The Holy Father (and Mother)? Multiple Tests of the Hypothesis That Parenthood and Parental Care Motivation Lead to Greater Religiosity

Nicholas Kerry[1,2] iD, Marjorie L. Prokosch[1,3],
and Damian R. Murray[1]

Abstract
Parenting is a universal element of human life. However, the motivational and attitudinal implications of parenthood remain poorly understood. Given that many major religions prescribe parent-benefiting norms restricting sexual promiscuity and socially disruptive behavior, we hypothesized that both parenthood and parental care motivation would predict higher levels of religiosity. Studies 1 to 3 ($N > 2,100$ U.S. MTurkers; two preregistered) revealed that parental status and motivation were robustly associated with religiosity in Americans, and that age-related increases in religiosity were mediated by parenthood. Study 4a (376 students) found a moderated experimental effect, such that emotionally engaged participants showed increases in religiosity in response to a childcare manipulation. Study 4b then replicated this effect in recoded data from Studies 1 and 2. Study 5 used data from the World Values Survey ($N = 89,565$) and found further evidence for a relationship between parenthood and religiosity. These findings support functional accounts of the relationship between parenthood and mainstream religiosity.

Approximately 84% of the world's current population identifies as "religious" (Pew Forum, 2017). However, there is substantial variability in the degree to which people make their chosen religion a part of their daily lives—how frequently they read scripture, how often they adhere to the norms prescribed by that scripture, and how often they attend religious ceremonies (see, for example, Norenzayan, 2016; Norenzayan & Gervais, 2013). Levels of religiosity also vary across the life span: on average, people tend to report lower religiosity in early adulthood and higher religiosity in later adulthood (e.g., Bengtson et al., 2015; Hayward & Krause, 2015; McCullough et al., 2005). But why does this within-culture and within-person variation exist?

Previous research attests to a relationship between parenthood and religiosity (e.g., Hayford & Morgan, 2008; Zhang, 2008). This relationship is most often causally attributed to the effect of religion in influencing people's decisions to have children (see Mahoney, 2010). Although religion undoubtedly influences reproductive decision-making and attitudes toward family, we hypothesize here that causality may also run in the opposite direction, such that parenthood—and

differences in parental care motivation—contributes to variation in religiosity.

The Psychological and Cognitive Consequences of Parenthood

Becoming a parent has notable, enduring psychological effects on parents (see, for example, Gray & Anderson, 2010; Grebe et al., 2019; Hrdy, 1999). Physiologically, new parenthood induces a range of hormonal changes in both men and women (Gettler et al., 2011, 2012; Grebe et al., 2019; Hahn-Holbrook et al., 2011; Kuzawa et al., 2010). These physiological changes are also accompanied by important changes in cognition, attitudes, and behavior (e.g., Fessler et al., 2014;

[1]Tulane University, New Orleans, LA, USA
[2]University of Pennsylvania, Philadelphia, USA
[3]University of Florida, Gainesville, USA

Corresponding Author:
Nicholas Kerry, Department of Psychology, University of Pennsylvania, 3720 Walnut Street, Philadelphia, PA 19104, USA.
Email: nickerry@sas.upenn.edu

Kerry et al., 2021; Kerry & Murray, 2018, 2020; Rutherford et al., 2015). Beyond parenthood, there is evidence that variation in parental care motivation—people's motivation to care for and display tenderness toward children—constitutes an important trait-like variable in both parents and nonparents that has similar psychological implications to parenthood itself (Buckels et al., 2015; Schaller, 2018, 2019). For example, parental care motivation predicts some of the same social attitudes as parenthood, including harsher moral judgments and increased social conservatism, independent of a person's parenthood status (Buckels et al., 2015; Kerry & Murray, 2018, 2020).

Of particular interest for this research, growing evidence suggests that parenthood is associated with (a) reduced short-term mating effort and (b) greater sensitivity to and avoidance of threats.

Parenting and Mating Effort

Preliminary evidence asserts a trade-off between parental care motivation and short-term mating motivations (Beall & Schaller, 2019; Zilioli et al., 2016). Correlational results reveal an inverse relationship between short-term mating orientation and feelings of tenderness toward children. Furthermore, priming short-term mating motives reduces feelings of tenderness toward children in both men and women (Beall & Schaller, 2019). Conversely, priming parental care motives may lessen short-term mating orientation (Beall & Schaller, 2019). Some evidence also implies a specific hormonal mediator for this trade-off between parental care and short-term mating motives: Becoming a parent is associated with a reduced testosterone ratio in both men and women (Barrett et al., 2013; Gray et al., 2002; see Roney & Gettler, 2015), and men who show greater testosterone responses to sexual stimuli also tend to be less interested in babies (Zilioli et al., 2016).

Parenting and Threat Perception

Parenthood also alters the implicit cost–benefit ratio for many behaviors. For example, risk-taking carries more potential benefit for un-partnered and uninvested individuals seeking to gain either status or attention from potential mates (Wilson & Daly, 1985). When mating motivation is high, the potential benefits of taking physical risks frequently outweigh the potential costs. However, for a parent of young children, who must invest resources in both their own and their children's welfare, the potential costs of this type of risk-taking outweigh the benefits. Indeed, longitudinal data show that men and women become more risk-averse during the early years of parenthood—an effect that diminishes once one's children reach adulthood (Görlitz & Tamm, 2015). Meanwhile, parenting may increase wariness of potential physical threats (Fessler et al., 2014), perhaps even prior to parturition (Pearson et al., 2009).

Religiosity, Family, and Threat Management

We operationalize the terms "religiosity" and "religious" in a narrow sense to refer to belief in institutionalized religions in which the deities and/or institutions organized around their worship play a direct role in prescribing moral norms.

Many religions prohibit both casual and extramarital sex and promote a family-oriented lifestyle; thus, religious belief predicts more restrictive reproductive moral attitudes across many cultures (Goeke-Morey & Cummings, 2017; Mahoney et al., 2008; Rostosky et al., 2004; Weeden & Kurzban, 2013). The Judeo-Christian Ten Commandments, for example, discourage behaviors that threaten long-term pair-bonds (e.g., "Thou shalt not covet thy neighbor's wife"; "Thou shalt not commit adultery") while also supporting traditional family structure ("Honor your father and mother"). Furthermore, the association between religion and more restrictive sexual attitudes and behaviors is found across cultures (e.g., Li et al., 2010; Schmitt & Fuller, 2015; Strassmann et al., 2012; Van Slyke & Wasemiller, 2017; Weeden et al., 2008). Collectively, this research has been taken as support for the "Reproductive Religiosity Model," which hypothesizes that a key function of religion in contemporary monogamous cultures is to promote low-promiscuity, pro-fertility, and marriage-centered social norms (Moon et al., 2019; Weeden et al., 2008).

Religious norms may also serve a threat-management function. Many religious proscriptions protect individuals, property, and social stability (e.g., "Thou shalt not commit murder"; "Thou shalt not steal"). Consistent with this logic, being religious is positively associated with risk-aversion in European samples and with concerns about physical threats in American samples (León & Pfeifer, 2017; Murray et al., 2019; Noussair et al., 2013).

Overview of the Current Research

The aforementioned literature logically implies two routes through which parenthood may influence religiosity. First, parenthood makes short-term mating effort costlier and less beneficial. Second, parenthood makes social norms that emphasize threat-protection and ingroup cohesion—such as rules forbidding violence or promoting community—more advantageous. Religious norms across many belief systems serve both purposes, and it is possible that parents are thus drawn to religion as a means to shape their social environments in line with these goals.

Parental care motivation may produce similar psychological effects to those of parenthood, regardless of actual parenthood status. First, nonparents who are high in parental care motivation are more likely to want to become parents and are therefore more likely to endorse social norms that favor parents. Second, from a strategic perspective, the more invested a parent is or plans to be in their children, the more likely it is that their attitudes will promote parent-benefiting

social norms. Thus, we hypothesized that parental care motivation leads to a tendency to shape social environments for heightened benefit to families and would consequently be associated with higher levels of religiosity. We tested these predictions across five studies, using age-diverse online samples and cross-cultural archival data.

Study 1

Study 1 was an exploratory study in which a short, self-devised, religiosity measure was added to a larger study. Study 1 was not preregistered. We predicted that both parenthood and parental care motivation would be positively associated with religiosity. Furthermore, we hypothesized that parenthood would mediate age-related increases in religiosity. To test whether the predicted associations between parenting variables and religiosity could be better explained by differences in upbringing, or aspects of sexual strategy that temporally *precede* parenthood, we included measures of childhood socioeconomic status (SES), childhood unpredictability, and age of sexual debut. To control for variation in maturational processes—which could indicate biological inclination to a particular mating strategy prior to becoming a parent—we included a self-report of the age of onset of puberty. In addition, Study 1 experimentally manipulated parenting salience using a written priming task.

Data, materials, and syntax files for all studies are available at: https://osf.io/s9yx5/?view_only=5529104a70c641a193c19e688e113065. We report all manipulations, measures, and exclusions in these studies.

Method

Eight hundred two American adults (473 women, 413 parents, ages 18–99 years, $M_{age} = 38.06$, $SD = 13.44$) were recruited through MTurk. Participants were excluded if they had participated in related studies, had MTurk approval ratings lower than 95%, or had completed >5,000 MTurk tasks. No completed surveys were excluded. This sample size gave 0.8 power to detect an effect of Cohen's $d = 0.25$ between experimental conditions, or a correlation of $r = .10$. Studies 1 to 3 were approved by the relevant institutional review board.

After consent, participants were randomly assigned to one of the three experimental conditions. In the child-interaction condition—which was intended to increase the salience of parenting motives—participants viewed a picture of children playing and were asked to write about a positive interaction that they had had with a child and about how they had felt at the time. Two control conditions were included, namely, a baseline control condition, in which participants saw a picture of a man getting dressed in formal clothes and were asked to write about what they did that morning, and an adult-interaction condition, which paralleled the child-interaction condition, except that participants viewed a picture of

workmates interacting and smiling, and were asked to write about a recent positive interaction with adults.

Measures

Parenthood. Parenthood status was assessed using a single-item question: "Do you have any children?" with options "yes" and "no."

Parental care motivation. Parental care motivation was assessed with the 25-item Parental Care and Tenderness scale (PCAT; Buckels et al., 2015). Example items include "When I see infants, I want to hold them"; "I can't stand how children whine all the time." [reverse scored]. Items were assessed on a 5-point scale indicating either level of agreement or level of tenderness ($\alpha = .95$).

Religiosity. Religiosity was assessed using a four-item scale ($\alpha = .85$) devised for the study, where participants' agreement was rated from 1 to 7 (1 = *strongly disagree* to 7 = *strongly agree*). Items related both to direct belief in a God ("I believe in a God who regularly influences or controls the world we live in") and views on religion's influence ("Religious teachings generally have a negative influence"; reversed). A principal components analysis using standardized item-scores suggested a clear single-factor solution, with the main factor accounting for 70.94% of variance. Scores on this four-item scale were later compared with the longer, validated, Centrality of Religion scale (see Study 3) and were found to correlate strongly with this more established measure ($r = .91$).

Childhood demographics. Participants completed two 3-item scales using a 7-point rating scale (1 = *strongly disagree* to 7 = *strongly agree*) that assessed their subjective childhood SES (Griskevicius, Delton, et al., 2011, "My family usually had enough money for things when I was growing up") and their perceptions of their childhood environment's instability (Griskevicius, Tybur, et al., 2011, "Things were often chaotic in my house"). These scales were mean scored into childhood SES ($\alpha = .66$) and childhood unpredictability composites ($\alpha = .82$). Participants reported their age of pubertal debut and age when they first had sex. These four measures have been linked to sexual strategy in adulthood (Belsky et al., 2010; Griskevicius, Delton, et al., 2011; James et al., 2012).

Demographics. Participants reported their age, gender, marital status, and current household income. A single item asking participants whether they voted Democrat, Republican, or "other/did not vote" in the most recent election was also included. As the third option is hard to interpret comparatively, only the first two options were compared in subsequent control analyses.

Additional measures. Studies 1 and 2 were run as part of a larger project on the effects of parental care motivation and

Table 1. Bivariate Correlations in Study 1.

Variable	2	3	4	5	6	7	8
1. Parental care motivation	.37***	.36***	.18***	.04	−.08*	−.08*	.01
2. Parenthood	—	.21***	.39***	−.06	−.04	−.01	−.03
3. Religiosity		—	.15***	.05	−.09*	−.01	−.09
4. Age			—	−.04	.12***	.05	.09*
5. Childhood SES				—	.19***	.02	−.03
6. Childhood unpredictability					—	−.03	.14***
7. Age of puberty						—	.15***
8. Age of sexual debut							—

Note. SES = socioeconomic status.
*$p \leq .05$. ***$p \leq .001$.

included additional measures of political attitudes on specific issues, not reported here.

Results and Discussion

Associations between parenthood, parental care motivation, and religiosity. As predicted, parents reported higher religiosity than nonparents, 4.07 versus 3.55, $t(799) = 6.18$, $p < .001$, Cohen's $d = 0.44$, 95% confidence interval (CI) = [0.30, 0.58]. Bivariate correlations between variables of interest can be seen in Table 1 and show that parental care motivation was positively associated with religiosity, $r(800) = .36$, $p < .001$, 95% CI = [0.30, 0.42]. This correlation was present within both parents ($r = .24$) and nonparents ($r = .36$) and was robust to controlling for childhood SES, childhood unpredictability, age of sexual debut, and puberty onset, as was the relationship between parenthood and religiosity (see supplemental online materials [SOM]). Scatterplots for the relationship between parental care motivation and religiosity in Studies 1 to 3 are shown in SOM (Figures S1, S3, and S10).

Experimental effects. We also conducted analyses to test whether there was any effect of the child-interaction manipulation on religiosity. A two-way analysis of variance (ANOVA) of condition (three levels) by parenthood status (two levels) revealed no effect of experimental condition, $F(2, 795) = 2.11$, $p = .122$, $\eta_p^2 = .01$. Further details are provided in SOM.

Mediation of age differences by parenthood and parental care motivation. Further analyses tested whether the age-related increases in religiosity found in past research would replicate in this sample and whether parenthood and parental care motivation mediated this relationship. Levels of parental care motivation and religiosity across age groups, for both parents and nonparents, are shown in Figure 1 (equivalent plots for Studies 2 and 3 are in SOM, Figures S5 and S11). A simple linear regression (linearity assumptions were not violated for the main variables in Studies 1 to 3—see SOM) revealed that religiosity increased with age, $\beta = .15$, $p < .001$. Including

parenthood status as a predictor reduced the magnitude of this relationship, $\beta = .08$, $p = .038$. A bootstrapped mediation analysis (using the LAVAAN package in Rosseel, 2012) tested a parallel mediation model including both parenthood and parental care motivation as mediators of the effect of age on religiosity (Figure 2A). This model revealed significant, independent, indirect effects through both parenthood, $b = .011$ ($SE = .002$), 95% CI = [0.006, 0.016], $p < .001$, and parental care motivation, $b = .006$ ($SE = .001$), 95% CI = [0.003, 0.008], $p < .001$. Within this model, the direct effect of age was negligible and slightly negative, $b = −.003$ ($SE = .004$), 95% CI = [−0.011, 0.005], $p = .444$, meaning that the mediators fully accounted for the uncorrected positive relationship between age and religiosity (parenthood 79% of original effect; parental care motivation 43%).

Importantly, this complete mediational effect was not simply a function of the covariances between these variables. An alternative model, in which religiosity was positioned as a mediator of the effects of age on parenthood and parental care motivation, found a much-reduced indirect effect, accounting for only around 27% of the association between age and parental care motivation and 7% of the association between age and parenthood (Figure 2B).

Study 2

Study 2 aimed to replicate the main findings of Study 1 using an extended measure of religiosity. We preregistered three predictions:[1] (a) that parental care motivation would predict religiosity, (b) that parental care motivation would mediate age differences in religiosity, and (c) that an experimental parenting manipulation would increase religiosity in 25- to 45-year-olds (materials and predictions available at https://osf.io/s9yx5/?view_only=5529104a70 c641a193c19e688e113065). Sample size and analysis plans were preregistered in addition to these predictions. Study 2 also tested the (unregistered) hypothesis that the relationship between parental care motivation and religiosity is mediated by differences in perceived threat and mating motivation.
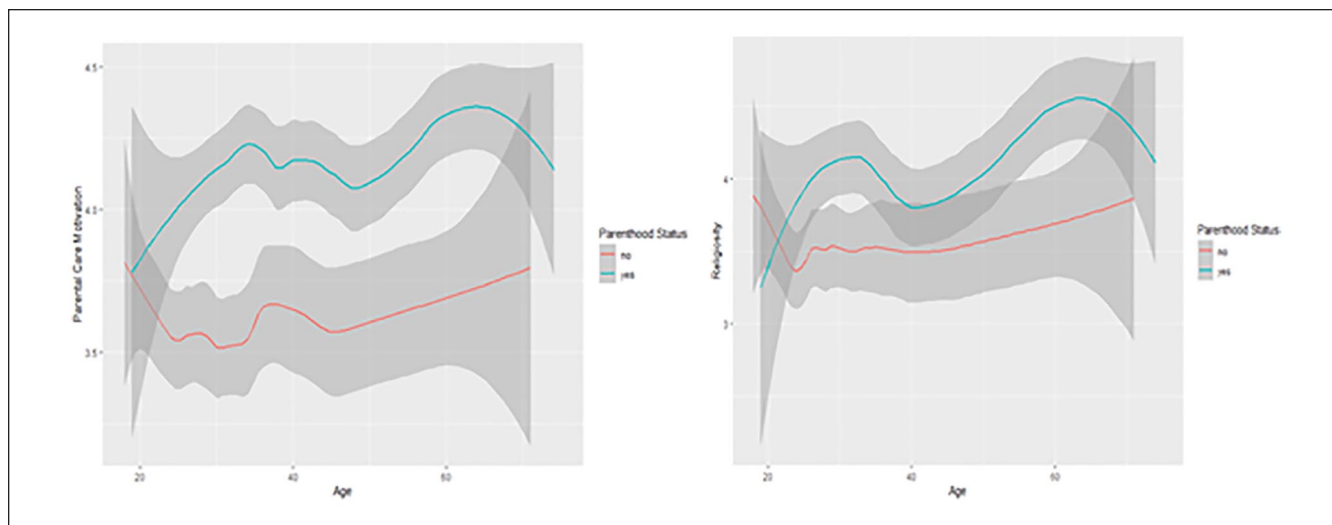
Figure 1. Smoothed line plots showing differences by age in parental care motivation (left) and religiosity (right) for parents and nonparents in Study 1.
Note. Dark gray areas show 95% confidence intervals.

Method

We prepaid 800 American MTurk participants. Participants were excluded (using TurkPrime) if they had participated in Study 1 or in other related studies examining parental care motivation. Thirty-seven participants were excluded for failing an attention check, leaving a final sample of 763 (477 women, 349 parents, ages 18–87 years, M_{age} = 35.96, SD = 12.42). This sample size gave 0.8 power to detect an effect of Cohen's d = .25 between experimental conditions, or a small correlation of r = .10.

Participants completed the same priming task as in Study 1. Only the child-interaction and adult-interaction conditions were included to increase statistical power.

Measures

Parenthood. As in Study 1, we assessed parenthood status with a simple yes/no question: "Do you have children?"

Religiosity. We extended the scale in Study 1 to include seven items (e.g., "religion is important and should be encouraged"). A principal components analysis revealed a single factor with eigenvalue >1, accounting for 65.36% of variance. Cronbach's α = .91.

Parental care motivation. As in Study 1, parental care motivation was assessed with the 25-item PCAT (Buckels et al., 2015; Cronbach's α = .94).

Dispositional threat concern. Trait-like worry about threats was assessed using the Belief in a Dangerous World scale (BDW; Altemeyer, 1988). The 12-item scale assesses agreement (1 = *strongly disagree*, 7 = *strongly agree*) with statements such as "There are many dangerous people in our

society who will attack someone out of pure meanness, for no reason at all" (reverse scored; α = .90).

Mating strategy. Mating strategy was assessed using the Sociosexual Orientation Inventory (Jackson & Kirkpatrick, 2007). Ten items assessed short-term mating orientation (α = .95) with statements such as "I can easily imagine myself being comfortable enjoying 'casual' sex with different partners" (1 = *strongly disagree*, 7 = *strongly agree*). For comparison, a further 10 items assessed long-term mating orientation (α = .91) with statements such as "I can see myself settling down romantically with one special person." These two subscales represent distinct, non-opposite constructs: short-term mating orientation is a measure of people's interest in uncommitted sexual encounters, whereas long-term mating orientation is a measure of people's desire to form and maintain committed romantic relationships (these are not necessarily mutually exclusive). Consistent with previous work (Jackson & Kirkpatrick, 2007), participants varied considerably more in short-term mating orientation (M = 3.53, SD = 1.74) than in long-term mating orientation (M = 5.96, SD = 1.02).

Demographics. Participants reported their age, gender, marital status, political affiliation, current household income, and a scale for an unrelated study.

Results and Discussion

Associations between parenthood and parental care motivation with religiosity. As in Study 1, parents scored higher on religiosity than nonparents (4.53 vs. 4.03, $p < .001$, Cohen's d = 0.44, 95% CI = [0.30, 0.58]). Correlations between pertinent variables can be seen in Table 2. As predicted, parental care
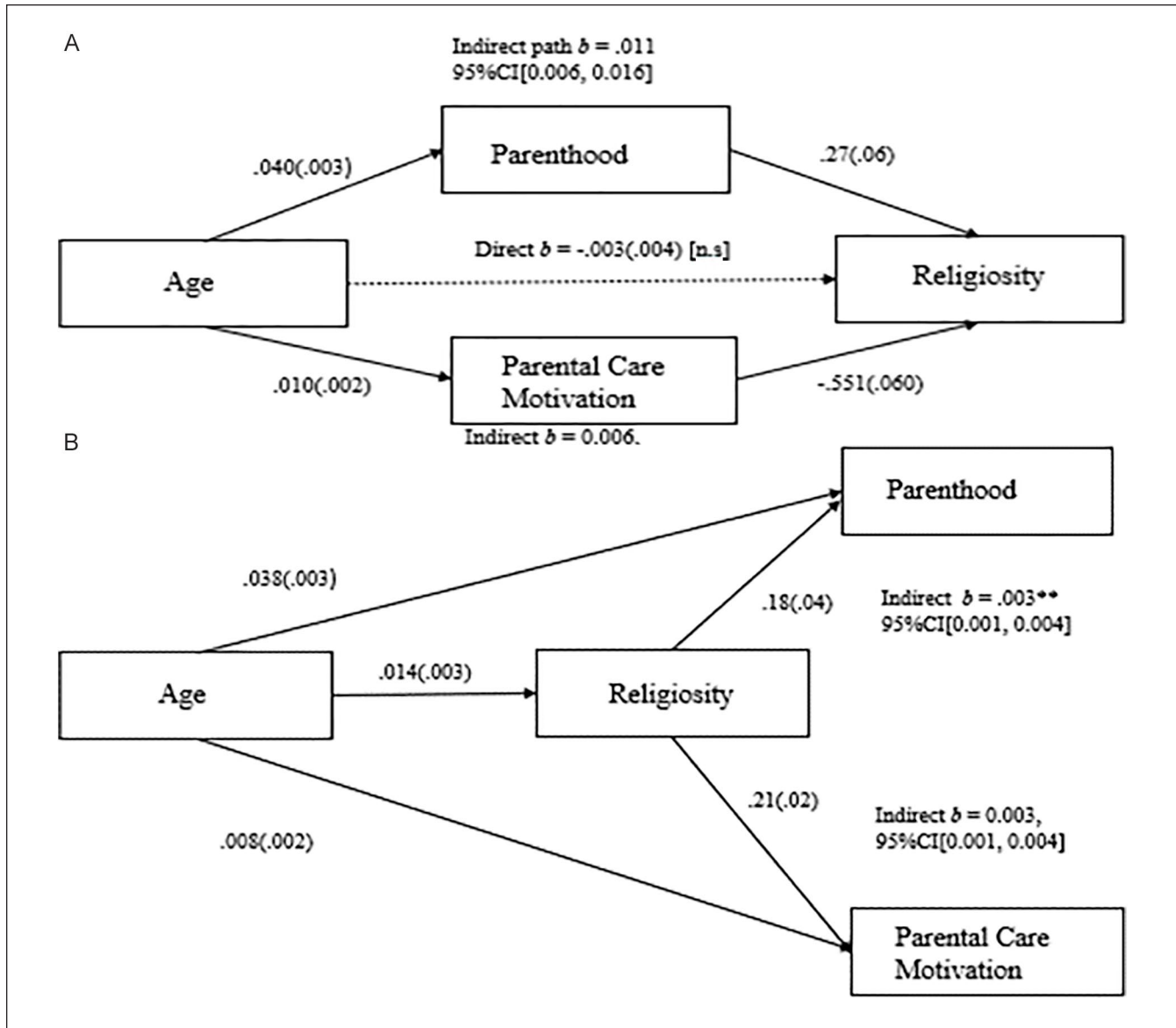
Figure 2. (A) Hypothesized mediation of age differences in religiosity by parenthood and parental care motivation, and (B) alternative mediational model.
Note. Numbers in parentheses indicate standard errors. CI = confidence interval; *ns* = nonsignificant.
All paths significant at $p < .001$ unless otherwise marked. **$p < .01$.

Table 2. Bivariate Correlations in Study 2.

Variable	2	3	4	5	6
1. Parental care motivation	.44***	.17***	−.27***	.29***	.32***
2. Parenthood	—	.15***	−.24***	.18***	.21***
3. Belief in a dangerous world			−.22***	.10**	.38***
4. Short-term mating orientation			—	−.36***	−.39***
5. Long-term mating orientation				—	.15***
6. Religiosity					—

**$p \leq .01$. ***$p \leq .001$.
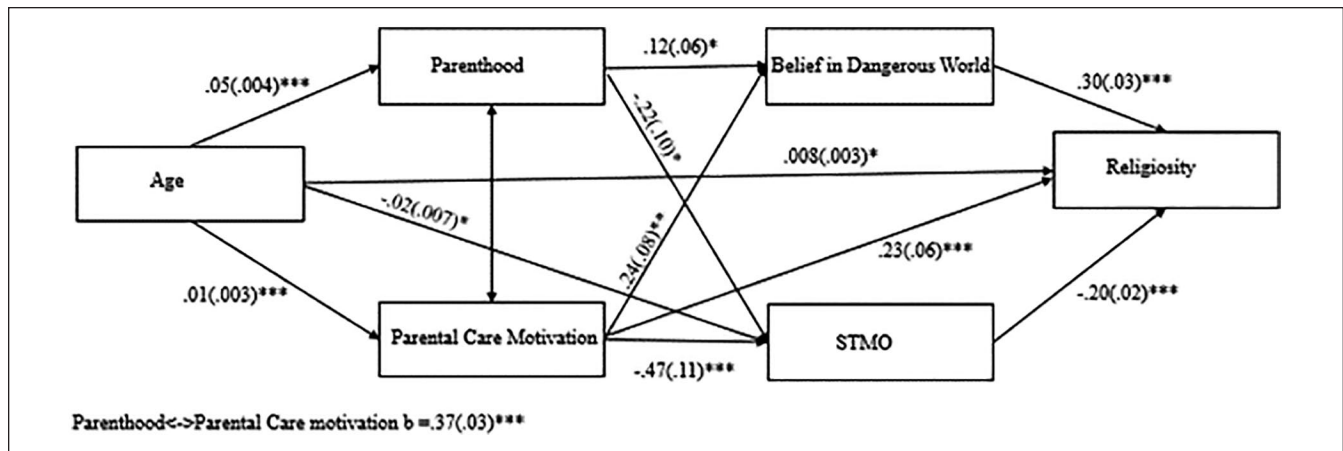
Figure 3. Path model (1b) testing serial and parallel mediation in Study 2.
Note. STMO = short-term mating orientation.
*p ≤ .05. **p ≤ .01. ***p ≤ .001.

motivation was a significant predictor of religiosity, β = 0.32, p < .001, 95% CI = [0.26, 0.39].[2] This association was robust to simultaneously controlling for age, sex, marital status, family income, and political party affiliation, β = .28, p < .001. Objective parenthood status similarly significantly predicted religiosity when simultaneously controlling for these variables, β = .12, p = .024. The relationship between parental care motivation and religiosity was positive in both parents (r = .10) and nonparents (r = .37), although the association was only significant in nonparents.

Experimental effects. We predicted a main effect of condition on religiosity in 25- to 45-year-olds, based on exploratory findings in Study 1 (see SOM). A two-way ANOVA with condition and parenthood as fixed factors revealed no effect of condition in this age group, $F(1, 477) = .67$, $p = .41$, $\eta_p^2 = .001$.

Mediation of age differences in religiosity. We predicted that age would positively predict religiosity and that parenthood status would mediate this relationship. Indeed, religiosity increased with age, β = .22, p < .001. Adding parenthood as a second predictor revealed concurrent unique associations of both age (β = .15, p < .001) and parenthood (β = 0.16, p < .001) with religiosity. As predicted, age increases in religiosity were partly accounted for by increases in parental care motivation: a bootstrapping procedure revealed a significant indirect effect, b = 0.006 (SE = 0.001), 95% CI = [0.004, 0.008], whereas the direct effect of age remained significant, b = 0.014 (SE = 0.003), 95% CI = [0.008, 0.021]. Results of a parallel mediation model (using LAVAAN) revealed significant and independent indirect effects through both parenthood, b = .010 (SE = .003), 95% CI = [0.005, 0.015], p < .001, and parental care motivation, b = .006 (SE = .001), 95% CI = [0.003, 0.009], p < .001, but no direct effect of age, b = .004

(SE = .004, 95% CI = [−0.004, 0.013], p = .293.[3] The indirect effect through parenthood accounted for 50% of the original effect, whereas the indirect effect through parental care motivation accounted for 30%.

Consistent with Study 1, an alternative model, in which religiosity was positioned as a mediator of the effects of age on parenthood and parental care motivation found much reduced indirect effects, accounting for 31% of the association between age and parental care motivation and less than 7% of the association between age and parenthood (see SOM).

Mediation by mating orientation and belief in a dangerous world. As shown in Table 2, parental care motivation was positively associated with religiosity and belief in a dangerous world, and negatively associated with short-term mating orientation. To test a fuller hypothesized model, in which parenthood and parental care motivation mediated age effects on religiosity through both belief in a dangerous world and short-term mating orientation, we constructed an initial model in LAVAAN (Model 1a), allowing all plausible directional causal pathways and allowing parenthood and parental care motivation to covary. We then fitted a second model (Model 1b, shown in Figure 3), which dropped two nonsignificant pathways from Model 1a. Fit indices for Model 1b indicated adequate model fit (standardized root mean squared residual [SRMR] = .04, root mean square error of approximation [RMSEA] = .08, comparative fit index [CFI] = .97, and Tucker–Lewis index [TLI] = .89). All indirect paths in Model 1b were statistically significant (see SOM for parameter estimates). Thus, the effect through parenthood is mediated by both belief in a dangerous world and short-term mating orientation, whereas the relationship between parental care motivation and religiosity is mediated by short-term mating orientation but not belief in a dangerous world. This

is consistent with the (speculative) explanation that parenthood leads to increases in protective instincts, whereas both parenthood and age-related increases in parental care motivation (regardless of parenthood status) lead to downregulation of interest in short-term mating. All three of these shifts, in turn, uniquely predict decreases in religiosity. Alternative models (plus subsequent iterations removing nonsignificant paths) in which the parenting variables were entered as outcomes produced poor model fit (see SOM, Figures S6 to S9).

A final exploratory model tested whether long-term mating orientation added explanatory value as an additional mediator to Model 1b. However, long-term mating orientation was nonsignificantly associated with religiosity in this model, and the addition of this variable worsened model fit. This suggests that the association between parental care motivation and religiosity may be better explained by reduction in short-term mating motivation (consistent with previous work, for example, Beall & Schaller, 2019) and increased protective motives, rather than being explained by increases in mate-retention motives. Overall, then, although these path results are consistent with the causal framework, caution is warranted as these are exploratory models using cross-sectional data. They cannot on their own be taken as strong evidence for causality.

Study 3

Study 3 was designed to further test the specificity of the association between parenting and religiosity. The central hypothesis implies that parents and those higher in parental care motivation are more religious because of the role that religion plays in restricting promiscuity and attenuating threats through moral norms. This hypothesis does *not* predict a similar relationship for other supernatural beliefs—such as superstitions or spiritualism. Thus, Study 3 included measures of these nonreligious supernatural beliefs as a comparison.

Furthermore, Study 3 aimed to test a plausible alternative explanation for the results from Studies 1 and 2: that a more religious upbringing leads to increased parental care motivation while concurrently accounting for higher religiosity in adulthood. Study 3 thus included a measure of childhood exposure to religion as a stringent control variable. Study 3 also included a more established religiosity measure—the Centrality of Religiosity scale.

We preregistered five predictions, detailed at aspredicted. org/bv9pf.pdf: (a) parents would score higher on religiosity than nonparents, (b) parental care motivation would positively predict religiosity, (c) both parenthood status and (d) parental care motivation would mediate age differences in religiosity, and (e) the relationship between parental care motivation and religiosity would be significantly larger than the relationship between parental care motivation and nonreligious supernatural beliefs. In addition to these predictions, sample size and analysis plans were preregistered.

Method

Six hundred participants were prepaid on MTurk. Anyone who participated in Studies 1 and 2 was excluded. In total, 613 surveys were submitted. Seventeen participants failed the attention check, leaving 596 participants (339 women; 263 parents, ages 18–72 years, $M_{age} = 35.88$, $SD = 12.23$). This sample size gave 0.8 power to detect a correlation of $r = .12$. Study 3 did not include an experimental manipulation.

The sample included participants of several religious denominations (34.4% Protestant, 22.7% Catholic, 2.6% Other Christian, 2.6% Jewish, 1.9% Muslim, 1.5% Buddhist, 0.3% Hindu, and 34.0% no religious denomination identified. The "other" category included a range of answers (e.g., "agnostic," "spiritualist," "no affiliation," and "pantheist"). Of participants who identified with a religious denomination, 90.1% indicated a Christian denomination.

Measures

Parenthood. As in Studies 1 and 2, parenthood status was assessed with the question, "Do you have children?"

Parental care motivation. As in Studies 1 and 2, parental care motivation was assessed with the PCAT (Buckels et al., 2015; $\alpha = .94$).

Religiosity. Religiosity was measured with the same seven-item scale as in Study 2 ($\alpha = .92$). For consistency with previous studies, it is this measure that is referred to simply as "religiosity." The 10-item Centrality of Religiosity scale was also included for comparison (Huber & Huber, 2012). Some items ask for degree of religious belief (e.g., "To what extent do you believe that God or something divine exists?"; $1 = not\ at\ all$, $5 = very\ much\ so$), whereas others assess frequency of behaviors, (e.g., "How often do you pray?"; $1 = never$, $5 = very\ often$). The scale contains five, two-item subscales: intellect, ideology, public practice, private practice, and experience (overall $\alpha = .96$).

To test whether parenting variables were also associated with religious *attendance*, we also included a single item that asked, "How many times have you attended a religious service (church, temple, mosque, etc.) in the last three months? If you have not, please enter zero."

Childhood religious experience. We adapted the Childhood Religious Experience Inventory–Primary Caregiver (Tratner et al., 2017), which assesses childhood exposure to religious ideas from a primary caregiver and engagement with religious activities. As preregistered, we omitted four items assessing whether the caregiver allowed freedom in choosing between different religions as we were not interested in *which* religion participants adopted, but the degree of religiosity. This left 12 items assessing agreement (on a 6-point scale, from *strongly disagree* to *strongly agree*), with statements such as "my primary caregiver . . .," ". . . told me that

Table 3. Bivariate Correlations in Study 3.

Variable	2	3	4	5	6	7	8
1. Parental care motivation	.37***	.37***	.37***	−.04	.01	−.08	−.03
2. Parenthood		.29***	.32***	.13*	.16**	.10	.08
3. Religiosity		—	.90***	.17***	.14***	.15**	.15***
4. Centrality of religiosity			—	.28***	.23***	.20***	.25***
5. Supernatural beliefs				—	.75***	.73***	.90***
6. Psi					—	.42***	.70***
7. Superstition						—	.49***
8. Spiritualism							—

*$p \le .05$. **$p \le .01$. ***$p \le .001$.

God loves me" and ". . . encouraged me to join a religious youth group" (α = .86).

Supernatural beliefs. The Paranormal Beliefs Scale (Tobacyk, 2004) was adapted to a shorter 11-item scale (α = .90), which included three subscales: Superstition, Spiritualism, and Psi. These items asked participants to rate agreement with statements such as "Black cats can bring bad luck" (superstition), "During altered states, such as sleep or trances, the spirit can leave the body" (spiritualism), and "A person's thoughts can influence the movement of a physical object" (psi) on a 7-point scale from *strongly disagree* to *strongly agree*.

Demographics. Participants also reported their age, ethnicity, gender, marital status, political affiliation, and current household income.

Results

Associations between parenthood, parental care motivation, and religiosity. Parents scored higher on religiosity than nonparents, 5.06 vs. 4.03, $t(591) = 7.29$, $p < .001$, Cohen's $d = 0.60$, 95% CI = [0.44, 0.77]. This difference was mirrored by scores on the Centrality of Religiosity scale, 3.21 vs. 2.44, $t(591) = 8.12$, $p < .001$, $d = 0.67$, 95% CI = [0.50, 0.84]. Parents also reported having attended more religious services in the past 3 months, 4.68 versus 2.26, $t(530) = 3.68$, $p < .001$, $d = 0.32$, 95% CI = [0.15, 0.59]. The relationship between parenthood and religiosity was robust to simultaneously controlling for age, sex, family income, and political party affiliation (β = 0.19, $p < .001$).

As predicted, the association between parental care motivation and religiosity was larger than the association between parental care motivation and other supernatural beliefs, Fisher's $z = 7.46$, $p < .001$. In fact, parental care motivation was not significantly correlated with either a total of the nonreligious supernatural beliefs or any of the three subscales (see Table 3). The relationship between objective parenthood status and religiosity was also larger than for parenthood and nonreligious supernatural beliefs, $z = 2.95$, $p = .003$.

Table 3 shows correlations between parental care motivation and the main outcome variables. As in Studies 1 and 2, there was a positive relationship between parental care motivation and religiosity, $r(594) = .37$, $p < .001$, which was present in both parents ($r = .22$, $p < .001$) and nonparents ($r = .37$, $p < .001$). The overall relationship between parental care motivation and the Centrality of Religiosity scale was identical in magnitude to the association for the seven-item religiosity scale, $r(596) = .37$, $p < .001$. Parental care motivation was significantly associated with all five subscales of the Centrality of Religiosity scale, Ideology, $r(594) = .33$, Experience, $r(594) = .34$, Intellect, $r(594) = .34$, Public Practice, $r(596) = .35$, and Private Practice, $r(594) = .35$. The association between parental care motivation and religiosity was robust to controlling for demographic variables, including age, sex, family income, parenthood status, and political party affiliation, β = 0.33, $p < .001$. Parental care motivation also positively predicted religious attendance, β = 0.16, $p < .001$ (β = 0.18, $p < .001$, for a ±3 SD winsorized version of the variable).

Childhood religious experience significantly predicted religiosity, β = 0.26, $p < .001$. However, parents were not significantly higher on childhood religious experience than nonparents, 3.05 versus 2.91, $t(591) = 1.48$, $p = .139$, $d = 0.13$. This latter result is inconsistent with the alternative causal explanation that people higher in religiosity are more likely to become parents. Entering parenthood and childhood religious experience together in a regression made little difference to the effect size of either parenthood, β = 0.27, $p < .001$, or childhood religious experience, β = 0.24, $p < .001$. The association between childhood religious experience and parental care motivation was nonsignificant, $r(596) = .08$, $p = .072$. Including both variables as predictors in a linear regression predicting religiosity revealed simultaneous unique effects of both variables (parental care motivation, β = 0.36, $p < .001$; childhood religious experience, β = 0.23, $p < .001$). Thus, we found no evidence that the relationships between parenthood, parental care motivation, and religiosity can be explained by religious upbringing.

Mediation of age differences in religiosity. We predicted that age differences in religiosity would be mediated by both

parental care motivation and parenthood. Age was significantly associated with religiosity, β = 0.19, *p* < .001. However, including parenthood and parental care motivation in the same regression model yielded significant unique effects of parental care motivation, β = 0.30, *p* < .001, and parenthood, β = 0.15, *p* < .001, but a nonsignificant effect of age, β = 0.07, *p* = .067.

We initially preregistered two mediation analyses, with parenthood and PCAT included as single mediators in separate models. Although both analyses supported predictions (see SOM), we retroactively decided that a bootstrapped parallel mediation model would be a more informative analysis. This model (using LAVAAN), including both parenthood and parental care motivation as mediators, revealed independent, indirect effects through both parenthood, *b* = .021 (*SE* = .004), 95% CI = [0.012, 0.030], *p* < .001, and parental care motivation, *b* = .010 (*SE* = .003), 95% CI = [0.005, 0.016], *p* < .001, but no direct effect of age, *b* = −.004 (*SE* = .007), 95% CI = [−0.018, 0.010], *p* = .574. In this model, the indirect effect through parenthood accounted for just below 78% of the original effect and parental care motivation for 37% (these percentages add to more than 100% because the total indirect effects were greater than the original correlation, leading to a negative direct effect in the model).

An alternative model placing religiosity as a mediator of the effects of age on parenthood and parental care motivation found a much-reduced indirect effect, accounting for 31% of the association between age and parental care motivation and below 7% of the association between age and parenthood (see SOM).

In sum, all five of the preregistered predictions for Study 3 were supported. Furthermore, exploratory analyses revealed that the relationships between parenthood, parental care motivation, and religiosity were independent of self-reported childhood religious experiences.

Study 4a

Given that manipulations in Studies 1 and 2 were online-only and did not explore potential moderators, Study 4a used a more interactive manipulation and included a measure of participants' emotional engagement with the manipulation to test for moderation effects. This study was not intended to further test the mediation of the age/religiosity relationship, given the restricted age range of undergraduate samples. Study 4a was not preregistered.

Method

Participants. Participants were 402 undergraduate students recruited from a private university in the southern United States, who participated in exchange for partial course credit. A sample size of 400 was decided upon a priori to provide more than 80% power to detect a small-to-moderate effect size of Cohen's *d* = .30 between two conditions after

provisioning for ~10% exclusions. Twenty-six participants were excluded for failing an attention check (which simply instructed them to click on the "agree completely" option for one item), leaving an analyzed sample of 376 participants (374 nonparents, 220 females, mean age = 19.16 years, *SD* = 2.35). The majority of the sample (73.1%) identified as White/Caucasian, 5.3% as Black/African American, 5.1% as Latino/Hispanic, 5.9% as South Asian, 3.9% East Asian, 5.6% mixed ethnicity, and 1.3% other ethnicity (0.3% no answer). Of the 374 participants who reported their religious affiliation, 34.8% were Christian, 28.6% reported no religious affiliation, 25.5% were Jewish, 3.7% Hindu, 1.6% Muslim, 0.8% Buddhist, 0.3% Sikh, and 4.6% other religion.

Procedure. Prospective participants were given the opportunity to sign up for a 30-min online study through the Zoom video-chat service at a predesignated time. They then met an experimenter (one participant at a time) at a link provided to them when signing up. Upon arriving in the chat room, participants were told about the general composition of the study and sent a link to the online survey. After consenting, participants completed the first part of the questionnaire, which included the parental care motivation scale, questions about their parents' attitudes, and demographic questions. Unlike Studies 1 and 2, the parental care motivation measure was included *before* the manipulation, so that it could be tested as a potential moderator of condition effects.

Upon completion of the first part of the questionnaire, participants were instructed to inform the experimenter that they were ready for the next part of the study. Participants were randomly assigned to one of the two conditions (childcare or control, described below), and the experimenter then proceeded with the experimental manipulation.

Participants in the childcare condition were asked to imagine being the parent of a child (questions and materials adapted from Jones et al., 2019). They were also asked to pick from a collection of 12 photographs of young children based on who most closely resembled how they would imagine their own future child. Participants then responded to a series of questions, asked by the experimenter, about the types of activities that they would do with this child in their imagined role as a parent and the types of feelings they would experience.

In the control condition, participants chose from one of 12 images of leisure and household objects and responded to a parallel set of prompts asking them to imagine enjoyable activities and to describe how they would feel while doing them.

Measures

Religiosity. We used the same seven-item scale as in Studies 2 and 3, α = .86.

Parental care motivation. Parental care motivation was assessed using a validated 10-item measure of the PCAT scale (Buckels et al., 2015; Hofer et al., 2018), α = .77.
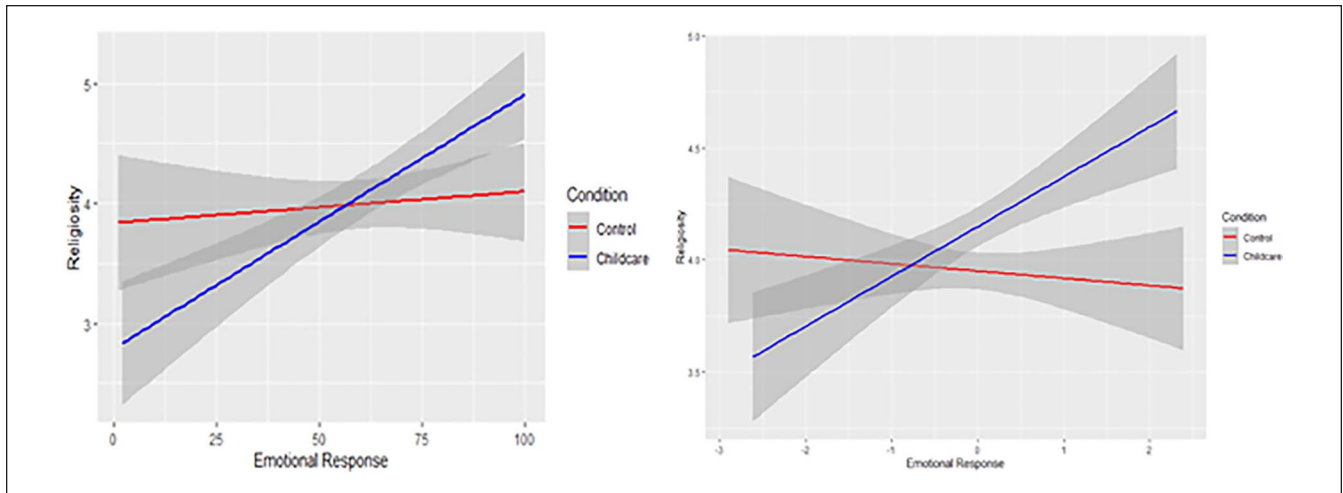
Figure 4. Effects of experimental condition on religiosity by levels of emotional response to manipulation in Study 4a (left, *n* = 402) and Study 4b (right, *n* = 1,565).
Note. Gray areas indicate 95% confidence intervals.

Parental religiosity. To assess parental religiosity, participants were asked to "Think of the parent or primary caregiver who spent most time with you as a child. This question is about their attitudes, not yours. How religious would you rate them, in comparison to the average American?" with a similar, optional, question for a second caregiver. Scores were then standardized and averaged (in cases where there were two caregivers).

Emotional response to manipulation. Participants were asked to rate their emotional response to the previous imagination task from 0 to 100 (0 = *no emotional response*, 100 = *extremely strong*).

Results and Discussion

Parental care motivation was positively correlated with religiosity, $r(374) = .22$, $p < .001$. Although participants' religiosity was highly correlated with their parents' religiosity ($r = .49$, $p < .001$), this appeared to be independent of the association between religiosity and parental care motivation: including both variables as predictors in a linear regression model (with religiosity as the dependent variable) resulted in unique associations with both parental care motivation, $\beta = .20$, $p < .001$, and parental religiosity, $\beta = .48$, $p < .001$.

Participants scored negligibly and nonsignificantly higher on religiosity in the childcare condition, 4.09 vs. 4.01, $t(374) = -0.53$, $p = .595$, 95% CI = [−0.39, 0.21]. However, exploratory bootstrapped moderation analyses (PROCESS, Model 1) found a significant interaction effect for condition and emotional response, $b = 0.02$ ($SE = 0.006$), $p = .003$, 95% CI = [0.007, 0.31]. Further analysis of conditional effects revealed that participants who reported

stronger (+1 *SD*) emotional responses to the manipulation reported greater religiosity in the childcare (vs. control) condition, $b = 0.48$ ($SE = .19$), $p = .014$, 95% CI = [0.10, 0.86], whereas those reporting average responses showed only a small, nonsignificant effect in this direction, $b = 0.16$ ($SE = 0.14$), $p = .26$, 95% CI = [−0.12, 0.44], and those reporting weaker (−1 *SD*) emotional responses showed a nonsignificant effect in the opposite direction, $b = -0.39$ ($SE = 0.21$), $p = .061$, 95% CI = [−0.80, 0.02]. This interaction is shown in Figure 4.

A similar analysis with parental care motivation as the moderator variable also found a significant moderation effect, $b = 0.54$ ($SE = 0.22$), $p = .016$, 95% CI = [0.10, 0.98]. Analysis of simple slopes at different values of the moderator revealed that effects of condition on religiosity were slightly negative for participants with lower (−1 *SD*) parental care motivation, $b = -0.23$ ($SE = 0.19$), $p = .239$, 95% CI = [−0.60, 0.15], nonsignificantly positive for those with average parental care motivation scores, $b = 0.15$ ($SE = 0.14$), $p = .289$, 95% CI = [0.13, 0.43], and more strongly positive for those with higher (+1 *SD*) scores, $b = 0.43$ ($SE = 0.19$), $p = .031$, 95% CI = [0.04, 0.80].

Study 4a thus found preliminary evidence that a childcare manipulation increased religiosity in participants who engaged more with the manipulation, but not with less engaged participants.

Study 4b: Reexamination of Experimental Data From Studies 1 and 2

Given the moderating effects of emotional engagement on the experimental manipulation in Study 4a, we investigated whether a similar moderating effect of emotional engagement may have been present in Studies 1 and 2 (in both
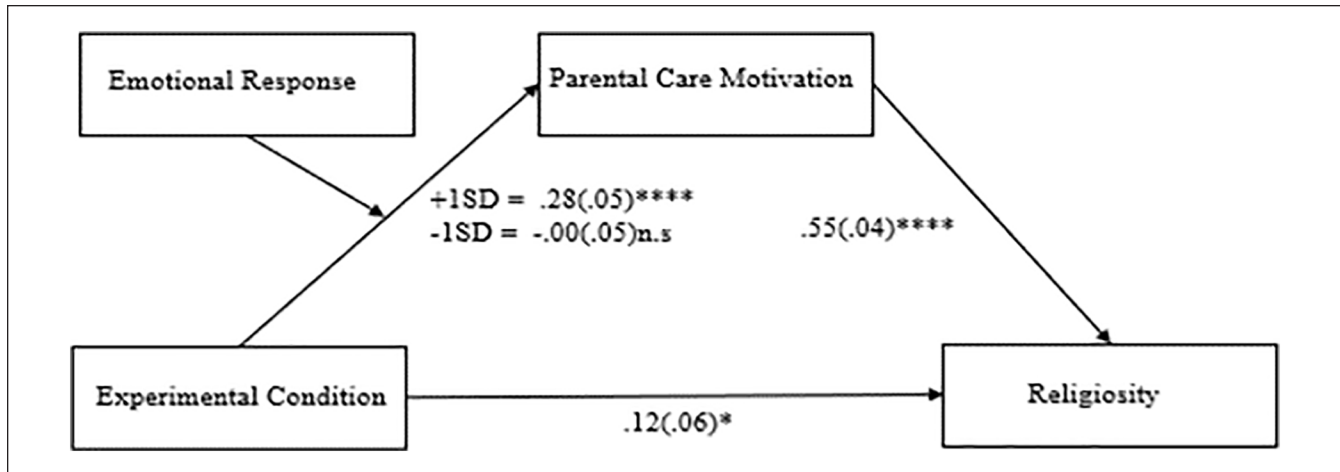
Figure 5. Moderated mediation in Study 4b.
Note. ns = nonsignificant.
*p < .05. ****p < .0001.

studies, each participant free-wrote about their reactions to the prime).

Method

For each participant response, we had two research assistants (who were blind to hypotheses) rate each participant's written responses to primes for emotionality on a scale of 1 to 5, where "5" indicates a *highly emotional response* and "1" indicates *no emotionality or responses*, indicating no engagement (i.e., inappropriate response to question or responses that were seemingly copy-pasted from the internet). To control for systematic differences in emotional response across conditions (scores were higher in the childcare condition), scores from the two research assistants were averaged and *z* scored relative to the study and condition to give an emotional response score. Scores from the two raters correlated moderately ($r = .41$). As the inter-rater correlation was modest, we checked robustness by running the main analyses (below) with each rater individually. For both analyses, this yielded significant results with the same patterns of moderation for both raters. Given that the methods were almost identical between Studies 1 and 2—and given the substantial sample sizes required to reliably accurately detect moderation effects (Blake & Gangestad, 2020)—data were combined to maximize power, giving an analytical sample size of 1,565 participants. Data from both control conditions in Study 2 were used in the combined control condition.

Results and Discussion

A bootstrapped regression moderation analysis (PROCESS macro, Model 1), with condition as the independent variable, emotional response as the moderator, and religiosity as the dependent variable yielded a significant interaction,

$b = 0.29$ ($SE = 0.08$), $p < .001$, 95% CI = [0.11, 0.41]. Analysis of conditional effects revealed a similar pattern to the interaction in Study 4a: Participants with unemotive responses showed no effects of experimental condition, $b = -0.00$ ($SE = 0.08$), $p = .963$, 95% CI = [−0.16, 0.17], whereas those with average responses showed small positive effects, such that they scored higher on religiosity in the childcare condition than in the control condition, $b = 0.16$ ($SE = 0.06$), $p = .010$, 95% CI = [0.04, 0.29], whereas participants with stronger emotional responses showed substantially larger effects in this direction, $b = 0.39$ ($SE = 0.08$), $p < .0001$, 95% CI = [0.22, 0.55].

To further test the hypothesized relations between variables, we tested a moderated mediation model, as shown in Figure 5, using Model 7 of the PROCESS macro (this was not possible in Study 4a as parental care motivation was measured before the manipulation). This model showed moderated mediation consistent with the logical framework: At higher levels of emotional response, there was a significant indirect effect of condition on religiosity through parental care motivation (such that scores on religiosity were higher in the childcare condition, with this effect mediated by increases in parental care motivation), $b = 0.15$ ($SE = 0.03$), 95% CI = [0.10, 0.21]. At average levels, there was a smaller indirect effect, $b = 0.06$ ($SE = 0.02$), 95% CI = [0.02, 0.11], and at lower levels there was no effect, $b = -0.00$ ($SE = 0.03$), 95% CI = [−0.06, 0.06].

To inform future experimental work, we also conducted exploratory analyses by age group in this combined dataset. Although there was no linear interaction between condition and age ($b = 0.00$, $p = .98$), participants aged 25 to 35 years (an age at which many either have children or are considering doing so soon and which has been the focus of other research on parental manipulation effects, for example, Fessler et al., 2014) showed much larger effects than

participants in other age categories ($b = 0.37, p < .001$) than participants in other age categories ($b = 0.08, p = .343$) and interaction ($b = 0.34, p = .020$).

In summary, although these patterns were not predicted a priori, Studies 4a and 4b found, and replicated, theoretically consistent results showing that two different childcare manipulations increased religiosity for participants who were emotionally engaged with the manipulation, but had no effect for those who were not.

Study 5

Study 5 aimed to test the universality and boundary conditions of the relationship between parenthood and religiosity, using a large, international dataset: the sixth wave of the World Values Survey (WVS, collected 2010–2014; Inglehart et al., 2014). We predicted that parenthood would be associated with greater religiosity across the whole dataset (independent of differences in religiosity). We were also interested in whether the relationship between parenthood and religiosity is specific to certain religions. In addition, as national-level wealth is negatively associated with religiosity, and as childlessness is more common in wealthier countries, Study 5 also included a measure of gross domestic product (GDP) as a covariate and potential moderator.

Study 5 was not preregistered.

Method

The sixth wave of the WVS has individual-level data from participants across 60 countries ($N = 89,565$). The sampling methodology employs random (or quota) sampling, meaning that within-country samples are typically more representative of the wider population than samples taken from online survey platforms or undergraduate samples. The full data are publicly available. To help more easily reproduce our analyses, we have also publicly uploaded a short version of the dataset (https://osf.io/s9yx5/?view_only=5529104a70c641a193c19e688e113065), which includes the variables specific to this study.

Measures

Religiosity. The WVS contains three individual-level measures of religiosity from a subsection assessing secular values. Participants were asked the frequency of their religious practice, whether they were a religious person, and how important they considered religion to be. Scores for each of these items ranged continuously from 0 to 1. For ease of interpretation, we inverted the scores so that higher scores indicate higher religiosity. We averaged the three measures to give a single combined religiosity measure (Cronbach's $\alpha = .73$).

Parenthood. As in studies 1 to 3, parenthood status was a dichotomous variable.

National wealth. We operationalized national wealth as GDP per capita (based on 2017 United Nations data). The raw variable was heavily positively skewed and was thus log-transformed for all analyses.

Age and sex. Age was strongly positively skewed and was thus log-transformed for all analyses. Biological sex was treated as a dichotomous variable, with all answers other than "male" and "female" treated as missing (there was no option for "intersex" in the original WVS survey).

Results and Discussion

Does the relationship between parenthood and religiosity exist globally?. To test the overall association between parenthood and religiosity, we ran a mixed-effects model with parenthood as the Level 1 fixed-effects variable and country as the Level 2 random-effects variable. Consistent with Studies 1 to 3, parenthood status positively predicted religiosity ($b = .04, SE = 0.002, t = 16.32, p < .001$, 95% CI = [0.032, 0.042]). As older adults and women are known to be more religious, and wealthier countries tend to be less religious, it was important to control for these variables. Adding a proxy of national wealth (nominal GDP per capita), alongside parenthood, age, and sex, as fixed effects variables and with country as the Level 2 random-effects variable, the effect of parenthood remained, $b = 0.03$ ($SE = 0.003$), $t = 12.61, p < .001$, 95% CI = [0.028, 0.038], as well as a positive effect of age, $b = 0.02$ ($SE = 0.007$), $t = 3.38, p < .001$, 95% CI = [0.001, 0.037], being female, $b = 0.03$ ($SE = 0.002$), $t = 14.04, p < .001$, 95% CI = [0.025, 0.033], and a negative effect of GDP, $b = -0.21$ ($SE = 0.002$), $t = 105.41, p < .001$, 95% CI = [−0.213, −0.205]. The addition of these covariates each led to better model fit as measured by both Akaike information criterion (AIC) and Bayesian information criterion (BIC) statistics, so these covariates were retained for further analyses.

A similar linear mixed effects model, which did not include parenthood, yielded a significant effect of age that was roughly twice the magnitude as compared with the model with parenthood included, $b = 0.08$ ($SE = 0.006$), $t = 14.07, p < .001$, 95% CI = [0.071, 0.094]. Thus, as with the U.S. samples, parenthood status accounted for more than half (56.6%) of the association between age and religiosity.

Is the relationship between parenthood and religiosity specific to certain religions?. To assess whether the parenthood–religiosity relationship was specific to certain religious groups, we analyzed relationships between parenthood and religiosity at both the country- and individual level, to consider both individual-level and societal-level influence. For the country-level analyses (Table 4), we assigned each country a code according to the major religion that was the most widely reported in that country. Meanwhile, for individual-level analyses, we split the file according to the individual's self-reported religious affiliation (Table 5). All coefficients were

Table 4. Unstandardized Coefficients for Parenthood Predicting Religiosity by Religious Denomination at Country Level.

Main religion	k	n	b_u	95% CI	b_c	95% CIs
Christian	33	49,305	0.04***	[0.037, 0.050]	0.04***	[0.033, 0.046]
Islamic	19	24,829	0.03***	[0.022, 0.036]	0.02***	[0.016, 0.032]
Hindu	1	4,078	0.04***	[0.019, 0.054]	0.03**	[0.007, 0.050]
Buddhist	3	4,410	0.11***	[0.094, 0.130]	0.06***	[0.039, 0.084]
Nonreligious	5	7,401	0.02**	[0.008, 0.039]	−0.02*	[−0.040, −0.005]

Note. k = number of countries in each religious group. b_u = uncorrected coefficient; b_c = after controlling for sex, age, and GDP; CI = confidence interval.
*p < .05. **p < .01. ***p < .001.

Table 5. Unstandardized Coefficients for Parenthood Predicting Religiosity by Religious Denomination at Individual Level.

Religion	n	b_u	95% CIs	b_c	95% CIs
Christian	35,965	0.03***	[0.020, 0.032]	0.02***	[0.018, 0.031]
Islamic	21,917	0.03***	[0.022, 0.036]	0.01**	[0.004, 0.021]
Hindu	3,905	0.05***	[0.028, 0.064]	0.02*	[0.003, 0.044]
Buddhist	3,799	0.07***	[0.028, 0.046]	0.03	[−0.002, 0.040]
Jewish	175	0.00	[−0.097, 0.102]	0.04	[−0.060, 0.144]

Note. b_u = uncorrected coefficient; b_c = after controlling for sex, age, and GDP; CI = confidence interval.
*p < .05.**p < .01. ***p < .001.

derived from mixed-effects models, with fixed effects nested within country.

There was a small, but significant, association between parenthood and religiosity in Christian, Muslim, Hindu, and Buddhist countries, which was robust to controlling for sex, age, and GDP (there were no majority Jewish or Sikh countries). However, there was only a small association in countries where nonreligious people outnumbered any religious group, and this relationship became slightly negative when accounting for age, sex, and national income. At the individual level, Christians, Muslims, Hindus, and Buddhist parents were more religious than nonparents of those religions although the association for Buddhists was nonsignificant after controlling for sex, age, and GDP. No relationship emerged for Jewish people although the relatively small sample size (175), along with the fact that these individuals were distributed across several countries, renders this estimate less reliable than the others.

Is the association between parenthood and religiosity larger in wealthier countries?. Although we made no a priori predictions about effects of national wealth, GDP was associated with both lower religiosity and with lower likelihood of being a parent after controlling for age, and further visualizations supported this relationship. Thus, we ran another model with parenthood, age, sex, and GDP as fixed effect predictors (all nested within country as a Level 2 random-effects variable), but added a parenthood by GDP interaction term. This yielded a significant interaction, indicating that effects of parenthood were larger in wealthier countries, $b = 0.05$ (*SE* = 0.004), $t = 11.04$, $p < .001$, 95% CI = [0.038, 0.054]. As

shown in Figure 6, average relationships are moderate ($\beta s \sim$ .20) in the wealthiest countries, but are close to zero in the poorest countries. It should be noted that these coefficients are not adjusted for age and sex.

One possible explanation for this relationship is that birth control is more widely available in wealthier countries, and childlessness is more common (indeed, in this dataset, childlessness is more common in wealthier countries for people of the same age, implying that people in wealthier countries may exercise more choice in whether they become a parent). This greater choice would allow greater influence of individual differences in parental care motivation on whether a person becomes a parent (as opposed to it being an inevitable result of having a sexual relationship in which both partners are fertile). Furthermore, wealthier countries tend to have more nonreligious individuals and thus less social (or in some cases legal) pressure to describe oneself as religious, meaning that people in these countries may also exhibit greater variation in religiosity. Consistent with this idea of reduced variation, there is some indication of ceiling effects in the WVS data, with several countries averaging >0.90 (and as high as 0.97) from a maximum religiosity score of 1.00, with these countries being overwhelmingly poorer (as shown above, there is a strong negative relationship between GDP and religiosity). However, although these explanations are plausible, they were not predicted a priori, and should be treated as tentative hypotheses: further research is necessary to properly understand the reasons for this moderation effect.
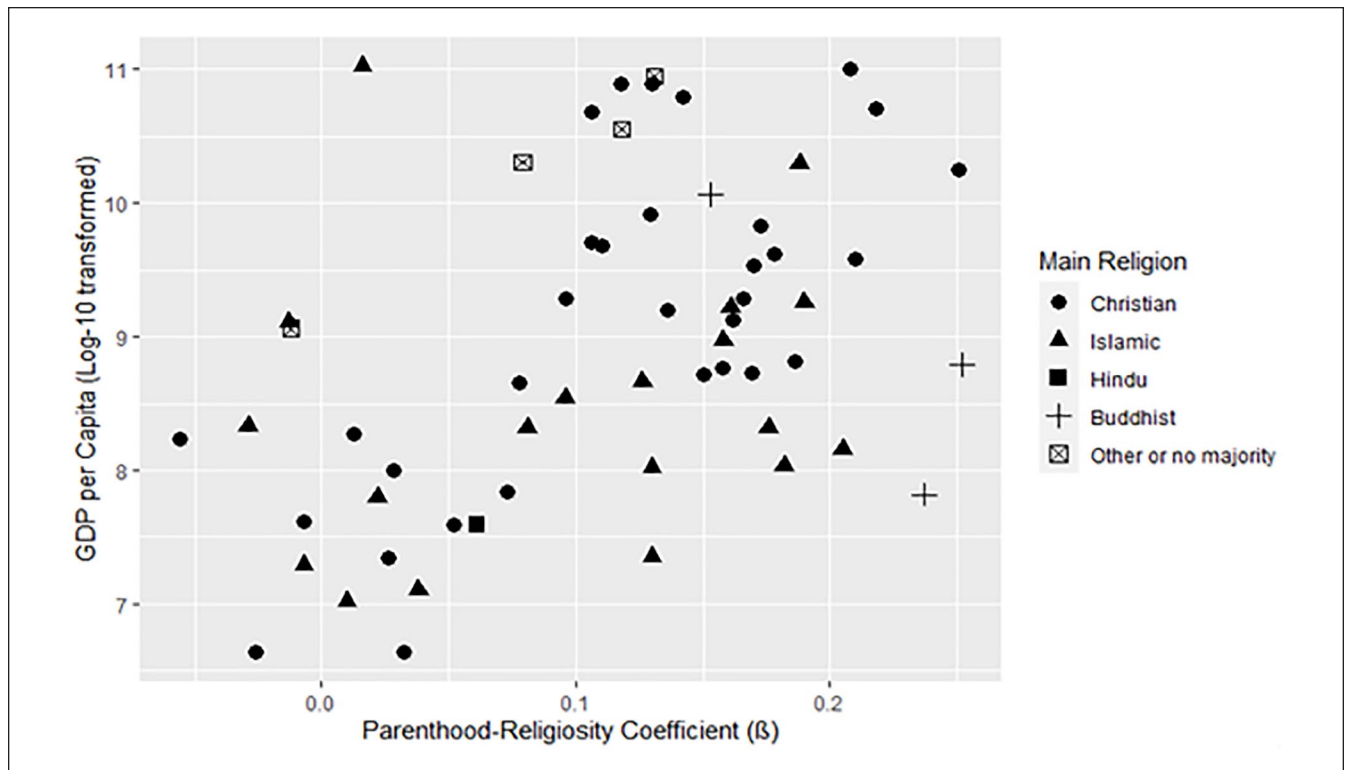
Figure 6. Standardized bivariate effect sizes for parenthood predicting religiosity, plotted by country, national GDP, and main national religion.
Note. GDP = gross domestic product.

General Discussion

The psychology of parenthood appears to have implications for religiosity. Across five studies, this relationship exists with both objective parenthood status and subjective parental care motivation, and is consistent across multiple measures of religiosity. These studies found both correlational and experimental evidence consistent with the hypothesis that parenting motives influence religiosity.

First, three online studies ($N > 2,100$) found consistent evidence that—in American samples—both parenthood and parental care motivation were associated with strength of religious belief and (in Study 3) self-reported religious attendance. Comparative analyses revealed that parental care motivation was the stronger predictor of religiosity. Beyond these correlational findings, the results of several analyses are consistent with the hypothesis that parenting motives lead to increases in religiosity. The most direct evidence comes from the finding that more responsive participants showed a relative increase in self-reported religiosity after childcare primes, an effect that was found in both students and online participants, and which was mediated by increases in parental care motivation.

The relationship between parental care motivation and religiosity was robust to multiple controls. Whereas parenthood and parental care motivation robustly predicted religiosity, parental care motivation did not predict any of three other

forms of supernatural belief, and parenthood status did so only weakly (Study 3). This specificity suggests that there is something particular about the characteristics of large-scale, organized religions that are functionally related to parenting. We predicted such an association between parenting and religiosity because of the role that many organized religions play in prescribing protective and sexually restrictive norms. Nonreligious spiritual beliefs do not typically fulfill this role. Thus, the weak or nonexistent relationships found in Study 3 support the hypothesis that parenting is related to religiosity *because* of its role in prescribing and reinforcing social norms. Finally, Study 5's global analysis ($N > 89,000$) revealed that the relationship between parenthood and religiosity was present across Christian, Islamic, Buddhist, and Hindu countries and individuals (no predominantly Jewish or Sikh countries were represented). These results are consistent with the hypothesis that there is a functional relationship between parenting and engagement with institutional religions.

The mediation of age differences in religiosity by parenthood and parental care motivation in Studies 1 to 3 is consistent with the hypothesis that age-related increases in religiosity (at least in American samples) are the result of entry into parenthood. Alternate mediational models—in which religiosity causally preceded parenthood and parental care motivation—found weaker mediational effects and

were a poorer fit for the observed data. Thus, the findings presented here offer new insight to these relationships, suggesting that parenthood and variation in parental care motivation may partly explain age-related increase in religiosity.

Further support for the directional hypothesis that parenting motives influence religiosity was provided in Studies 3 and 4a, where statistically controlling for measures of childhood religious exposure and parental religious belief had almost no effect on the relationship between parental care motivation and religiosity. Similarly, Study 1 found no evidence for other plausible "third variable" explanations, namely, that the relationship between parental care motivation and religiosity could be better explained by temporally prior indicators of sexual development or early life ecological stressors. Controlling for age of puberty onset, age of sexual debut, and measures of childhood resource scarcity and unpredictability had little effect on the strength of relationships between parenthood, parental care motivation, and religiosity. These findings are consistent with the reproductive religiosity model and add to a growing body of work suggesting that reproductive strategies may influence religiosity (e.g., McCullough et al., 2005; Weeden et al., 2008).

Of course, many plausible mechanisms may account for a causal relationship between parenthood and religion. We hypothesized a causal relationship as a consequence of parents gleaning greater benefits from safer and more sexually restricted social environments. Although the mediational models presented in Study 2 are consistent with this interpretation, they were (a) based on cross-sectional data and (b) explained less than half of the covariance between parental care motivation and religiosity. Consequently, these mediations do not in themselves constitute strong evidence for any interpretation, nor do they preclude other explanatory factors. For example, it is also possible that parenthood and parenting motives are linked to religiosity as a consequence of the perception that religion is important in children's moral education, or the belief that religious institutions reinforce community values or group cohesion.

One potentially informative avenue for future research could be to directly test the hypothesized reasons for the relationship between parenting and religiosity. For example, we might speculate that parents would be especially receptive to aspects of religion that reinforce moral norms and promote family, community, and group cohesion. Thus, future research might test this experimentally by reminding participants of these characteristics of religion and testing whether this leads to disproportionately positive shifts in attitudes toward religion for parents (relative to nonparents).

The experimental findings presented here have implications for research aiming to manipulate parental care motivation. The studies presented here suggest that future work might benefit from checking the efficacy of manipulations and exploring potential moderating individual differences. As is clear here, non-naturalistic parenting manipulations are much more emotionally potent for some people than for others. It is noteworthy that analyses in Study 4b indicated that participants in the 25 to 35 age range showed stronger experimental effects than other age groups. Although these analyses were exploratory, this finding suggests that future experimental studies should carefully consider age distributions of their target samples, and should also assess and test whether any experimental effects are conditional upon participants' degree of emotional engagement.

Future research should also strive to further investigate the extent to which the findings presented here are generalizable and explore sources of this variation. The analyses presented in Study 5 suggested that there is substantial cross-cultural variation in the relationship between parenthood and religiosity, but the origins of much of this variation remain unclear. One possibility is that certain familial and societal structures moderate this relationship. For example, if changes in parental care motives underlie the association between parenthood and religiosity, this might predict smaller relationships between parenthood and religiosity in cultures where alloparenting (i.e., children being cared for by people other than biological parents) is more common (see Kerry & Murray, 2021). Similarly, effects may vary according to the division of childcare between men and women, or it may be the case that the practice of polygyny might create cultural differences that are gender dependent, given that polygyny may differentially affect parental investment and the importance of mate-retention.

Conclusion

People vary greatly in their belief in God, their loyalty to religious institutions, and their dedication to the practices and norms that these institutions promote. This variation exists not only between individuals but also across individuals' own life spans. The studies reported here provide evidence for a functional relationship between parenting and religiosity, which may explain some of this variation. This research thus provides insight to previously established changes in religiosity over the life span (e.g., Hayward & Krause, 2015; McCullough et al., 2005), and the interplay between religion and behavioral strategies (e.g., Mahoney, 2010; Moon et al., 2019; Weeden et al., 2008), by highlighting the role of two largely unexplored calibrators of religious attitudes and behavior: parenthood and parental care motivation. Many crucial questions about the nature of this relationship remain to be addressed in future research. Nonetheless, this research implies a meaningful and robust relationship between parenthood, parental care motivation, and belief in large-scale world religions.

access publication was funded by Tulane University's Supporting Impactful Publications grant.

ORCID iD

Nicholas Kerry [iD] https://orcid.org/0000-0001-7413-4691

Supplemental Material

Supplemental material is available online with this article.

Notes

1. Note that the same preregistration also refers to predictions for measures of specific political attitudes that were part of the same wider project, but were reported elsewhere.
2. A Breusch–Pagan test, using lmtest for R, revealed significant heteroscedasticity for this association, BP = 4.16, p = .041. However, a regression involving a log-transformed version of religiosity (which eliminated this issue) yielded inferentially identical results.
3. After data collection, we made the further informed analytical choice that a parallel mediation model would be more informative than the simple mediation models involving single mediators (i.e., either parenthood or PCAT) proposed in the preregistrations for Studies 2 and 3.

References

Altemeyer, B. (1988). *Enemies of freedom*. Jossey-Bass.

Barrett, E. S., Tran, V., Thurston, S., Jasienska, G., Furberg, A. S., Ellison, P. T., & Thune, I. (2013). Marriage and motherhood are associated with lower testosterone concentrations in women. *Hormones and Behavior*, *63*(1), 72–79.

Beall, A. T., & Schaller, M. (2019). Evolution, motivation, and the mating/parenting trade-off. *Self and Identity*, *18*(1), 39–59.

Belsky, J., Steinberg, L., Houts, R. M., & Halpern-Felsher, B. L. (2010). The development of reproductive strategy in females: Early maternal harshness → earlier menarche → increased sexual risk taking. *Developmental Psychology*, *46*(1), 120–128.

Bengtson, V. L., Silverstein, M., Putney, N. M., & Harris, S. C. (2015). Does religiousness increase with age? Age changes and generational differences over 35 years. *Journal for the Scientific Study of Religion*, *54*(2), 363–379.

Blake, K. R., & Gangestad, S. (2020). On attenuated interactions, measurement error, and statistical power: Guidelines for social and personality psychologists. *Personality and Social Psychology Bulletin*, *46*(12), 1702–1711.

Buckels, E. E., Beall, A. T., Hofer, M. K., Lin, E. Y., Zhou, Z., & Schaller, M. (2015). Individual differences in activation of the parental care motivational system: Assessment, prediction, and implications. *Journal of Personality and Social Psychology*, *108*(3), 497–514.

Fessler, D. M., Holbrook, C., Pollack, J. S., & Hahn-Holbrook, J. (2014). Stranger danger: Parenthood increases the envisioned bodily formidability of menacing men. *Evolution and Human Behavior*, *35*(2), 109–117.

Grebe, N. M., Sarafin, R. E., Strenth, C. R., & Zilioli, S. (2019). Pair-bonding, fatherhood, and the role of testosterone: A meta-analytic review. *Neuroscience & Biobehavioral Reviews*, *98*, 221–233.

Gettler, L. T., McDade, T. W., Feranil, A. B., & Kuzawa, C. W. (2011). Longitudinal evidence that fatherhood decreases testosterone in human males. *Proceedings of the National Academy of Sciences of the United States of America*, *108*(39), 16194–16199.

Gettler, L. T., McDade, T. W., Feranil, A. B., & Kuzawa, C. W. (2012). Prolactin, fatherhood, and reproductive behavior in human males. *American Journal of Physical Anthropology*, *148*(3), 362–370.

Goeke-Morey, M. C., & Cummings, E. M. (2017). Religiosity and parenting: Recent directions in process-oriented research. *Current Opinion in Psychology*, *15*, 7–12.

Görlitz, K., & Tamm, M. (2015, April 15). Parenthood and risk preferences. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2618442

Gray, P. B., & Anderson, K. G. (2010). *Fatherhood: Evolution and human paternal behavior*. Harvard University Press.

Gray, P. B., Kahlenberg, S. M., Barrett, E. S., Lipson, S. F., & Ellison, P. T. (2002). Marriage and fatherhood are associated with lower testosterone in males. *Evolution and Human Behavior*, *23*(3), 193–201.

Griskevicius, V., Delton, A. W., Robertson, T. E., & Tybur, J. M. (2011). Environmental contingency in life history strategies: The influence of mortality and socioeconomic status on reproductive timing. *Journal of Personality and Social Psychology*, *100*(2), 241–254.

Griskevicius, V., Tybur, J. M., Delton, A. W., & Robertson, T. E. (2011). The influence of mortality and socioeconomic status on risk and delayed rewards: A life history theory approach. *Journal of Personality and Social Psychology*, *100*(6), 1015–1026.

Hahn-Holbrook, J., Holbrook, C., & Haselton, M. G. (2011). Parental precaution: Neurobiological means and adaptive ends. *Neuroscience & Biobehavioral Reviews*, *35*(4), 1052–1066.

Hayford, S. R., & Morgan, S. P. (2008). Religiosity and fertility in the United States: The role of fertility intentions. *Social Forces*, *86*(3), 1163–1188.

Hayward, R. D., & Krause, N. (2015). Aging, social developmental, and cultural factors in changing patterns of religious involvement over a 32-year period: An age-period-cohort analysis of 80 countries. *Journal of Cross-Cultural Psychology*, *46*(8), 979–995.

Hofer, M. K., Buckels, E. E., White, C. J., Beall, A. T., & Schaller, M. (2018). Individual differences in activation of the parental care motivational system: An empirical distinction between protection and nurturance. *Social Psychological and Personality Science*, *9*(8), 907–916.

Hrdy, S. B. (1999). *Mother nature: A history of mothers, infants, and natural selection*. Pantheon.

Huber, S., & Huber, O. W. (2012). The centrality of religiosity scale (CRS). *Religions*, *3*(3), 710–724.

Inglehart, R., Haerpfer, C., Moreno, A., Welzel, C., Kizilova, K., Diez-Medrano, J., Lagos, M., Norris, P., Ponarin, E., Puranen, B., et al. (Eds.). (2014). *World Values Survey: Round six—Country-pooled datafile version*. JD Systems Institute. www.worldvalues-survey.org/WVSDocumentationWV6.jsp

Jackson, J. J., & Kirkpatrick, L. A. (2007). The structure and measurement of human mating strategies: Toward a multi-dimensional model of sociosexuality. *Evolution and Human Behavior*, *28*(6), 382–391.

James, J., Ellis, B. J., Schlomer, G. L., & Garber, J. (2012). Sex-specific pathways to early puberty, sexual debut, and sexual risk taking: Tests of an integrated evolutionary–developmental model. *Developmental Psychology*, *48*(3), 687–702.

Jones, A. C., Durante, K., Hill, S., & Bradshaw, H. (2019, October 17–20). 7L parenthood increases desire for conspicuous luxury goods. In *ACR North American Advances*. https://www.acrwebsite.org/volumes/v47/acr_vol47_2551251.pdf

Kerry, N., Blake, K. R., Murray, D. R., & Brooks, R. C. (2021). Male descendant kin promote conservative views on gender issues and conformity to traditional norms. *Evolutionary Human Sciences*, *3*, Article e34. https://doi.org/10.1017/ehs.2021.29

Kerry, N., & Murray, D. R. (2018). Conservative parenting: Investigating the relationships between parenthood, moral judgment, and social conservatism. *Personality and Individual Differences*, *134*, 88–96.

Kerry, N., & Murray, D. R. (2020). Politics and parental care: Experimental and mediational tests of the causal link between parenting motivation and social conservatism. *Social Psychological and Personality Science*, *11*(2), 284–292.

Kerry, N., & Murray, D. R. (2021). Politics and parenting. In V. A. Weekes Shackelford & T. K. Shackelford (Eds.), *The Oxford handbook of evolutionary psychology and parenting* (pp. 135–154). Oxford University Press.

Kuzawa, C. W., Gettler, L. T., Huang, Y. Y., & McDade, T. W. (2010). Mothers have lower testosterone than non-mothers: Evidence from the Philippines. *Hormones and Behavior*, *57*(4–5), 441–447.

León, A. K., & Pfeifer, C. (2017). Religious activity, risk-taking preferences and financial behaviour: Empirical evidence from German survey data. *Journal of Behavioral and Experimental Economics*, *69*, 99–107.

Li, Y. J., Cohen, A. B., Weeden, J., & Kenrick, D. T. (2010). Mating competitors increase religious beliefs. *Journal of Experimental Social Psychology*, *46*, 428–431.

Mahoney, A. (2010). Religion in families, 1999–2009: A relational spirituality framework. *Journal of Marriage and Family*, *72*(4), 805–827.

Mahoney, A., Pargament, K. I., Tarakeshwar, N., & Swank, A. B. (2008). Religion in the home in the 1980s and 1990s: A meta-analytic review and conceptual analysis of links between religion, marriage, and parenting. *Psychology of Religion and Spirituality*, *S1*, 63–101.

McCullough, M. E., Enders, C. K., Brion, S. L., & Jain, A. R. (2005). The varieties of religious development in adulthood: A longitudinal investigation of religion and rational choice. *Journal of Personality and Social Psychology*, *89*(1), 78–89.

Moon, J. W., Krems, J. A., Cohen, A. B., & Kenrick, D. T. (2019). Is nothing sacred? Religion, sex, and reproductive strategies. *Current Directions in Psychological Science*, *28*(4), 361–365.

Murray, D. R., Kerry, N., & Gervais, W. M. (2019). On disease and deontology: Multiple tests of the influence of disease threat on moral vigilance. *Social Psychological and Personality Science*, *10*(1), 44–52.

Norenzayan, A. (2016). Theodiversity. *Annual Review of Psychology*, *67*, 465–488.

Norenzayan, A., & Gervais, W. M. (2013). The origins of religious disbelief. *Trends in Cognitive Sciences*, *17*(1), 20–25.

Noussair, C. N., Trautmann, S. T., Van de Kuilen, G., & Vellekoop, N. (2013). Risk aversion and religion. *Journal of Risk and Uncertainty*, *47*(2), 165–183.

Pearson, R. M., Lightman, S. L., & Evans, J. (2009). Emotional sensitivity for motherhood: Late pregnancy is associated with enhanced accuracy to encode emotional faces. *Hormones and Behavior*, *56*(5), 557–563.

Pew Forum. (2017). *The changing global religious landscape*. http://www.pewforum.org/2017/04/05/the-changing-global-religious-landscape/

Roney, J. R., & Gettler, L. T. (2015). The role of testosterone in human romantic relationships. *Current Opinion in Psychology*, *1*, 81–86.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*, 1–36.

Rostosky, S. S., Wilcox, B. L., Wright, M. L. C., & Randall, B. A. (2004). The impact of religiosity on adolescent sexual behavior: A review of the evidence. *Journal of Adolescent Research*, *19*(6), 677–697.

Rutherford, H. J., Wallace, N. S., Laurent, H. K., & Mayes, L. C. (2015). Emotion regulation in parenthood. *Developmental Review*, *36*, 1–14.

Schaller, M. (2018). The parental care motivational system and why it matters (for everyone). *Current Directions in Psychological Science*, *27*(5), 295–301.

Schaller, M. (2019). Evolutionary psychology meets socio-ecological psychology: The motivational psychologies of disease-avoidance and parental care. *Current Opinion in Psychology*, *32*, 6–11.

Schmitt, D. P., & Fuller, R. C. (2015). On the varieties of sexual experience: Cross-cultural links between religiosity and human mating strategies. *Psychology of Religion and Spirituality*, *7*(4), 314–326.

Strassmann, B. I., Kurapati, N. T., Hug, B. F., Burke, E. E., Gillespie, B. W., Karafet, T. M., & Hammer, M. F. (2012). Religion as a means to assure paternity. *Proceedings of the National Academy of Sciences of the United States of America*, *109*(25), 9781–9785.

Tobacyk, J. J. (2004). A revised paranormal belief scale. *International Journal of Transpersonal Studies*, *23*(1), 94–98.

Tratner, A. E., Sela, Y., Lopes, G. S., Ehrke, A. D., Weekes-Shackelford, V. A., & Shackelford, T. K. (2017). Development and initial psychometric assessment of the Childhood Religious Experience Inventory–Primary Caregiver. *Personality and Individual Differences*, *114*, 5–9.

Van Slyke, J. A., & Wasemiller, A. (2017). Short-term mating strategies are negatively correlated with religious commitment: Exploring evolutionary variables for religiosity at a small Christian liberal arts college. *Evolutionary Psychological Science*, *3*(3), 253–260.

Weeden, J., Cohen, A. B., & Kenrick, D. T. (2008). Religious attendance as reproductive support. *Evolution and Human Behavior*, *29*(5), 327–334.

Weeden, J., & Kurzban, R. (2013). What predicts religiosity? A multinational analysis of reproductive and cooperative morals. *Evolution and Human Behavior*, *34*(6), 440–445.

Wilson, M., & Daly, M. (1985). Competitiveness, risk taking, and violence: The young male syndrome. *Ethology and Sociobiology*, *6*(1), 59–73.

Zhang, L. (2008). Religious affiliation, religiosity, and male and female fertility. *Demographic Research*, *18*, 233–262.

Zilioli, S., Ponzi, D., Henry, A., Kubicki, K., Nickels, N., Wilson, M. C., & Maestripieri, D. (2016). Interest in babies negatively predicts testosterone responses to sexual visual stimuli among heterosexual young men. *Psychological Science*, *27*(1), 114–118.