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Casino-based cash transfers and fertility among the Eastern Band of Cherokee Indians in North Carolina: A time-series analysis

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Abstract

Fertility decline remains a key concern among high-income countries. Prior research indicates that income supplementation through unconditional cash transfers (UCT) may correspond with increased fertility. We examine whether a casino-based UCT, in the form of *per capita* (percap) payments to members of the Eastern Band of Cherokee Indians (EBCI) corresponds with an acute increase in fertility. We use North Carolina vital statistics datasets from 1990 to 2006 and apply time-series analysis methods to examine the relation between specific months of percap payments (exposure) and monthly number of conceptions that result in live births (outcome) among the EBCI. We control for autocorrelation and monthly counts of births (arrayed by conception cohorts) among white women (ineligible for UCT receipt) in the study region. Results indicate an increase in conceptions that result in live births at 1 and 3 months after percap receipt among EBCI women aged ≥20 years (exposure month lag 1 coefficient = 1.74, $p = 0.03$; exposure month lag 3 coefficient = 1.60, $p = 0.04$). Exploratory analyses indicate that the observed fertility increase concentrates among primiparae EBCI women. We do not find any association between percap payment timing and births to EBCI women aged <20 years.

Keywords

unconditional cash transfer; Eastern Band of Cherokee Indians; fertility; quasi-experiment; time-series analysis

Introduction

Concerns about fertility decline in high income countries has led to calls for urgent remedial measures, particularly in regions exhibiting sustained sub-replacement fertility (Sobotka et al., 2019). In the US, the total fertility rate declined to sub-replacement levels following the 2008 recession and has not reverted to pre-recession trends (Schneider, 2015; Schneider & Hastings, 2015; The World Bank, 2019). Income constraints and economic uncertainty may partly explain this fertility decline (Becker, 1960; Blau & Robins, 1989; Brewster & Rindfuss, 2000; Seltzer, 2019). Economic uncertainty in particular may correspond with pessimistic views about the future that in turn may lead to birth postponement (Chiara L Comolli & Vignoli, 2021; Vignoli et al., 2020). Scholars argue that policies tailored towards increasing economic and financial security may elicit a positive fertility reaction in western economies (Chiara Ludovica Comolli, 2017).

Although the causes of fertility decline remain multifaceted and complex (Pampel, 2010), some scholars posit that augmenting non-wage household income may influence fertility decisions (Becker, 1960). This expectation aligns with inverse correlations observed between fertility and economic development (Pampel, 2010). Economic prosperity corresponds with higher wages, which increases the monetary value of time spent in labor market participation and may limit time investment in home-production, including childcare (Becker, 1960). Supplementation of non-wage income may offset foregone wages from time spent in caregiving, potentially reduce the opportunity cost of childcare and thus incentivize childbearing (Becker, 1960).

Examination of cash transfers that emulate universal basic income may offer evidence on whether guaranteed long-term non-wage income gains correspond with fertility change. Unconditional Cash Transfers (UCTs) and Conditional Cash Transfers (CCTs) have been widely utilized in low- and middle-income countries as incentive-based programs for poverty alleviation that target disadvantaged groups for cash receipt and income supplementation (Gentilini et al., 2014). CCTs usually require fulfilment of health or education-related conditions by beneficiaries (e.g. routine health check-ups, regular school attendance) for cash receipt (Doetinchem et al., 2008; Fiszbein & Schady, 2009). UCTs also target disadvantaged, low-income groups but do not impose conditionalities towards cash transfers (Hasdell, 2020; Haushofer & Shapiro, 2013). For this reason, UCTs approximate universal basic income programs better than do conditional cash or benefits transfer interventions (Hasdell, 2020; Yonzan et al., 2020). Owing to UCTs’ absence of conditionality fulfilment for cash receipt, self-selection bias presents as a smaller concern in their evaluation relative to CCTs (Millán et al., 2019).

Whereas several long-running social welfare programs align with the CCT framework in the US (Grogger & Bronars, 2001; Jagannathan & Camasso, 2003; Moffit, 1998), there exist relatively fewer UCTs that span sizeable populations over an extended period of time. We know of only two evaluations in the US that examined whether income gains from such programs affect fertility. Both these evaluations focus on the Alaska Permanent Fund (APF) - a universal income guarantee program for all residents in Alaska that began following oil production on Alaska’s North Slope in 1982 and has continued since (Cowan

& Douds, 2022; O'Brien & Olson, 1990; Yonzan et al., 2020). Yonzan et al. (2020) and Cowan & Douds (2022) independently examine the number of births to Alaska residents and find an increase in fertility following initiation of the APF among women ≥ 20 years old, but not among women <20 years of age). Yonzan et al. also examine birth spacing but do not find evidence of changes in interbirth interval length following APF dividend receipt. In addition to overall changes in fertility among Alaskan women, Cowan & Douds (2022) examine differential responses by socioeconomic status of APF recipients and find that higher magnitudes of annual APF dividends correspond with increased fertility among low-income women. These studies examine a large population over multiple time periods. However, the external validity of their findings (i.e. whether UCT-based income gains correspond with increased fertility) remains unclear owing to potentially unique attributes of Alaska that may not translate to other regions in the country.

We add to this emerging body of evidence by examining fertility responses to a different UCT in a relatively smaller, low-income population in North Carolina, US. Members of the Eastern Band of Cherokee Indians (EBCI) started receiving additional income from 1996 onwards (to present) following the development of new casinos on their reservation spanning three counties (Graham, Swain and Jackson) in western North Carolina (Costello et al., 2003; Ullmer, 2007). This income derives from casino revenue, fifty percent of which is shared with the EBCI community and disbursed to members through a per capita dividend program (*Indian Gaming Regulatory Act (IGRA).*, 1988).

Beginning in 1996, EBCI members with a high school (or equivalent) diploma, or above 21 years of age, started receiving the per capita dividends immediately. Cash transfers to EBCI children were accrued in trust funds until they either graduated high school or turned 21 years (Costello et al., 2003; Ullmer, 2007). This UCT or *per capita* payment, also referred to as 'percap', given in annual sums until 1998 and in biannual sums thereafter, is disbursed to all registered EBCI members and their offspring in the region (Ullmer, 2007). By contrast, individuals from other race/ethnicities (primarily white) residing in Graham, Swain and Jackson counties do not receive this cash transfer.

All eligible EBCI women received the percap after the casino opened, as well as every year thereafter. Supplement Figure 1 shows the magnitude of percap payments disbursed to EBCI members from 1995–2006. On average, an EBCI member who started receiving these payments from 1995 until 2006 would have accrued about $ 100,000 (in constant US Dollars) over the past 11 years, which represents substantial income augmentation through this unconditional cash transfer. By 2001, an EBCI woman who gave birth at age 23 (median age of women who gave birth in Graham, Swain and Jackson counties in North Carolina in 2001) would expect to have accrued, on average, approximately $15,000 in cumulative transfers from the casino (also see Ullmer 2007 for average payments per years from 1996 to 2007). Studies report a marked reduction in poverty, improved mental health, greater educational attainment and increased optimism about the future among the EBCI following the initiation of these casino-based percap payments (R. Akee et al., 2018; R. K. Q. Akee et al., 2010; Costello et al., 2010; Singh et al., 2020; Ullmer, 2007). Conversely, research also reports acute risk-prone responses to cash receipt from this UCT, in the form of increased accidental deaths among EBCI youth in the months of percap receipt (Bruckner et al., 2011).

Given these countervailing trends, it remains unclear whether this non-wage income receipt would increase or decrease fertility in this population (or have no effect).

In the present study, we examine whether and to what extent casino-based UCT payments correspond with acute changes in number of conceptions that result in live births to EBCI women. Prior research on fertility responses to UCTs in the US (1) does not account for temporal patterning, or autocorrelation, in fertility trends in the study population and (2) does not focus on immediate fertility response to cash receipt (Cowan & Douds, 2022; Yonzan et al., 2020). These limitations constrain direct attribution of increased fertility to UCTs for two key reasons. First, secular trends in fertility as well as correlation between past and future values (autocorrelation) may correspond with fertility change independent of exposure to cash transfers. Second, absent estimation of immediate or proximate responses, we cannot determine precise ‘induction periods’ wherein fertility decisions (if causally related to cash transfer) may exhibit perturbations within a short time span following UCT receipt (Catalano & Serxner, 1987).

We overcome these limitations by examining changes in conceptions that result in live births to EBCI women within 0 to 3 months of percap receipt through time-series analysis that accounts for autocorrelation and exploits the precise, month-specific timing of percap payments over a 17-year period, from 1990 to 2006. We control for births to non-EBCI white women in Graham, Swain and Jackson counties over the same time period to adjust for factors that may independently correspond with the patterning of fertility in this region (e.g., availability of healthcare facilities, macroeconomic changes). Our study augments prior research and contributes to current policy discourse on the relation between income supplementation and fertility in the US and in other high-income countries.

Methods:

Data and variables

We retrieved data on individual births by race/ethnicity, maternal age, county of maternal residence, date of birth, and gestational age at birth from the North Carolina Vital Statistics Database, from 1989 to 2007 (North Carolina State Center for Health Statistics (NCHS), 2021). These individual-level datasets compile information from birth certificate records and are made available by the North Carolina State Center for Health Statistics (North Carolina State Center for Health Statistics (NCHS), 2021). We used gestational age at birth (weeks) and date of birth (mm/dd/yy) to create cohorts by estimated month of conception for all live births reported in the database (Singh et al., 2017). Births conceived in 2006 but born in 2007 were retrieved from 2007 birth data and incorporated into respective 2006 monthly conception cohorts.

The precise monthly timing of percap payment serves as our exposure, or independent, variable. Starting in 1996, these payments were disbursed annually (in December) for the first two years (until 1997). Thereafter, percap payments became biannual, with disbursements to eligible EBCI members occurring in June and December (Ullmer, 2007). We coded these payment months as 1 and all non-payment months as 0, including all months preceding December 1996 (prior to the initiation of these casino-based cash transfers).

This exercise yielded a total of 20 “treatment” months (coded as 1) and 184 non-treatment months (coded as 0).

We defined our outcome as the monthly count of live births arrayed by conception cohorts among EBCI women who reported maternal county of residence as Graham, Swain or Jackson counties. We used American Indian race/ethnicity of the mother to approximate EBCI status because EBCI members comprise over 95% of the American Indian racial/ ethnic group in Graham, Swain and Jackson counties in North Carolina (EBCI PHHS, 2021; Karres, 2012). In alignment with analytic approaches utilized in evaluation of this UCT in prior research, we specified monthly conception cohorts among non-Hispanic white women in Graham, Swain and Jackson counties as our comparison group (Akee et al., 2018; Akee et al., 2010; Singh et al., 2020). We constructed two age group-specific monthly conception cohort series for treatment (EBCI women) and comparison groups (white women)- <20 years old and ≥20 years old at the time of conception- owing to distinct differences in fertility decisions and behavior by age, as documented in prior research (Cowan & Douds, 2022; Yonzan et al., 2020). We restricted our analysis from 1990 to 2006 to (1) include time periods before initiation of the casino-based cash transfers and (2) exclude the period during and following the Great Recession of 2007–08, as studies report a substantial decline in fertility across the US following this ecological stressor (Schneider, 2015; Schneider & Hastings, 2015). These restrictions yielded four series of 204 months each (i.e., two maternal age groups, each for births to EBCI and [separately] for white women in Graham, Swain and Jackson counties in North Carolina.)

Analysis

We test whether the count of monthly conceptions that result in live births to EBCI women increases above expected values within 0 to 3 months immediately following percap payments. These counts, however, may exhibit temporal patterns such as seasonality and upward/downward trends over our study period (Catalano & Serxner, 1987). This patterning, collectively referred to as autocorrelation, violates the assumption of correlational tests because the expected value of births to EBCI women in a given month would not (1) be independent of past months and (2) approximate the mean of past values (Catalano & Serxner, 1987; Shumway et al., 2000).

To overcome these analytic and inferential issues, we applied iterative pattern recognition routines to identify and model autocorrelation using Autoregressive, Integrated Moving Average (ARIMA) analysis methods. ARIMA modelling, developed by Box and Jenkins, yields predictions from correlated time-series data that express the counterfactual (Box et al., 2015). In the present study, this counterfactual reflects monthly births to EBCI women expected under the null hypothesis- i.e., no proximate effect of percap payment months on our dependent variable. Residuals obtained from ARIMA models fulfill key assumptions of normality, independence, and a mean of 0. This analytic approach has been used widely in epidemiologic and demographic research examining short-run fertility patterns in the US (Gemmill et al., 2021; Lee, 1993; Pflaumer, 1992).

We conducted ARIMA time-series modelling using software from Scientific Computing Associates (Liu et al., 1992) and applied autocorrelation detection routines to conception cohorts among EBCI women, controlling for births to white women over our test period. We examined births to women aged <20 years and ≥ 20 years separately. Our analytic steps appear below:

1. We used Box-Jenkins ARIMA time-series methods to identify and model autocorrelation in the monthly counts of births to EBCI women (Box et al., 2015). To account for seasonality inherent in birth periods that is shared across race/ethnicity, we used monthly births among white women in Graham, Swain and Jackson counties as a control variable. These women do not receive the percap payment. This specification, in ARIMA modelling, serves as a transfer function that ‘filters’ out temporal patterning in births (e.g., seasonality) that occurs generally in Graham, Swain and Jackson counties (Box et al., 2015).
2. We constructed a binary exposure of percap payment months over our test period. This variable took a value of 1 for months in which percap payment occurred (20 months in our test period), and 0 otherwise (184 months).
3. We added the exposure variable to the model described in step 1 and specified a Box-Jenkins test equation to detect any relation between our outcome and exposure variables, net of autocorrelation. We added 0–3 month lags to the exposure such that deviations from expected values in our outcome could be detected not only for the immediate month of percap payments but also up to 3 months thereafter. We selected this induction period based on past research that posits this window for an immediate response to economic change (Bruckner et al., 2011; Margerison Zilko, 2010).
4. We inspected the residuals of the error term, produced by the ARIMA model described in step 4, to verify the absence of autocorrelation.
5. For tests in step 3 that rejected the null, we explored whether and to what extent changes in monthly birth counts among EBCI women concentrate among primiparous relative to multiparous EBCI women. We conducted this exploratory analysis to gauge whether fertility decisions immediately following income receipt from percap payment operate differently based on parenthood status.
6. We also explored the association between the exposure and maternal age to gauge whether any observed fertility response in steps 3–5 vary across two broad age maternal groups: (a) change in monthly counts of births among women aged 21–30 years following percap payment months, and (b) monthly counts of births among women aged >30 years following percap payment months.

We specified the following equation for ARIMA time series analysis:

$$Y_t = c + \omega_1 B^1 NonEBCI_t + \left(\omega_2 B^2 + \omega_3 B^3 + \omega_4 B^4\right) Percap_t + \frac{\left(1 - \theta B^p\right)}{\left(1 - \varphi B^q\right)} a_t$$

Where:

Y_t is the monthly count of births to EBCI women in month *t*.

c is a constant

$NonEBCIbirths_t$ is the control variable of monthly births to non-EBCI women

ω_1 is the coefficient of the control variable (monthly births to non-EBCI women) $Percap_t$ is the binary indicator variable for the for percap payment at month t.

B^n is the value of the variable at month t-n.

ω_2 to ω_4 are the estimated parameters for the percap payment variable, lagged at 2, 3, and 4 months before births to EBCI women.

θ is the moving average parameter.

ϕ is the autoregressive parameter.

B^p and B^q are backshift operators that yield the value of a at month t-p for autoregressive and t-q for moving average patterns respectively.

a_t is the error term at month t.

Equation 1 estimates the relation between the lagged exposure variables ($PercapMonth_t$ through $PercapMonth_{t-3}$) on our outcome time series (Y_t) while controlling for non-ECBI births in month t and accounting for autoregressive and moving average components determined through iterative Box-Jenkins pattern recognition methods (Box et al., 2015).

Results

Over our study period, the 204 conception cohorts yielded 10,464 live births in Graham, Swain and Jackson counties (Table 1). Of these births, approximately 28% (2,933) occurred to EBCI women. Teen childbearing was common, with 34% and 22% of births occurring to women aged <20 years in EBCI and white women, respectively. Among women ≥ 20 years, monthly counts of births averaged 9.42 (SD=3.35) among EBCI women and 28.81 (SD=7.10) among white women.

Figure 1 plots births per monthly conception cohort, to EBCI and white women in our data, by maternal age groups (Panel A: <20 years; Panel B ≥20 years). Conception cohorts exposed to percap payment (among the EBCI) are marked by gray vertical lines. Both series display substantial month-to-month variation but no visibly discernable seasonality or trend. Table 2 presents results from our time-series tests. After controlling for births to white women in Jackson, Swain, and Graham counties, Box-Jenkins routines did not identify any autocorrelation parameters in the EBCI outcome series for either age group.

Results show an increase in conceptions that result in live births to ≥ 20 years old EBCI women 1 (coefficient= 1.74, $p = 0.03$) and 3 months (coefficient= 1.60, $p = 0.04$) following percap payments (Table 2, model b). This increase corresponds with about 70 additional births ([1.74 × 20 percap payments]+[1.60 × 20 percap payments]) statistically attributable to percap payments among EBCI women aged ≥ 20 years. On a relative scale, 1.60 to

1.74 additional monthly births following percap payments translate to an 18% increase from the mean number of live births per month among ECBI women >=20 in the sample (i.e., 1.74/9.42). For EBCI women aged < 20 years, we fail to reject the null (Table 2, model a). Examination of residuals in both age groups shows no autocorrelation (Supplement Figure 2).

Exploratory Analyses

We considered whether the increase in short-term fertility we observe following percap payments concentrates among first and/or higher-order births. Using maternal birth history information provided in the North Carolina vital statistics data, for women aged ≥ 20 years, we formulated two conception cohort series based on parity among the EBCI and comparison (white) groups: (1) primiparous i.e., first-time mothers and (2) multiparous i.e., mothers with prior live births (descriptive statistics shown in Supplement Table 1). ARIMA modelling identified an AR(1) parameter for births among primiparae EBCI women (model included births to primiparae white women as a transfer function) (Table 3, model a). Box-Jenkins routines did not identify any autocorrelation in monthly birth counts to multiparous EBCI women (model adjusted for births to multiparous white women) (Table 3, model b). Results show that the increase in births to ≥20 years old EBCI women 1 month following percap payment concentrates among the primiparae (coefficient = 0.92, $p = 0.02$) but not among the multiparae (Table 3).

We also examined fertility changes by two broad maternal age groups- (a) 21–30 years, and (b) >30 years, following percap payments. Table 4 presents the results from these analyses. We find a strong fertility response among EBCI women aged 21–30 years at exposure lag 1 (Table 4, Model a), whereas this relation appears evenly distributed across exposure lags 1, 2 among EBCI women aged > 30 years (Table 4, Model b), indicating a slightly higher response among younger EBCI women (1.52 among 21–30 years old versus 0.57+0.59 = 1.16 among > 30 years old) (Table 4).

Discussion

Fertility decline remains a concern among high-income countries. Recent work in Alaska suggests that fertility increases following population-level increases in non-wage income (Cowan & Douds, 2022; Yonzan et al., 2020). We built on that work and examined whether and to what extent the timing of casino-based Unconditional Cash Transfers, in the form of percapita payment timing, corresponds with increased monthly conceptions that result in live births among the Eastern Band of Cherokee Indian (EBCI) population in North Carolina. Results from our time-series analyses suggest a modest increase in conceptions that result in live births at 1 and 3 months following disbursement of percapita (or percap) payments among EBCI women aged ≥ 20 years. Our results align with findings from prior research on other UCTs in the US (Cowan & Douds, 2022; Yonzan et al., 2020) and suggest that provision of universal income may increase short-term fertility, particularly among ≥ 20 years old, primiparae women and among EBCI women aged 21–30 years.

Strengths of our study include its quasi-experimental design that exploits the exogenous initiation and timing of the casino-based UCTs in our study population. We establish temporal order (i.e., exposure precedes outcome), estimate immediate effects, and use as controls births to white women living in the same region as our treatment group (EBCI).

Use of white women as a control series accounts for shared ecological and temporal factors in these counties that affect fertility but are not unique to a percap response. We also use publicly available vital statistics birth data for Graham, Swain, Jackson counties in North Carolina, which allows independent replication and verification.

Weaknesses include that, as with any observational study, we cannot fully rule out unobserved factors that may confound our results. Such an unobserved confounder would have the following characteristics: (1) exhibit high correlation with the timing of casino percap payments, (2) correspond with increased fertility among EBCI women, but (3) not correspond with fertility increase among white women within 0 to 3 months of percap payments in our study region. Whereas we know of no such factor, we cannot rule out this possibility.

Unlike other UCT evaluations in the US (Cowan & Douds, 2022; Yonzan et al., 2020), we are unable to conduct robust estimations of differential effects of percap payments on fertility by socioeconomic status and detailed maternal age groups owing to small sample size for these groups. Another key limitation of our study includes that we do not have information on the dollar amount received by every EBCI woman in the North Carolina vital statistics births dataset. Other studies examining fertility effects of UCTs in the US utilize exact cash amounts received by women, which helps quantify potential monetary investment or threshold payments that may elicit fertility change (Cowan & Douds, 2022; Yonzan et al., 2020). We, however, do not have information on exact percap payments per person owing to substantial variability of these amounts based on accrual of interest among those who received their first payment after turning 21 years of age and/or graduated high school. Our study treats the exposure as homogenous to all eligible EBCI women and our estimates provide average treatment effect of the percap payments on fertility change.

Whereas the EBCI population we examine is unique in several aspects, findings have the potential to hold for other populations in the US as well. Our results align closely with UCT evaluations in Alaska, both in terms of age group (≥ 20 years old women) and effect magnitude (in relation to population size) (Cowan & Douds, 2022; Yonzan et al., 2020). Our estimates correspond with approximately 70 additional births (~18% increase from average monthly births) to EBCI women statistically attributable to percap receipt from 1995 (beginning of the UCT) to 2006. Taken together, this body of work provides proof-of-concept that universal income in the form of UCTs may correspond with increased short-term fertility in the US.

Whereas prior work on risky behaviors following percap receipt among the EBCI reports increase in high-risk outcomes (Bruckner et al., 2011), we and others (Cowan & Douds, 2022; Yonzan et al., 2020) find no relation between UCT receipt and increase in adolescent childbearing, which might proxy for risky behavior. Evidence from Europe, while not directly comparable to the US owing to differences in parental benefits and healthcare systems, also supports the potential role of universal income through UCTs as a feasible mechanism to increase fertility, at least in the short-term (Brewer & Ratcliffe, 2012; Kalwij, 2010; Laroque & Salanié, 2008).

Our ecological, aggregate-level time-series analyses preclude the inclusion of individual-level correlates of birth outcomes such as maternal education, smoking and healthcare access. Given our use of high temporal resolution (monthly), we do not expect these variables to exhibit wide variation on a month-to-month basis, per conception cohort, over our study period. Scholars interested in exploring these individual-level variables may examine the risk of preterm births, low birthweight and other birth outcomes in relation to the casino-based cash transfers in our study population.

A central limitation of this analysis is that we are not able to discern whether percap payments increase completed fertility among exposed cohorts (i.e., fertility quantum) or if the increase we observe is a result of shifts in the timing of childbearing (i.e., fertility tempo). Adjudicating these mechanisms would require data on cohort fertility measures (which are not yet available) rather than the period measures we use here. That stated, a review of family-friendly policies on fertility in OECD countries largely concludes that financial transfers appear to accelerate timing of births, rather than increase the total number of births (Thévenon & Gauthier, 2011). Future research should therefore attempt to disentangle these effects, where data allow, to better inform public policy.

Our study uses North Carolina Vital Statistics birth datasets that are electronically compiled using birth certificate records. Owing to the self-reported nature of race on birth certificate data (Buescher et al., 2004), and other reports of higher misclassification of race among American Indian populations (Dougherty et al., 2019; Small-Rodriguez & Akee, 2021), we cannot rule out measurement error due to racial misclassification.

Although we are unable to investigate mechanisms underlying our results, we draw attention to three potential explanations informed by theoretical perspectives and prior research. First, percap payments may have led to short-term increases in attempts for pregnancy, especially among individuals and couples with a latent demand for children. This increase in attempts may concentrate among those without children, such that an influx of cash among nulliparous couples in particular may affect decision-making thresholds associated with the transition to parenthood (Beach et al., 1982). Second, percap payments may have increased the acceptability of unplanned pregnancies, thereby reducing demand for induced abortion (Aiken et al., 2016). Third, because prior literature finds that economic downturns are associated with increased risk of spontaneous abortion, percap payments may have buffered against economic stressors associated with pregnancy loss (Bruckner et al., 2016). Our findings do not preclude anticipation effects and our observed increase in fertility may also arise from increased conception efforts in anticipation of percapita payments (given the consistent timing of these payments each year) among EBCI members.

Our datasets preclude the determination of “true” conceptions in that we only examine conceptions that result in live births. Our estimates, therefore, potentially represent a lower bound of the impact of unconditional cash transfers on fertility among the EBCI. Fetal deaths and induced abortions recorded in vital statistics systems may offer a feasible alternative, but the reporting of fetal deaths presents formidable challenges, particularly with respect to early fetal loss that largely goes undetected in early months of a pregnancy (Martin & Hoyert, 2002) and self-managed abortions that are not reported to the state (NCSCHS, 2023). However, the incidence of early preterm births (i.e., <32 week) may gauge positive selection in utero, following percap receipt, if this unconditional cash transfer increased the likelihood of frailer fetuses (that would otherwise have been spontaneously aborted or miscarried) being carried to a live birth (Bruckner & Catalano, 2018; Margerison et al., 2023). We encourage future research to test this hypothesis of positive selection in utero by examining whether our observed increase in fertility also corresponds with increased early preterm births and fewer fetal losses following exposure to unconditional cash transfers.

Fertility levels may also track general optimism and reduced economic uncertainty—and thus the willingness to invest in future offspring—in a population (Chiara L Comolli & Vignoli, 2021; Chiara Ludovica Comolli, 2017; Vignoli et al., 2020). Studies show that reproductive outcomes exhibit high sensitivity to ambient, ecological stressors such as unemployment rates and macrosocial shocks (Bruckner & Catalano, 2018; Buckles et al., 2021; Margerison Zilko, 2010). The recent societal and economic restrictions related to curbing the COVID-19 pandemic in the US (in Spring 2020) provides a recent stark example of the relation between economic uncertainty and fertility (Aassve et al., 2020, 2021; Wilde et al., 2020).

Prior research among the EBCI shows an increase in optimism about the future following percap receipt (Singh et al., 2020). It is plausible that this increase in optimism underlies our findings with respect to fertility as well. We encourage future research to examine whether other indicators of collective optimism, such as suicides, alcohol use disorder, and mortality from drug overdose (i.e. deaths of despair) decline following income gains from UCTs in the US and other high income countries (Case & Deaton, 2020).

Only subsequent research can determine whether the observed increase in number of births to EBCI women also corresponds with improved birth outcomes. Following initiation of percap payments, the EBCI community as a whole has experienced substantial socioeconomic development (Bullock & Bradley, 2010; Ullmer, 2007). This increased prosperity may translate into improved birth outcomes such as reduction in low birth weight, preterm births, and infant mortality among the EBCI. It is also plausible that several maternal health indicators such as access to antenatal and postnatal care improved following the initiation of the casino-based UCT in this population. Conversely, increased optimism following UCT receipt has the potential to yield frailer births (owing to lower *in-utero* selection) and increased number of preterm and small-for-gestational-age births among the EBCI (R. A. Catalano et al., 2020; Forbes & Mock, 1998; Karasek et al., 2015). Whereas a detailed examination of these potential relations remains beyond the scope of the present study, we encourage future research to examine whether and to what extent birth outcomes vary with UCT receipt in this population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Income supplementation through unconditional cash transfers (UCT) may correspond with increased fertility.
- We examine whether a casino-based UCT, in the form of per capita (percap) payments to members of the Eastern Band of Cherokee Indians (EBCI) corresponds with an acute increase in fertility.
- We find an increase in conceptions that result in live births at 1 and 3 months after percap receipt among EBCI women aged ≥20 years.

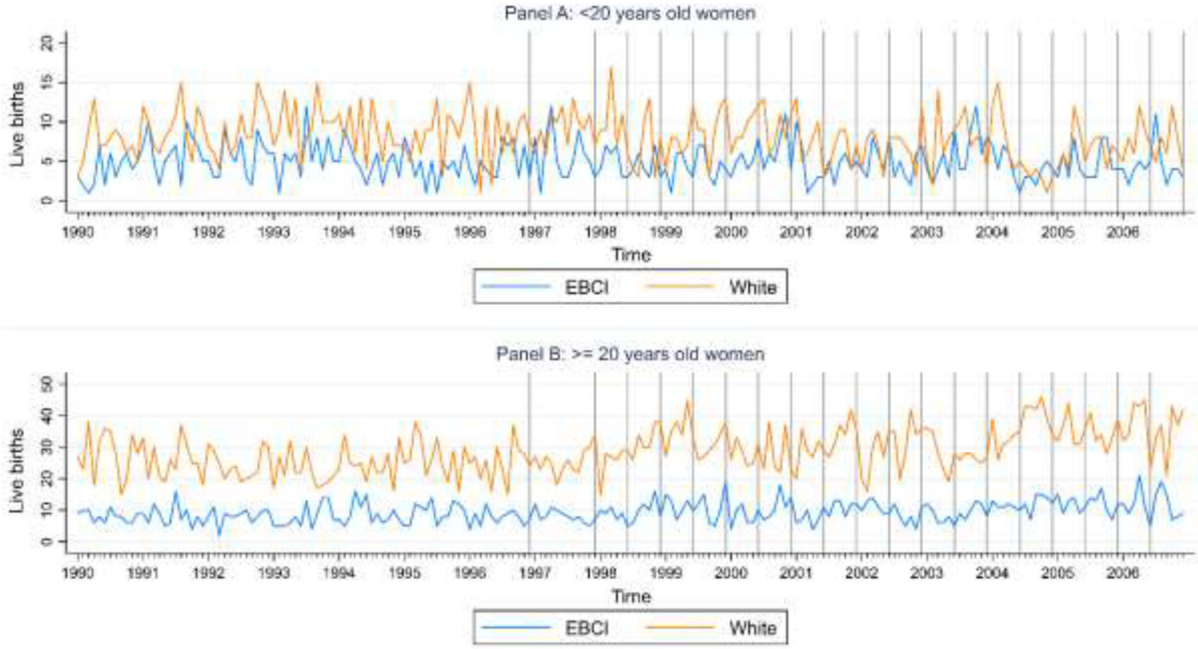

Figure 1.
Live births among EBCI and white birthing persons arranged by month of conception, in Graham, Swain and Jackson counties in North Carolina, 1990 to 2006. Births to birthing persons aged <20 years shown in Panel A, and to those ≥ 20 years shown in Panel B. Vertical gray lines indicate percap payment months.

Table 1:

Descriptive statistics of births to EBCI and white women in Graham, Swain and Jackson counties in North Carolina, 1990 to 2006.

	Total births over study period	Mean monthly count of births (Standard Deviation)
EBCI women aged <20 years	1,011	4.96 (2.34)
EBCI women aged ≥ 20 years	1,922	9.42 (3.35)
White women aged <20 years	1,654	8.11 (3.16)
White women aged ≥ 20 years	5,877	28.81 (7.10)

Table 2:

Time-Series results for EBCI live births from January 1990 to December 2006, as a function of exposure to percap payment months, autocorrelation, and (as a control variable) births to white women.

Variable	Model a: Births to < 20 years old EBCI women	Model b: Births to ≥ 20 years old EBCI women
	Coefficient (SE)	Coefficient (SE)
Constant	4.34 (0.50) ***	5.46 (0.94) ***
Births to white women	0.10 (0.05)	0.12 (0.03) ***
ARIMA parameters	(none detected)	(none detected)
Exposure lag (percap payment months)		
0	−0.55 (0.55)	0.34 (0.78)
1	−0.04 (0.57)	1.74 (0.78) *
2	−0.94 (0.56)	1.17 (0.79)
3	−0.19 (0.56)	1.60 (0.79) *

* $p < 0.05$; two-sided test.

** $p < 0.01$; two-sided test.

*** $p < 0.001$; two-sided test.

Table 3:

Time-Series results for EBCI live births to birthing persons aged ≥20 years, as a function of exposure to percap payment months, autocorrelation, and (as a control variable) births to white women. Analyses conducted separately for primiparae and multiparae.

Variable	Model a: Births to primiparae EBCI women	Model b: Births to multiparae EBCI women
	Coefficient (SE)	Coefficient (SE)
Constant	1.63 (0.38) ***	4.96 (0.69) ***
Births to white women	0.07 (0.03) *	0.09 (0.04) *
ARIMA parameters (Model a: AR 1; Model b: None)	0.15 (0.07) *	--
Exposure lag (percap payment months)		
0	−0.37 (0.39)	0.94 (0.67)
1	0.92 (0.40) *	0.99 (0.69)
2	0.17 (0.41)	1.16 (0.69)
3	0.59 (0.39)	0.96 (0.70)

* $p < 0.05$; two-sided test.

** $p < 0.01$; two-sided test.

*** $p < 0.001$; two-sided test.

Table 4:

Time-Series results for EBCI live births from January 1990 to December 2006, as a function of exposure to percap payment months and autocorrelation, by maternal age groups.

Variable	Model a: Births to 21–30 years old EBCI women	Model b: Births to > 30 years old EBCI women
	Coefficient (SE)	Coefficient (SE)
Constant	none	1.02 (0.19) ***
Births to white women	0.30 (0.01) ***	0.04 (0.03)
ARIMA parameters	AR (8): −0.21 (0.07) *	(none detected)
Exposure lag (percap payment months)		
0	1.03 (0.62)	0.33 (0.25)
1	1.52 (0.63) *	0.57 (0.26) *
2	0.90 (0.63)	0.59 (0.26) *
3	1.03 (0.63)	0.43 (0.27)

* $p < 0.05$; two-sided test.

** $p < 0.01$; two-sided test.

*** $p < 0.001$; two-sided test.