pregnancies.[[**74**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-74)] Joseph et al found that the ORs for abruption were 1.23 (95% CI 1.02 to 1.50), 1.39 (95% CI 1.12 to 1.73), 1.64 (95% CI 1.24 to 2.16), and 1.82 (95% CI 0.99 to 3.34) in women 25 to 29, 30 to 34, 35 to 39, ≥ 40 years compared with those 20 to 24 years.[[**75**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-75)] Salihu noted an association between abruption and age in a dose-dependent fashion.[[**22**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-22)] On a different note, Jolly et al could not find a higher rate of abruption with advanced maternal age,[[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] and Cleary-Goldman et al noted no higher rates of abruption and previa until after the age of 40.[[**13**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-13)] Although an increased incidence of placenta previa is related to higher parity, age-related progressive vascular endothelial damage has also been postulated as a contributing factor.

#### Preterm Labor and Delivery

Data reported on the relationship between maternal age and prematurity are conflicting; some provide evidence for a rise,[[**22**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-22)] [[**24**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-24)] [[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] and others for a fall with age.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**76**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-76)] [[**77**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-77)] [[**78**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-78)] It is not clear how the incidence relates to healthy elderly mothers. Behavioral factors and irregular antenatal visits when associated with advanced age may contribute to an increase in the risk of preterm delivery or small-for-gestational-age infants.[[**9**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-9)] [[**79**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-79)] Other contributing factors include hypertensive disorders, multiple gestation,[[**80**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-80)] and urinary tract infections.[[**81**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-81)] Tan and Tan found rates of premature labor of 16.2% in their study of 111 primigravidas > 35 years of age compared with 6.3% in the control group,[[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] a finding that was supported by Lehmann and Chism.[[**82**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-82)] Jacobsson et al also reported a significant increase in preterm birth < 37, < 34, and < 32 weeks of gestation.[[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] Delbaere et al compared primiparous women ≥ 35 years with those 25 to 29 years old.[[**83**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-83)] Even after adjusting for confounders, older women had a lower mean gestational age at delivery, similar preterm delivery rate at < 37 weeks, but more preterm delivery at < 32 weeks (OR 1.51, 95% CI 1.04 to 2.19) and at < 28 weeks (OR 1.97, 95% CI 1.06 to 3.67).[[**83**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-83)]

Growth Restriction

It has been suggested that delayed motherhood is associated with an increased proportion of babies < 2500 g.[[**1**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-1)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] [[**86**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-86)] This may be due to age-related changes in the uterine vasculature, poorer placental perfusion, or transplacental flux of nutrients.[[**87**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-87)] Nonetheless, when data are adjusted for confounding factors such as parity, education, early prenatal care, socioeconomic status, prepregnancy weight, weight gain during pregnancy, smoking, and maternal medical conditions, the differences in birth weight are no longer significant.[[**88**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-88)] [[**89**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-89)] On the other hand, Cnattingius et al postulated an association between advanced maternal age and growth restriction in mothers as young as the late 20s, which persisted after adjusting for confounding factors.[[**79**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-79)] Similarly, Salihu et al found that growth restriction was significantly higher in singleton pregnancies of women above 40 years.[[**22**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-22)]

#### Large for Gestational Age

On the other end of the spectrum, macrosomia is commonly associated with the offspring of older mothers, particularly of multiparas.[[**2**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-2)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] Associated predictors are maternal obesity and untreated or poor adherence to the management of gestational diabetes.[[**91**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-91)] Shmueli and Cullen suggested that increased maternal education, income, and better social status (factors associated with older mothers in affluent countries) contribute to increased birth weight and reduce the risk of low birth weight.[[**92**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-92)]

#### Fetal Malpresentation

Breech presentation is more common in mothers with advanced maternal age.[[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] Jolly et al noted an odds ratio (OR) of 1.72 (95% CI 1.50 to 1.98) for having a breech presentation in women > 40 years of age.[[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] Similarly Delbaere et al found a higher rate of abnormal presentation in women ≥ 35 years compared with those 25 to 29 years (OR 1.35, 95% CI 1.17 to 1.55).[[**83**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-83)] Dildy et al reported a breech presentation incidence of 11% in parturients > 45 years of age.[[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] Explanations brought forward for this increased incidence include uterine leiomyomata, underlying uterine anomalies leading to an unplanned delay in childbearing,[[**97**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-97)] multiple gestations, and the age-dependent fall in skeletal muscle mass including the muscles of the abdominal wall.[[**98**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-98)]

#### Dysfunctional Labor and Cesarean Delivery

Studies have consistently reported an increased risk of cesarean delivery with advancing maternal age.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] [[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] [[**75**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-75)] [[**83**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-83)] [[**99**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-99)] [[**100**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-100)] [[**101**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-101)] [[**102**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-102)] Age-related contributing factors include fetal distress, multiple gestation, nonvertex presentation, macrosomia, placenta previa, contracted pelvis, and repeat cesarean delivery.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] [[**59**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-59)] [[**97**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-97)] Among nulliparas more than 35 years of age, cesarean delivery rates of 21 to 52% have been reported.[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)] [[**54**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-54)] [[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] [[**97**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-97)] [[**103**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-103)] [[**104**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-104)] This increase is partly attributed to prelabor cesarean delivery, with the most common indications being prior myomectomy and malpresentation.[[**97**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-97)] Bianco et al suggested that the increase in cesarean delivery was common to both nulliparas (OR 3.1, 95% CI 2.6 to 3.7) and multiparas (OR 3.3, 95% CI 2.6 to 4.1) > 40 years of age compared with those 20 to 29 years.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] The incidence of cesarean delivery for dystocia also increases with age[[**2**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-2)] [[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] [[**54**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-54)] [[**55**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-55)] [[**56**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-56)] [[**62**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-62)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] [[**102**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-102)] and is at least twice as high among pregnant women > 35 years of age as among younger ones.[[**99**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-99)] [[**104**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-104)] [[**106**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-106)] The incidence of emergency cesarean delivery is also higher in women above 35 years of age.[[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] This may be due to an increased incidence of placental abruption, placenta previa, and preterm labor in these women.[[**114**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-114)] Patel et al, in a study involving 12,944 women, found that maternal age was independently associated with increased odds of cesarean delivery including all cesareans (OR 1.07, 95% CI 1.04 to 1.09), elective cesareans (OR 1.04, 95% CI 1.01 to 1.08), and emergency cesareans (OR 1.11, 95% CI 1.08 to 1.15) per year increase in maternal age.[[**115**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-115)] Induction of labor occurs more frequently with advancing maternal age.[[**5**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-5)] [[**54**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-54)] [[**63**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-63)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] [[**75**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-75)] [[**97**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-97)] [[**117**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-117)] Older women were also more likely to be induced for the indication of postdates once they passed 41 weeks of gestation (31.9%, 34.4%, 38.1%, and 50% in these age categories, respectively).[[**98**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-98)] Women ≥ 35 years of age are ~1.5 times more likely to have operative vaginal delivery.[[**67**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-67)] [[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)] Dulitzki et al, comparing women ≥ 44 years with those 20 to 29 years old and after controlling for confounding variables, found a significantly higher rate of operative delivery: 8.3% versus 3.2%.[[**12**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-12)] Gilbert et al, in a retrospective study based on 24,032 birth certificates and hospital discharge record data, found that nulliparas and multiparas ≥ 40 years old had significantly higher rates of operative vaginal deliveries compared with women 20 to 29 years.[[**4**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-4)]

### POSTPARTUM HEMORRHAGE

Bianco et al found that postpartum hemorrhage was significantly increased in older multiparas compared with younger controls.[**[5](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620%22%20%5Cl%20%22R00001-5)**]

### POSTPARTUM DEPRESSION

Postpartum depression is thought to be more prevalent among older mothers, particularly primiparas.[[**137**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-137)] Social factors and psychological distress/anxiety might contribute to the higher risk.[[**128**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-128)] [[**137**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-137)]

### BREAST-FEEDING

Older women are > 1.5 times more likely to breast-feed than younger women, reflecting more positive attitudes to breast-feeding in older women.[[**71**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-71)]

### MATERNAL MORTALITY

Maternal mortality rates increase with age at conception and the largest increase is noted in black women > 40 years of age.[[**62**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-62)] [[**139**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-139)] [[**140**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-140)] Rochat et al, after reviewing more than 5000 maternal deaths in the United States from 1968 through 1975, reported that mortality rates were four times higher among women 35 to 39 years of age than among those who were 20 to 24.[[**140**](https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0028-1085620#R00001-140)]