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RESEARCH ARTICLE

REVISED Demographic and socioeconomic predictors of religious/spiritual beliefs and behaviours in a prospective cohort study (ALSPAC) in Southwest England: Results from the parental generation [version 3; peer review: 2 approved, 1 approved with reservations]

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v3 **First published:** 25 May 2022, **7**:159
https://doi.org/10.12688/wellcomeopenres.17897.1
Second version: 05 Jan 2023, **7**:159
https://doi.org/10.12688/wellcomeopenres.17897.2
Latest published: 22 Aug 2023, **7**:159
https://doi.org/10.12688/wellcomeopenres.17897.3

Abstract

Background: We explored associations between possible demographic and socioeconomic causes of religious/spiritual beliefs and behaviours (RSBB) in the parental generation of the Avon Longitudinal Study of Parents and Children (ALSPAC).
Methods: We used a prospective birth cohort study (ALSPAC) in Southwest England with 14,157 enrolled mothers and 14,154 associated partners. Three RSBB outcome measures collected during pregnancy were examined: religious belief (belief in God/a divine power; yes/not sure/no), religious affiliation (Christian/none/other) and religious attendance (frequency of attendance at a place of worship). Multiple demographic and socioeconomic exposures were assessed (23 in mothers and 22 in partners). We explored age-adjusted associations between each exposure and outcome using multinomial regression, in addition to exposure-age interactions.
Results: Many demographic and socioeconomic factors were associated with RSBB, including age, ethnicity, marital status, education, income and deprivation. Overall, higher socioeconomic position was associated with increased levels of RSBB, particularly regarding religious attendance. For instance, compared to mothers with the lowest level of educational attainment, a degree-level

Open Peer Review

Approval Status ? ✓ ✓

	1	2	3
version 3 (revision) 22 Aug 2023			
version 2 (revision) 05 Jan 2023		✓ view	✓ view
version 1 25 May 2022	? view	? view	

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education was associated with a six-fold increase in the relative risk ratio of religious attendance at least once a week, relative to not attending at all (RRR=5.90; 95% CI=[4.44; 7.86]). The magnitude of these associations often varied by outcome, e.g., income was associated with religious attendance, but only weakly with religious affiliation. Although results were demographically and socially patterned, overall effect sizes were relatively small, with a largest pseudo-R^2 value of 2.4%. Patterns of association were similar for mothers and partners.

Conclusion: The observed positive association between socioeconomic position and RSBB is contrary to much previous theoretical and empirical work. Potential reasons for these differences are discussed, including cross-cultural variation in religiosity and state support, and differences between RSBB measures. This descriptive paper can also help inform future studies using these data regarding the consideration of appropriate confounders.

Keywords
ALSPAC, religion, confounding, bias, socioeconomic position, descriptive study

This article is included in the Avon Longitudinal Study of Parents and Children (ALSPAC) gateway.

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Any reports and responses or comments on the article can be found at the end of the article.

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Competing interests: No competing interests were disclosed.

Grant information: The UK Medical Research Council and Wellcome (Grant ref: 217065/Z/19/Z) and the University of Bristol currently provide core support for ALSPAC. This publication is the work of the authors, and they will serve as guarantors for the contents of this paper. A comprehensive list of grants funding is available on the ALSPAC website (http://www.bristol.ac.uk/alspac/external/documents/grant-acknowledgements.pdf). This project was made possible through the support of a grant from the John Templeton Foundation (ref no. 61917). The opinions expressed in this publication are those of the author(s) and do not necessarily reflect the views of the John Templeton Foundation.
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: Major-Smith D, Morgan J, Halstead I *et al.* **Demographic and socioeconomic predictors of religious/spiritual beliefs and behaviours in a prospective cohort study (ALSPAC) in Southwest England: Results from the parental generation [version 3; peer review: 2 approved, 1 approved with reservations]** Wellcome Open Research 2023, **7**:159 https://doi.org/10.12688/wellcomeopenres.17897.3

First published: 25 May 2022, **7**:159 https://doi.org/10.12688/wellcomeopenres.17897.1

REVISED **Amendments from Version 2**

"The revised version of our manuscript has taken into consideration the helpful and constructive comments of the reviewers (detailed more fully in our responses to the reviewers). All updates were minor additions to the discussion section, and include:

- Providing additional discussion points regarding some of the limitations of our study sample (i.e., predominantly White and Christian) meaning that potentially important differences by both ethnicity and religious background could not be explored in detail using these data. Additional discussion on the sample being pregnant women and their partners, and implications of this for generalisability, has also been added.
- Providing an additional explanation based on the historical and social ties between the Church of England (the main religious affiliation in this population) and British ruling and middle classes for our unexpected finding that higher socioeconomic position was positively associated with religious/spiritual beliefs and behaviours (RSBB) in this population.
- Providing additional information regarding differences between RSBB outcomes (e.g., that religious attendance may have different associations with health outcomes compared to religious belief and/or affiliation), and that these aspects of RSBB likely differ by religious background (e.g., that regular religious attendance may be a more important facet of Christian practice, compared with Islam).
- Updating some sections with subsequent relevant ALSPAC references that have been published since this paper was submitted (e.g., on RSBB and continued ALSPAC participation, and on similar associations between sociodemographic factors and RSBB in the ALSPAC offspring generation).
- Correcting some minor typographic errors"

Any further responses from the reviewers can be found at the end of the article

Introduction

There is an increasing appreciation that religious/spiritual beliefs and behaviours (RSBB) may impact health outcomes, both physical and mental[1–3]. Despite this growing recognition, the role of RSBB in wider health research is often neglected, partly because of a lack of high-quality prospective studies with detailed information on RSBB and relevant potential confounders[4].

Confounding occurs when a third variable causes both the exposure and the outcome[5–7]. Factors such as socioeconomic background, education and deprivation – which may cause RSBB – are known to impact health[8], and therefore may act as confounders in analyses. Identifying confounders is essential when exploring how RSBB may impact health outcomes – or in wider research involving RSBB as an exposure or outcome – as causal inferences may be biased without proper adjustment for confounding.

Research has identified three broad categories of variables which may cause RSBB (see 9,10): socioeconomic, cognition/psychology and cultural transmission. In this paper we focus on the first factor (in addition to demographic factors). A socioeconomic perspective suggests that RSBB may be heightened in times of stress, uncertainty or insecurity as a way for people to explain and understand these events and find meaning in the world[11–14]. This perspective posits that as material security increases, such as via well-functioning secular institutions, religiosity – broadly defined as encompassing a range of religious/spiritual beliefs and behaviours including religious belief, affiliation, attendance and prayer[15] – will decline. Therefore, socioeconomic and demographic factors – such as deprivation, lower social class, lower income and marginalised minority groups – are expected to be associated with heightened religiosity. Some evidence supports this view, finding a country-level association between increased material security lower levels of religiosity[16], and that marginalised groups in US society, such as women, racial minorities and those from a lower socioeconomic position (SEP), are more likely to be religious[11]. Indeed, there is evidence that lower SEP, often proxied by educational attainment, is associated with higher levels of religiosity[17–19]. However, this effect is not replicated in all studies[9,10,20], and the association between socioeconomic factors and RSBB appears to vary by numerous factors, including, for example: i) by country, with a negative association between education and religiosity found overall, but the association was highly variable within countries, and in some countries was positive[18]; ii) by religious denomination, with associations between education and religious belief variable depending on the Christian denomination[20] (see also 21); iii) by the RSBB outcome used, as in the US education often has a positive association with religious attendance, but a negative association with religious belief[22,23] and frequency of prayer behaviours; and iv) by the socioeconomic factor explored, with education having a positive association with religious attendance but no association for income in the US[23]. This body of work indicates that there is no simple association between socioeconomic position and RSBB. Studies may therefore need to examine this relationship on a case-by-case basis to explore the strength and direction of these associations and to understand the reasons for these divergences.

The aim of this paper is to explore whether demographic and socioeconomic factors are associated with RSBB in the parental generation of a prospective birth cohort (the Avon Longitudinal Study of Parents and Children; ALSPAC) which has detailed data on a range of both RSBB outcomes and sociodemographic variables. This work is therefore primarily descriptive; by examining variables which may cause RSBB we can help inform the choice of confounders in future studies using these ALSPAC data. By analysing a range of RSBB outcomes and sociodemographic variables, this research will also provide a detailed exploration of how different measures of RSBB – including religious belief, affiliation and attendance – associate with various socioeconomic measures – including education, income, area-level deprivation and occupational social class. This research can assess whether these associations differ from one another, and also whether these results in a cohort of UK parents vary from those of previous research, most of which has been conducted in the US. It is important to note that although there is an underlying assumption throughout this paper that these demographic and socioeconomic factors

cause RSBB, it is also possible that these factors are also caused by RSBB, and that causation may be bidirectional. This is a crucial point we return to and expand upon in the discussion. Although previous ALSPAC publications have described this RSBB data and identified broad trends, such as religiosity being higher in both women and the older generation of participants[24–27], to date no study has described these data in detail by exploring various associations between a wide range of demographic and socioeconomic factors and RSBB. While the selection of sociodemographic factors is based on causal considerations, our aim is not to estimate the unbiased causal effects between these sociodemographic variables and RSBB, and instead our aim here is more modest: to describe these broad associations and act as a platform to inform future research in this area.

Methods

Participants

Pregnant women resident in Bristol (UK) and surrounding areas with expected dates of delivery between 1st April 1991 and 31st December 1992 were invited to take part in the study. The initial number of pregnancies enrolled was 14,541, of which there were a total of 14,676 foetuses, resulting in 14,062 live births and 13,988 children who were alive at 1 year of age[28,29]. The current research focuses specifically on the parental generation. After removing one pregnancy if the mother had two pregnancies enrolled in ALSPAC (to avoid duplicated data from the same mother) and dropping observations for participants who had withdrawn consent for their data to be used, a total of 14,157 mothers were included in the final dataset, along with 14,154 associated partners (usually the father of the study child; hereafter 'partners'). Partners were not formally enrolled into ALSPAC, but were given partner-based questionnaires by the mother (if she had a partner and chose to share the questionnaire). This means that partner-based questionnaires may not have been completed by the same partner over time (although numbers of such cases are likely to be relatively small); for the purposes of this study, we assume that the identity of the partner is the same across all waves of data collection used. Although approximately 2,000 partners never participated in ALSPAC, all potential partners have been included here to show levels of missing data, and because many of these partners have information about them from questionnaires completed by the mother. Please note that the study website contains details of all the data that is available through a fully searchable data dictionary and variable search tool.

Outcome measures

The outcome variables for this study were the participants' RSBB (Table 1). These have been measured repeatedly in the parental generation (during pregnancy, at 5, 6, 9 and 28 years post-partum[26]). For the purposes of this study, we will explore

Table 1. Summary of religious/spiritual beliefs and behaviours (RSBB) outcomes used in this study for both mothers and partners. Sample sizes are 14,157 for mothers and 14,154 for partners.

RSBB outcome		Mother (N; %)	Partner (N; %)
Belief in God/a divine power	*Yes*	6,067 (49.9%)	3,552 (36.9%)
	Not sure	4,289 (35.3%)	3,311 (34.4%)
	No	1,806 (14.8%)	2,758 (28.7%)
	Total	12,162	9,621
Missing data		1,995 (14.1%)	4,533 (32.0%)
Religious affiliation	*None*	1,836 (15.3%)	2,440 (25.8%)
	Christian	9,666 (80.5%)	6,521 (68.9%)
	Other	511 (4.2%)	506 (5.3%)
	Total	12,013	9,467
Missing data		2,144 (15.1%)	4,687 (33.1%)
Frequency of attendance at a church/place of worship	*Min once a week*	877 (7.4%)	570 (6.1%)
	Min once a month	817 (6.9%)	406 (4.3%)
	Min once a year	3,480 (29.3%)	2,473 (26.2%)
	Not at all	6,715 (56.5%)	5,974 (63.4%)
	Total	11,889	9,423
Missing data		2,268 (16.0%)	4,731 (33.4%)

three RSBB outcomes measured at baseline during pregnancy (mean mother's age at birth = 28.0 [SD = 5.0; range = 15 to 44]; mean partner's age = 30.4 [SD = 5.8; range = 15 to 70]): religious belief (belief in God or some divine power; yes vs not sure vs no); religious affiliation (Christian vs none vs other); and religious attendance (frequency of attendance at a place of worship; at least once a week vs at least once a month vs at least once a year vs not at all). These RSBB outcomes were chosen because they cover a range of theoretically-important elements of religiosity (belief, affiliation and behaviour[15]) and have been used extensively in previous research[30], allowing comparisons to previous literature.

Exposure measures

To explore the demographic and socioeconomic factors associated with RSBB we used a range of exposures chosen according to empirically or theoretically supported relationships or *a priori* reasoning of potential causal relationships with RSBB. This encompasses socioeconomic factors described in the introduction, in addition to a broad demographics category. A summary of these variables is given in Table 2, while full descriptive statistics of each exposure are provided in Table S1 (please see Extended data for supplementary tables and figures[31]). All exposures were assessed during pregnancy or shortly afterwards.

Confounder variables

As the aim of this paper is to describe broad associations of factors which may cause RSBB, rather than provide a causal estimate of these relationships, all analyses here only adjust for age (other than the age-only models). Further research is required to explore these relationships in more depth to make causal claims, but adjusting for age will remove one common source of confounding.

Analysis

We first explored correlations between the exposures to examine how inter-related these variables were. For all continuous, ordered categorical and binary variables we used Pearson correlations, while for unordered categorical variables (only two variables; home ownership and marital status) we approximated these correlation coefficients by running a series of multinomial models with these variables as the outcome and then square-rooting the pseudo-R^2 value (cf. 32). While ordinal and binary variables do not meet the assumptions for Pearson correlations (i.e., they are not continuous or normally-distributed), as this approach was used primarily to understand the broad associations between these variables – rather than the specific correlation coefficients – we believe it is appropriate for our purposes here.

We then assessed whether each of the exposures in Table 2 was associated with each of the RSBB outcomes in Table 1 using multinomial regression. Multinomial analyses were chosen because two of the outcomes (religious belief and religious affiliation) were unordered categorical variables. We also decided to run multinomial regression on the ordered categorical outcome (religious attendance) for two reasons. First, we initially ran ordinal regression models on this outcome, but the assumption of proportional odds was violated (as indicated via a Brant test); multinomial regression does not require this assumption. Second, by performing multinomial regressions on all outcomes the regression coefficients are all on the same scale (relative risk ratios) and therefore broadly comparable to one another, facilitating interpretation of effect sizes. All analyses adjusted for age (other than the age-only models). Given differences in RSBB by age/generation[24], we also explored whether predictors of RSBB varied by age by including an interaction between age and each exposure (assuming a linear association with age).

To provide a single *p*-value for each model to assess model fit, we ran two sets of likelihood ratio tests for each exposure-outcome combination: the first assessed whether inclusion of the exposure improved model fit relative to an age-only model (or an empty model, where age was the exposure); the second assessed whether inclusion of an interaction term between age and the exposure improved model fit relative to the model with no interaction. In an attempt to minimise the false discovery rate, for each outcome we applied a Bonferroni-correction corresponding to the number of exposures tested. For mothers there were 23 exposures, giving a Bonferroni-adjusted threshold when using a standard 0.05 alpha value of 0.05/23 = 0.0022 (0.05/22 = 0.0023 for the interaction models); as partners had 22 exposures, the adjusted alpha value was 0.05/22 = 0.0023 (0.05/21 = 0.0024 for the interaction models). These adjusted thresholds were not used to arbitrarily dichotomise results into 'significant' and 'non-significant'[33], but rather were used as a useful summary to describe large numbers of associations and to assess the strength of evidence against the null hypothesis of no association between the exposure and outcome[34]. To give an indication of the increase in model fit resulting from inclusion of the exposure, we calculated the difference in McFadden's pseudo-R^2 value between the model with vs without the exposure (or with vs without the interaction term, for interaction models). Although this pseudo-R^2 value is not directly comparable to a standard R^2 'variance explained' statistic from a linear model (pseudo-R^2 values often being smaller than the corresponding R^2 value, for example 35,36), it is nonetheless a useful metric to assess model fit and for comparisons between exposures. This approach was repeated in the mother and partner cohorts. All analyses were conducted in Stata v.17, but can also be performed in the open-source software R[37].

Results

Descriptive statistics

Descriptive statistics for the RSBB outcomes are displayed in Table 1. In the mother's cohort, 50% believed in God/a divine power, while 15% did not; religious belief was lower among partners (37%), while non-belief was higher (29%). Patterns were similar for religious affiliation, with 80% of mothers having a Christian affiliation and 15% having no affiliation; for partners, 69% identified as Christian and 26% had no affiliation. Religious attendance was lower than religious belief and affiliation, with 56% of mothers and 63% of partners never attending a place of worship; 14% of mothers and 10% of partners attended a place of worship a minimum of once a week or

Table 2. Summary of variables used as exposures. Other than household income (measured when study children were aged 3/4 years) and partner financial difficulties (measured 8 months post-partum), all variables were assessed in pregnancy or shortly after.

Variable (*variable name*)	Variable coding	Notes
Demographic variables		
Age (*AgeAtBirth*; *AgeInPreg* for partners)	Continuous (years)	
Ethnicity (*nonWhiteEthnic*)	Binary (White vs Other than White)	Also used recent COVID4 questionnaire to fill in missing data
Marital status (*maritalStatus*)	Unordered category (never married vs currently married vs widowed/divorced/separated)	
Residential mobility (in last 5 years; *mobility*)	Ordered category (0 moves vs 1 move vs 2 moves vs 3 moves vs 4 moves vs 5 or more moves)	
Urban/rural status (*rural*)	Binary (town/village/hamlet vs urban)	For partners, using mothers data
Parity (*parity*)	Ordered category (0 vs 1 vs 2 or more)	For partners, using mothers data
Socioeconomic variables		
Highest education qualification (*education*)	Ordered category (CSE/none vs vocational vs O-level vs A-level vs degree)[a]	
Mother's highest education qualification (*maternalEdu*)	Ordered category (CSE/none vs vocational vs O-level vs A-level vs degree)[a]	
Father's highest education qualification (*paternalEdu*)	Ordered category (CSE/none vs vocational vs O-level vs A-level vs degree)[a]	
Occupational social class (*highSocClass*)	Binary (low [III manual/IV/V] vs high [I/II/III non-manual])[b]	
Mother's occupational social class (*highSocClass_mat*)	Binary (low [III manual/IV/V] vs high [I/II/III non-manual])[b]	
Father's occupational social class (*highSocClass_pat*)	Binary (low [III manual/IV/V] vs high [I/II/III non-manual])[b]	
Household income (*income*)	Continuous (log income per/week)	
Index of multiple deprivation (*IMD*)	Ordered category (1st quintile [least deprived] vs 2nd quintile vs 3rd quintile vs 4th quintile vs 5th quintile [most deprived])	For partners, using mothers data
Townsend deprivation index (*townsendDep*)	Ordered category (1st quintile [least deprived] vs 2nd quintile vs 3rd quintile vs 4th quintile vs 5th quintile [most deprived])	For partners, using mothers data
Mother or partner access to car (*accessToCar*)	Binary (yes vs no)	
Housing status (*housing*)	Unordered category (owned/mortgaged vs renting vs council/housing association vs other)	For partners, using mothers data
Recent financial difficulties (*financeDiffs*)	Binary (yes vs no)	
Financial difficulties score (*financeDiffsScore*)	Continuous (from 0 [no difficulties] to 15 [severe difficulties])	
Family's financial circumstances got worse during childhood (*poorerChildhood*)	Binary (yes vs no)	
Crowding index (*crowding*)	Ordered category (calculated by dividing the number of people in the household by the number of rooms; ≤ 0.5; > 0.5 to 0.75; > 0.75 to 1; > 1)	For partners, using mothers data
Self-reported neighbourhood quality index (*neighPercept*)	Continuous (score from 0 [low quality neighbourhood] to 12 [high quality neighbourhood])	
Partner absence in pregnancy (*partnerAbsence*)	Binary (partner present vs partner absent)	Not applicable for partners

[a] CSE = Certificate of Secondary Education qualification (examinations sat at the end of secondary school at approx. age 16; compulsory from the early 1970s, unless completing O-level qualifications instead); O-level = Ordinary level qualifications (examinations sat at the end of secondary school, often for more academically-able pupils at approx. age 16); A-level = Advanced level qualification (non-compulsory examinations sat at the end of college or sixth form at approx. age 18).

[b] For more information on these occupational social classes, see: https://sru.soc.surrey.ac.uk/SRU9.html.

once a month. Descriptive statistics for each of the exposures, split by each RSBB outcome category, are displayed in Tables S2 (for religious belief), S3 (for religious affiliation) and S4 (for religious attendance).

Mothers

A heat-plot of the correlation matrix between all 21 continuous, ordered categorical and binary variables is displayed in Figure 1 (full correlation coefficients are displayed in Table S5; approximate correlation coefficients for the unordered categorical variables home ownership status and marital status are in Table S6). Other than a few highly-correlated variables measuring similar constructs – such as IMD (index of multiple deprivation) and Townsend deprivation indices – and clusters based on education and occupational social class, associations between most of the exposures were not especially strong. For instance, the correlation between the mother's highest educational qualification and the highest qualification of her mother was 0.41, while income was negatively associated with index of multiple deprivation (r = -0.39; although given the issues raised above regarding using Pearson correlations for binary and ordinal variables, these specific coefficients should be taken as merely illustrative of the strength of these relationships). This suggests that, although many of the exposures are correlated to some extent, overall, they are likely to be at least somewhat independent.

Many exposures were associated with each of the three RSBB outcomes. A plot of the p-values from the likelihood ratio tests is displayed in Figure 2. Taking 'religious belief' as an example, 17 of 23 (74%) exposure main effects were associated with this outcome at the Bonferroni-corrected alpha value, while 20 (87%) reached a conventional 0.05 alpha threshold. Compared to main effects, there were fewer associations reported for interaction terms; again using 'religious belief' as an example, 9 of 22 (41%) interactions were associated at the Bonferroni-corrected alpha value, while 11 (50%) reached a 0.05 alpha threshold. Results were broadly comparable for the religious affiliation outcome, although for religious attendance more main effects were reported (but fewer interaction associations). A summary of results for each of the RSBB outcomes is in Table 3 (with a full list of p-values from all likelihood ratio tests given in Table S7).

Pseudo-R^2 values for each exposure-outcome association are displayed in Figure 3. While pseudo-R^2 values cannot be interpreted directly as measures of variance explained, overall these results demonstrate that the improvement in model fit due to each exposure is relatively small. The highest pseudo-R^2 value is 2.4% (with marital status as the exposure and religious affiliation as the outcome), and the majority of values are below 1%. Pseudo-R^2 values for the interaction terms are even weaker, with the largest value of 0.5% for the interaction

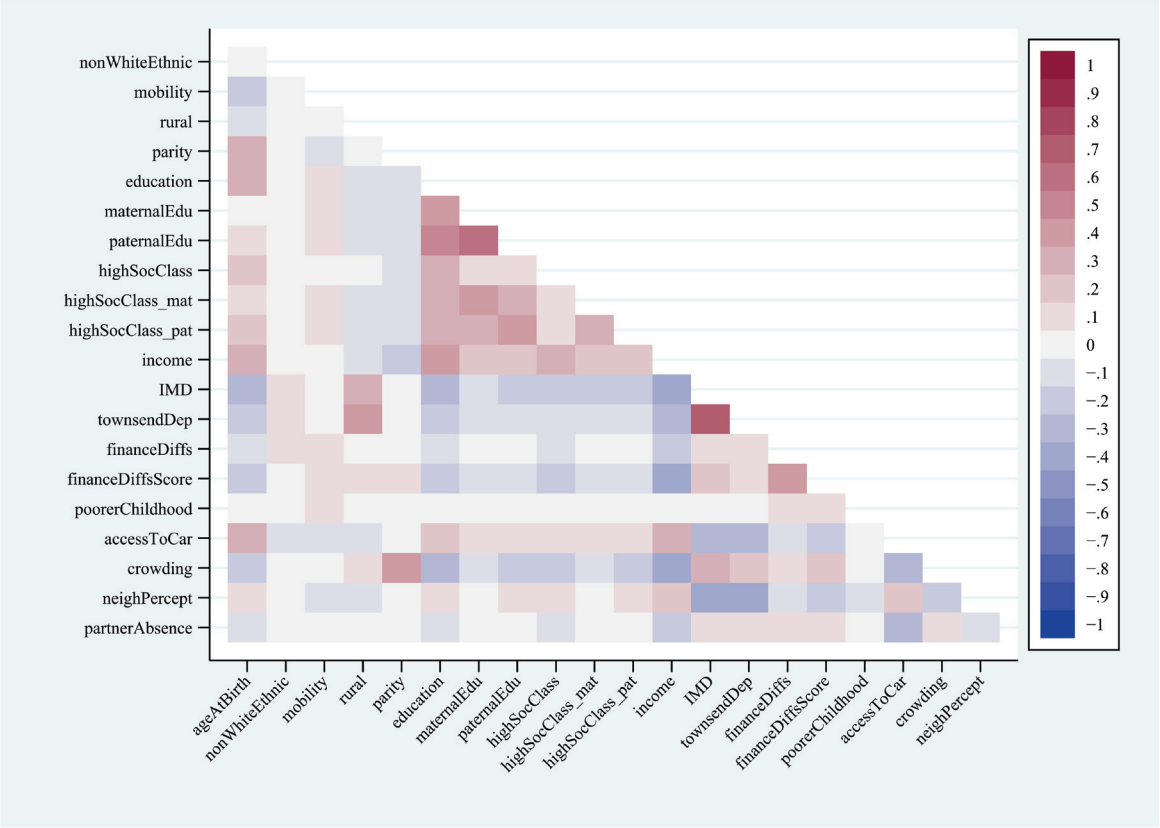


Figure 1. Heat-plot of the correlation matrix between all continuous, ordered categorical and binary exposures used in the mother's analysis (numerical results are displayed in table S5). For full details on the variables included here, see Table 2.

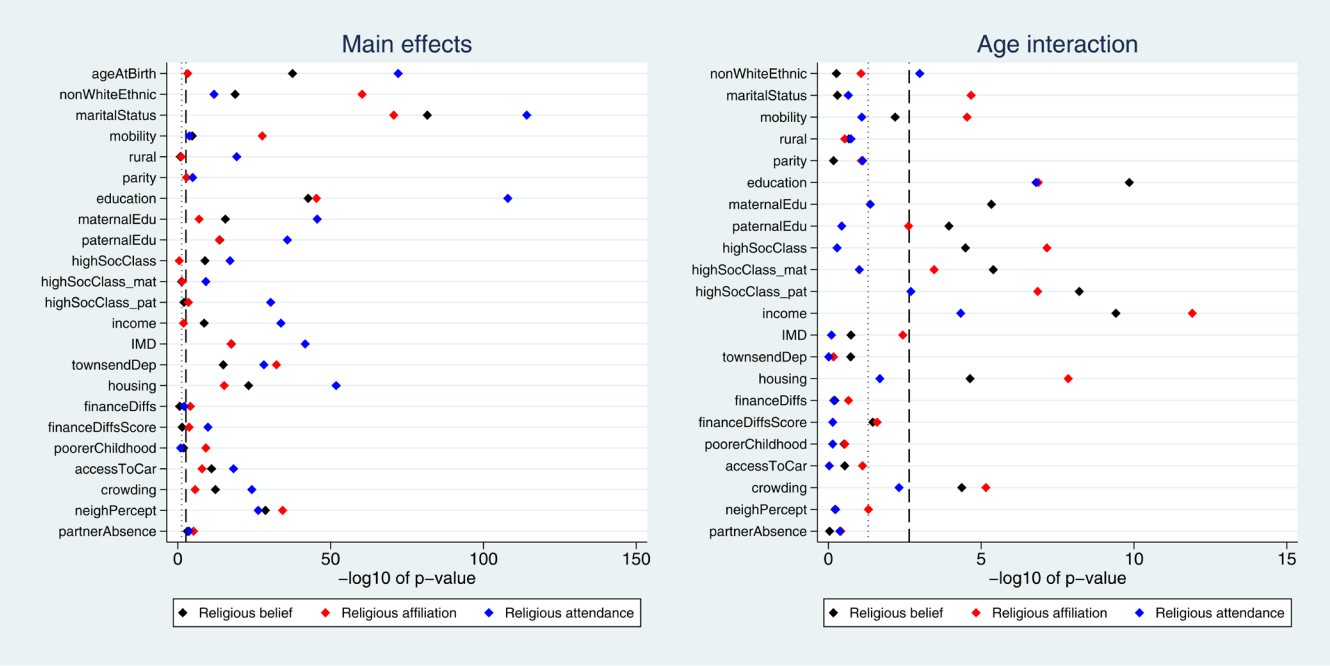


Figure 2. *P*-values for each exposure and RSBB outcomes for mothers. The left-hand plot shows the age-adjusted main effects; the right-hand plot shows the interaction between age and the exposure. The light dashed line indicates a standard 0.05 *p*-value threshold; the thicker dashed line denotes the Bonferroni-corrected *p*-value threshold (0.05/23 = 0.0022 for main effects and 0.05/22 = 0.0023 for interaction effects). Results to the right of these lines indicate a *p*-value below said threshold. For full details on the variables included here, see Table 2. For sample sizes, see tables S9-S11.

Table 3. Summary of associations between 23 exposures and the three RSBB outcomes at both the Bonferroni-corrected and conventional 0.05 alpha levels for the mothers' analyses. Results show the number (percentage) of exposures below both the Bonferroni-corrected and 0.05 alpha levels for each RSBB outcome.

	Number (%) of main effects below *p*-value thresholds		Number (%) of interactions below *p*-value thresholds	
	Bonferroni-corrected (0.05/23 = 0.0022)	0.05	Bonferroni-corrected (0.05/22 = 0.0023)	0.05
Religious belief	17 (74%)	20 (87%)	9 (41%)	11 (50%)
Religious affiliation	19 (83%)	21 (91%)	9 (41%)	14 (62%)
Religious attendance	21 (91%)	22 (96%)	4 (18%)	7 (32%)

between age and income with religious affiliation as the outcome. Thus, although the majority of exposures were below the Bonferroni-adjusted *p*-value threshold, the amount of variance explained by these exposures is likely to be small (full pseudo-R^2 results are given in Table S8). Overall, these findings suggest that many exposures were associated with these RSBB outcomes, albeit relatively weakly, and that fewer interaction effects with age were reported.

However, this focus on *p*-values and pseudo-R^2 values only tells us whether an association is present and the strength of the association, and not the direction of said association. Additionally, as can be seen in Figure 2 and Figure 3, there appears to be some heterogeneity of effects between different RSBB outcomes; for instance, age at birth is strongly associated with religious belief and religious attendance, but less so for religious affiliation. We now turn to specific parameter estimates to explore the direction of these results. Given the sheer number of associations explored here, we will pick out a few key results to focus on (full results are given in Tables S9-S11).

Taking demographic variables first, older mothers were more religious than younger mothers, with older mothers more likely to believe in God/a divine power, have a religious

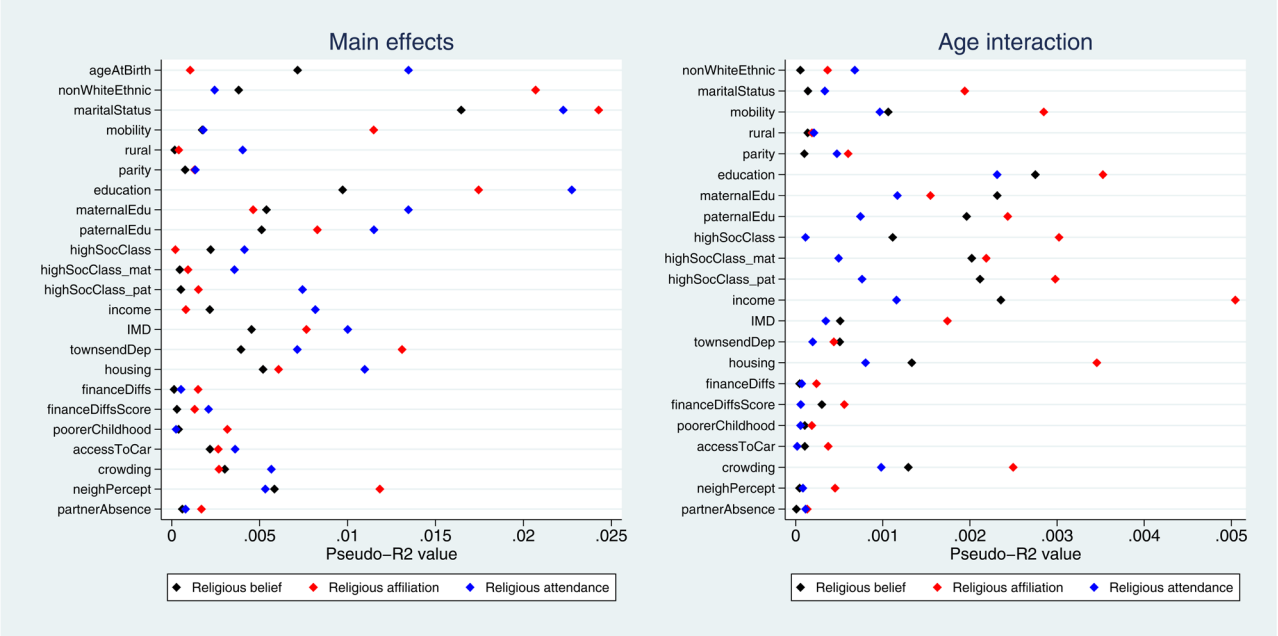


Figure 3. Pseudo-R^2 values for each exposure and RSBB outcomes for mothers. The left-hand plot shows the age-adjusted main effects; the right-hand plot shows the interaction between age and the exposure. For full details on the variables included here, see Table 2. For sample sizes, see tables S9–S11.

affiliation and attend a place of worship more frequently (Figure 4). As relative risk ratios from multinomial regressions are not necessarily intuitive to interpret, predicted probabilities for each of the RSBB outcomes by age are shown in Figure S1. Having an ethnicity other than White (Figure S2), being married (relative to never being married; Figure S3) and lower levels of residential mobility (Figure S4) were each associated with increased religiosity. Urban/rural status and parity had little association with RSBB.

Many socioeconomic factors were associated with RSBB. For instance, education was strongly associated with RSBB, albeit sometimes in a non-linear fashion (Figure 5); higher educational attainment was associated with an increased probability of both religious belief and Christian religious affiliation, although this reversed for mothers with a degree. In contrast, religious attendance had a broadly linear association with education, with higher educational qualifications associated with increased attendance. Living in owned/mortgaged accommodation (Figure S5), lower levels of deprivation (Figure S6), higher income (Figure S7) and higher occupational social class (Figure S8) were each associated with higher levels of religiosity. Factors such as parental social class, recent financial difficulties, partner absence during pregnancy or family becoming poorer in childhood had weaker and/or inconsistent associations with RSBB.

Overall, there were few interactions between age and RSBB. Exceptions include education, where older mothers with a degree were less likely to believe in God/a divine power, identify as Christian or attend a place of worship, compared to younger mothers with a degree (Figure S9 for relative risk ratios; figures S10a, S10b and S10c for predicted probabilities by age and education for these outcomes). Additionally, interactions between age and both income and occupational social class were found, with higher income and occupational social class associated with being less likely to believe in God or identify as Christian among older mothers (Figures S11 and S12).

Partners

A heat-plot of the correlation matrix between the 20 continuous, ordered categorical and binary variables for partners is displayed in Figure S13 (full correlation matrix in Table S12; approximate correlation coefficients for the unordered categorical variables home ownership status and marital status are in Table S13). As with the mothers' data, other than some clustering by the deprivation and education/occupational social class variables, the majority of associations between the exposures were moderate or weak (e.g., the correlation between the partner's highest educational qualification and being of higher occupational social class was 0.46).

Many exposures were associated with each of the RSBB outcomes. A plot of the *p*-values from the likelihood ratio tests is displayed in Figure 6. A summary of results for each of the RSBB outcomes is in Table 4, with a full list of *p*-values from all likelihood ratio tests in Table S14. Similar to the mothers'

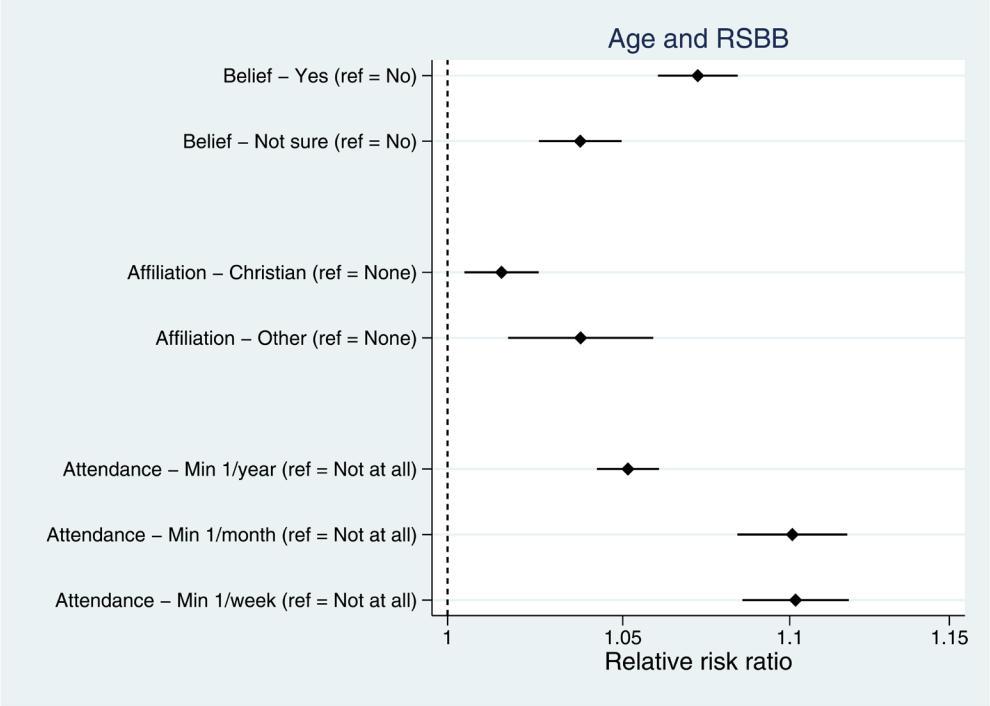


Figure 4. Associations between age and RSBB outcomes for mothers. All results are from multinomial regression analyses and show the relative risk ratio for a one-year increase in age relative to the outcome reference (specified on the y-axis). The x-axis is on the log scale. Error bars are 95% confidence intervals. Sample sizes: religious belief = 12,106; religious affiliation = 11,959; religious attendance = 11,836.

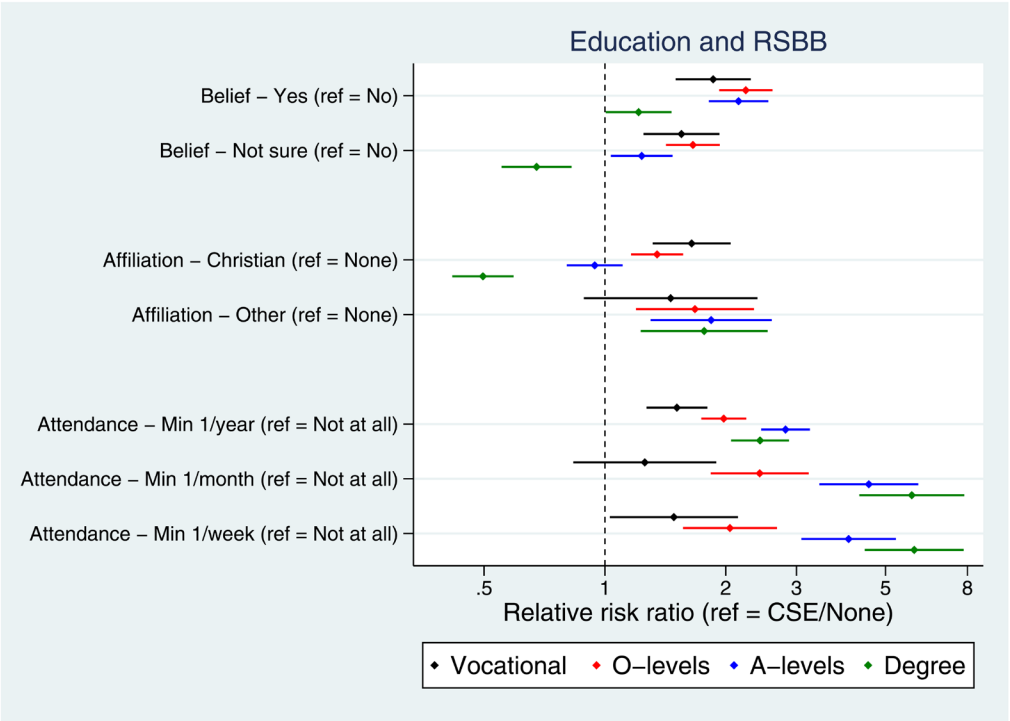


Figure 5. Associations between education and RSBB outcomes for mothers. All results are from multinomial regression analyses and show the relative risk ratio for a given educational level relative to both the educational reference level (CSE/None) and the outcome reference (specified on the y-axis). The x-axis is on the log scale. Error bars are 95% confidence intervals. Sample sizes: religious belief = 11,456; religious affiliation = 11,326; religious attendance = 11,206.

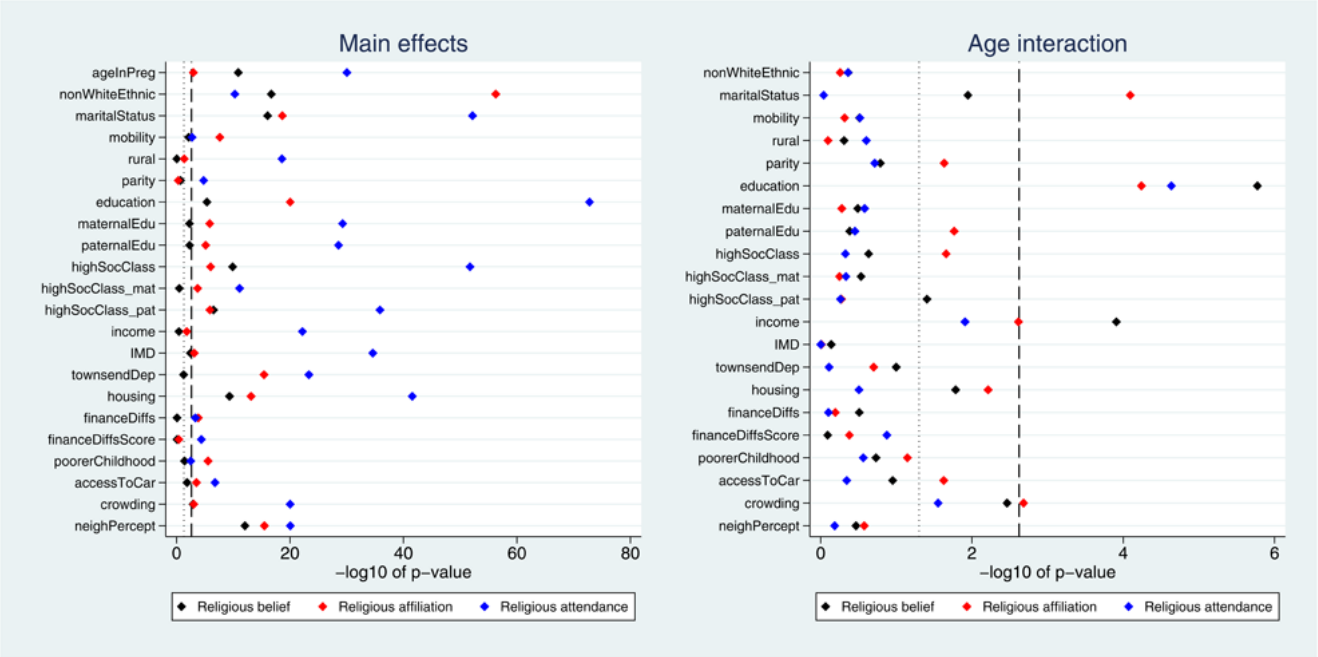


Figure 6. *P*-values for each exposure and RSBB outcomes for partners. The left-hand plot shows the age-adjusted main effects; the right-hand plot shows the interaction between age and the exposure. The light dashed line indicates a standard 0.05 *p*-value threshold; the thicker dashed line denotes the Bonferroni-corrected *p*-value threshold (0.05/22 = 0.0023 for main effects and 0.05/21 = 0.0024 for interaction effects). Results to the right of these lines indicate a *p*-value below said threshold. For full details on the variables included here, see Table 2. For sample sizes, see tables S16-S18.

Table 4. Summary of associations between 22 exposures and the three RSBB outcomes at both the Bonferroni-corrected and conventional 0.05 alpha levels for the partners analyses. Results show the number (percentage) of exposures below both the Bonferroni-corrected and 0.05 alpha levels for each RSBB outcome.

	Number (%) of main effects below *p*-value thresholds		Number (%) of interactions below *p*-value thresholds	
	Bonferroni-corrected (0.05/22 = 0.0023)	0.05	Bonferroni-corrected (0.05/21 = 0.0024)	0.05
Religious belief	9 (41%)	15 (68%)	2 (10%)	6 (29%)
Religious affiliation	18 (82%)	20 (91%)	3 (14%)	9 (43%)
Religious attendance	21 (95%)	22 (100%)	1 (5%)	3 (14%)

data, many main effects were identified, few interaction effects were reported, and there was heterogeneity in terms of exposure associations over different RSBB outcomes. The pseudo-R^2 values are displayed in Figure S14 (full results in Table S15), and are again relatively small in magnitude and similar to the mothers' data (largest main effect pseudo-R^2 of 2.4%; largest interaction pseudo-R^2 of 0.3%).

We now turn to the direction of these partner results. Again, given the large number of associations explored, we will only focus on a few key results here (full results are given in Tables S16-S18). Similar to the mothers' data, of the demographic variables, older age (Figure S15 for relative risk ratios; Figure S16 for predicted probabilities), other than White ethnicity (Figure S17), being married (Figure S18) and lower levels of residential mobility (Figure S19) were associated with increased religiosity among the partners. For socioeconomic factors, education was again associated with RSBB, with higher educational qualifications associated with being less likely to identify as Christian, yet increased religious attendance

(Figure S20). Higher occupational social class (figure S21), lower levels of deprivation (Figure S22) and home ownership (Figure S23) were associated with increased religiosity. Other socioeconomic factors had null or inconsistent associations with RSBB, such as higher income being associated with increased religious attendance but not religious belief or affiliation (Figure S24).

As with the mothers, there were few interactions between age and the exposures, although older partners with a degree were less likely to believe in God/divine power, identify as Christian or attend a place of worship, compared to younger partners with a degree (Figure S25 for relative risk ratios; Figures S26a, S26b and S26c for predicted probabilities by age and education for these outcomes). Higher income was also associated with being less likely to believe in God among older partners (Figure S27).

Discussion

Many demographic and socioeconomic factors are associated with RSBB in mothers and partners in this cohort. Older age, other than White ethnicity, being married, higher educational attainment, increased income, higher occupational social class and lower deprivation were all associated with increased religiosity, for at least some RSBB outcomes. Other factors, such as parity, recent financial difficulties, rural vs urban location, partner absence (for mothers), access to a car and family becoming poorer during the parent's childhood had either weak, null or inconsistent associations with RSBB outcomes. Despite some highly significant associations (as indicated by *p*-values), the estimated variance explained using pseudo-R^2 values was relatively low, with a maximum value of 2.4%, highlighting that relatively little of the variation in RSBB is explained by individual demographic and socioeconomic factors. Patterns of results were broadly similar for both mothers and partners, although religiosity was lower among partners (Table 1), as reported previously[27].

Given the descriptive nature of this work we caution against interpreting these results in causal terms; however, we make some tentative comparisons with previous theory and research to situate these results in the wider literature. First, contrary to many previous studies[11,17,18] and theories of material security[12–14], we found a positive association between many socioeconomic factors and RSBB outcomes, with increased household income, lower levels of deprivation and higher occupational social class associated with increased religious belief, affiliation and attendance. These patterns were similar, but more nuanced, for education, with higher educational attainment linearly associated with religious attendance, but non-linearly associated with religious belief and affiliation; relative to the lowest education category (CSE/no qualifications), mothers with vocational, O-level or A-level qualifications were more likely to believe in God or have a religious affiliation, while mothers with a degree were less likely to have religious belief or state they had a Christian religious affiliation (Figure 5; similar patterns were observed in the partners, Figure S20). Together, these results suggest that lower socioeconomic position is not associated with increased religiosity in this population, and in fact that higher socioeconomic position is broadly associated with increased religiosity.

Additional research is required to understand these socially patterned results in greater detail and, in particular, why they differ from previous research and theoretical expectations, but we make some tentative suggestions here. One potential reason is that most of the previous work in this area has been conducted in the US, yet these associations are known to differ cross-culturally[18,38]. The finding that education is positively associated with religious attendance is perhaps less surprising as it has been reported in the US previously[21–23] – although cross-cultural analyses do suggest an overall negative association between education and religious attendance[38] – and could be explained by the known positive association between educational attainment and all forms of social interaction[23]; as education is a proxy for socioeconomic position, this may also explain the positive association between religious attendance and other socioeconomic factors, such as income, occupational social class and area-level affluence. The positive associations between these socioeconomic factors and religious belief and affiliation are more surprising, however, as most previous research has found either negative[11,17] or null[9,10,22] associations with these RSBB measures. Although difficult to identify the precise reason(s), one potential explanation may be the higher degree of state social support for the less affluent members of UK society[39]. This may mean that the need for religion as a key source of emotional, social and psychological support when in a situation of material insecurity – as reported in various US samples[11,40] – is weaker in the UK. A further, and not mutually exclusive, explanation could be due to differences in religiosity between the US and the UK, with the UK being much less religious than the US[41]. Indeed, previous cross-cultural work has suggested that the negative association between education and religiosity is weaker in less religious countries, and in some cases even positive[18]; given the higher level of religious attendance among educated individuals within these societies, perhaps this attendance directly affects religious belief and affiliation[18]. Alternatively, the close social, political and historical connections between the Church of England (the main religious affiliation in this population) and the British ruling and middle classes may also potentially account for the observed positive associations between socioeconomic position and RSBB[42]. These are of course very preliminary explanations, and we hope that future work will explore and understand these associations in greater detail.

Other socioeconomic factors – such as recent financial difficulties, access to a car, partner absence (for mothers) and family financial difficulties in childhood – had weaker associations with RSBB outcomes than wider socioeconomic factors such as education, deprivation and occupational social class. These broader socioeconomic factors may therefore have a larger impact on religious beliefs and behaviours in this population (assuming that these socioeconomic factors cause RSBB).

Similar to other previous work conducted in the US[21], we also observed variation in the associations between exposures and different RSBB outcomes. For instance, among mothers, both

age (Figure 4) and income (Figure S7) were associated with religious belief and religious attendance, but associations with religious affiliation were weaker. These results indicate that there may be heterogeneity across RSBB outcomes and exposures, suggesting that different RSBB variables measure different facets of religiosity, each of which may be caused by different factors. For instance, religious belief and attendance may be somewhat independent of religious affiliation[43], as affiliation may reflect nominal or historical group identity, rather than strength of religious convictions. However, when comparing these results we need to be aware that the difference between 'significant' and 'non-significant' may not itself be significant[44]. That is, just because higher occupational social class (as an example) is 'significantly' associated with religious belief, but 'non-significantly' associated with religious affiliation, this does not mean that the difference between occupational social class for religious belief and religious affiliation are 'significantly' different from one another (in fact, the effect sizes are broadly similar; Figure S8). Similar considerations also apply when comparing different exposures within one RSBB outcome as well. Nonetheless, despite these caveats there does appear to be some variation between different RSBB outcomes that may help inform future work and could be explored in greater detail. For example, much work has suggested that religious attendance, rather than other aspects of RSBB, often has stronger associations with a range of health and behavioural outcomes, including mental health, prosocial behaviour and all-cause mortality[45–47], perhaps due to enhanced social support from religious networks and the transmission of religious norms[48].

Although less prevalent than main effects, some interaction effects with age were reported. The strongest effects were found for education and income. Older participants with higher educational attainment and income were associated with lower levels of religiosity compared to younger participants. These results demonstrate that associations between the exposure and RSBB outcome may vary by the age of the mother or partner, so should be considered when using this data (although the variance explained by these interaction terms is rather weak; maximum pseudo-R^2 of 0.5%).

Strengths and limitations

A key strength of this research is the use of a large, deeply-phenotyped, longitudinal birth cohort with a wealth of variables measured which could be used as confounders in future studies. This cohort also contains detailed, longitudinal RSBB data, which can be used to explore associations between RSBB and health outcomes in detail. At recruitment in pregnancy, this cohort was broadly representative of the target population[28], although since recruitment there has been drop-out, which is known to be non-random and may result in selection bias[49–51].

There are several limitations with this study. First, we attempted to focus on demographic and socioeconomic exposures that may *plausibly* cause RSBB. In many cases, however, it is not certain whether the exposure variable is a cause or consequence of RSBB, or both (or neither). For instance, marital status may cause RSBB, but it is also possible that being religious causes people to be more likely to get and remain married; thus, there may be reciprocal causation, with religiosity causing an increased probability of getting/staying married, and then marriage increasing subsequent religiosity. As another example, certain religions may encourage (or discourage) norms and behaviours which promote educational attainment, again meaning that RSBB would be a cause, rather than consequence, of socioeconomic factors (see 52,53 for instance). These issues may also play out on longer historical timescales as well; for instance, due to religious discrimination and persecution, religious affiliation may result in differences in socioeconomic position. While some factors cannot be caused by RSBB, such as age, sex or ethnicity, these potential issues of reverse and bidirectional causality may apply to many of the variables explored here. One consequence of this is that unravelling the factors causing RSBB becomes a difficult task; if a variable is caused by RSBB, then we would not want to include it in a model aiming to examine the causes of RSBB, as doing so may also have the unintended side effect of acting as a collider[5,54,55], thus biasing other causal estimates; see Figure S28 for a simple worked illustration.

A second consequence of this potential reciprocal causation is that this has implications for our choice of variables when trying to estimate causal effects if RSBB is the exposure. For example, say that we are interested in whether RSBB impacts mental health, and we are deciding whether to include marital status as a confounder or not[5,7,56]. If marital status causes both RSBB and mental health, then it is a confounder and should be adjusted for to obtain an unbiased effect of RSBB on mental health (in this example we are ignoring all other potential confounders; Figure S29a). If RSBB causes both marital status and mental health, then marital status may be a mediator on the RSBB-mental health causal path, and we would not want to adjust for this if we were interested in the total causal effect of RSBB on mental health (Figure S29b). If there is reciprocal causation, with RSBB at time 1 causing an increased probability of marriage, which in turn increases RSBB at time 2, which in turn increases the probability of staying married, then we would have a situation where marital status is both a confounder (at time 1) and a mediator (at time 2; Figure S29c). If marital status was not measured at time 1, then estimating a causal effect of RSBB on mental health may be impossible using standard multivariable regression-based approaches. The causal model generating the observed data therefore needs to be considered, and the analysts' assumptions made clear, when deciding which covariates to include in an analysis model[5]. This paper has focused on RSBB data from one time-point in each analysis; where possible, future work can help untangle these thorny issues by making use of the longitudinal and intergenerational nature of the ALSPAC data with repeated data on RSBB and many of the exposures here in both the parental and child generations (for a discussion of similar causal considerations when working with longitudinal data, see 57).

A further limitation is that as this paper is descriptive and only adjusted for age, it is possible that many associations

may be biased due to residual confounding. For example, both age and education are likely to cause both income and RSBB, yet as we did not adjust for education here when exploring income, this association may be biased. However, as we have repeatedly stressed, the aim of this paper is purely to describe these patterns and inform future work, and these associations should not be taken as causal estimates. Missing data may also result in bias due to selection. This could occur if both the exposure and the outcome, or unmeasured factors associated with both, cause selection/participation[5,58]; we are currently exploring whether RSBB is associated with continued ALSPAC participation (and hence selection; see 59). Methods such as multiple imputation[60], inverse-probability weighting[61], and sensitivity analyses[62] could be used to explore/test these assumptions. Resolving these issues is beyond the scope of this paper, but concerns of bias due to confounding and selection need to be explored in future studies using this data, especially when the aim is causal inference.

A further limitation is that it is difficult to know how generalisable these results are, especially as the population is primarily White and predominantly Christian (most of whom are Church of England/Anglican). Despite differences in religiosity, associations between exposures and RSBB outcomes for mothers and partners in this study were broadly similar, but whether the same factors would be associated with RSBB in different generations (e.g., their children; see 63), historically, or across nations, religions and cultures is difficult to say. However, this cultural, social and historical variation is likely to be substantial[18,64]. For instance, due to small sample sizes we unfortunately had to combine all 'other than White' ethnic minority groups together, as well as all non-Christian religious affiliations (both ≤5% of the total sample). We were therefore unable to explore associations by different ethnicities, or by different religious faiths, in detail, potentially obscuring important differences between these groups. Relatedly, aspects of religious practice are likely to vary by religious faith, which could not be explored in the present study, but ought to be taken into consideration in future work comparing across religions; regular religious attendance may be a more important feature of Christian practice compared to Islam, for example[65]. Additionally, given that participants were the parental generation of a birth cohort the focus of this study is on pregnant women and their partners. Although religiosity in this cohort is somewhat stable over time[66] (meaning these results are unlikely to be specific to pregnancy), it is possible that different sociodemographic patterning with RSBB may be found in a more general adult population. Therefore, analyses similar to these need to be replicated in independent cohorts both in the UK and cross-culturally before making broad generalisations about the factors associated with RSBB, and to understand the social, cultural and ecological factors shaping these relationships.

Finally, we note that this paper does not cover all potential causes of RSBB. For instance, as mentioned in the introduction, studies have suggested three broad categories of factors which may cause RSBB: socioeconomic, cognitive/psychological and cultural transmission (in addition to demographic[9,10]). Here we have only focused on demographic and socioeconomic variables; additional descriptive work in this cohort is currently underway exploring cognitive/psychological (see 67) and cultural factors associated with RSBB, while other research is examining the potential influence of environmental exposures, such as cigarette smoking and traumatic events, on RSBB.

Conclusion

These results demonstrate that numerous demographic and socioeconomic factors are associated with religious/spiritual beliefs and behaviours among this cohort of Bristol-based mothers and partners, particularly: age, ethnicity, marital status, education, income, occupational social class and deprivation. In general, higher socioeconomic position is associated with greater religiosity. However, individually these variables explain relatively little of the variation in RSBB. We again emphasise that these results should not be interpreted causally; nonetheless, we hope that this descriptive paper can be used to help inform future studies using this data, particularly regarding differences between the RSBB outcomes and the choice of potential demographic and socioeconomic confounders.

Ethics

Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. Informed consent for the use of data collected via questionnaires and clinics was obtained from participants following the recommendations of the ALSPAC Ethics and Law Committee at the time.

Data availability

Underlying data

Please see the ALSPAC data management plan which describes the policy regarding data sharing (http://www.bristol.ac.uk/alspac/researchers/data-access/documents/alspac-data-management-plan.pdf), which is by a system of managed open access. Data used for this submission will be made available on request to the Executive (alspac-exec@bristol.ac.uk). The datasets presented in this article are linked to ALSPAC project number B3911, please quote this project number during your application. Analysis code supporting this submission is openly-available at: https://github.com/djsmith-90/AnalysisCode_PredictorsOfRSBB_B3911.

The steps below highlight how to apply for access to the data included in this study and all other ALSPAC data:

1. Please read the ALSPAC access policy (http://www.bristol.ac.uk/media-library/sites/alspac/documents/researchers/data-access/ALSPAC_Access_Policy.pdf) which describes the process of accessing the data and samples in detail, and outlines the costs associated with doing so.
2. You may also find it useful to browse our fully searchable research proposals database (https://proposals.epi.bristol.ac.uk/?q=proposalSummaries), which lists all

research projects that have been approved since April 2011.

3. Please submit your research proposal (https://proposals.epi.bristol.ac.uk/) for consideration by the ALSPAC Executive Committee. You will receive a response within 10 working days to advise you whether your proposal has been approved.

Extended data

Open Science Framework: Supplementary information supporting this submission can be found on the Open Science Framework "Demographic and socioeconomic predictors of religious/spiritual beliefs and behaviours in a prospective cohort study (ALSPAC) in Southwest England: Results from the parental generation" project page, https://doi.org/10.17605/OSF.IO/T3RJH[31].

This project contains the following extended data:

- "G0SocioDemoPredictorsOfRSBB_SuppInfo.pdf" (the supplementary information file)
- "G0SocioDemoPredictorsOfRSBB_STROBE.pdf" (the completed STROBE cohort study reporting guidelines checklist).

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Acknowledgements

We are extremely grateful to all the families who took part in this study, the midwives for their help in recruiting them, and the whole ALSPAC team, which includes interviewers, computer and laboratory technicians, clerical workers, research scientists, volunteers, managers, receptionists and nurses.

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Open Peer Review

Current Peer Review Status: ? ✓ ✓

Version 2

Reviewer Report 07 August 2023

https://doi.org/10.21956/wellcomeopenres.20786.r62264

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✓ **Rana Jawad**
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The paper explores associations between possible demographic and socioeconomic causes of religious/spiritual beliefs and behaviours (RSBB) in the parental generation of the Avon Longitudinal Study of Parents and Children (ALSPAC). It uses a prospective birth cohort study (ALSPAC) in Southwest England with 14,157 enrolled mothers and 14,154 associated partners. Three RSBB outcome measures collected during pregnancy are examined: religious belief (belief in God/a divine power), religious affiliation (Christian/none/other) and religious attendance. Multiple demographic and socioeconomic exposures are. exploring age-adjusted associations between exposures and outcomes using multinomial regression, in addition to exposure-age interactions.

The study finds that a range of demographic and socioeconomic factors are associated with RSBB, including age, ethnicity, marital status, education, income and deprivation. A surprising and novel finding is that higher socioeconomic position (including degree-level education) is associated with increased levels of RSBB, particularly regarding religious attendance. The depth of these associations vary by outcome, for example, income is strongly associated with religious attendance, but only weakly with religious affiliation. Although results were demographically and socially patterned, overall effect sizes are small. What is note-worthy about the results is that the observed positive association between socioeconomic position and RSBB goes counter to much theoretical and empirical work. Reasons given by the authors for these differences are discussed, including cross-cultural variation (mainly between the UK and USA) in religiosity and state support, and differences between RSBB measures. One reason not explored in the paper is the close social and political association between the Church of England and the British middle class which might account for the findings regarding higher socio-economic status. This does not however, help to explain ethnic minority religious beliefs and orientations in the rest of the UK.

Overall, the paper is descriptive in nature but discusses its limitations carefully and has the advantage of laying the foundations for future research that can address more deeply the effect of confounders. To this end, the paper is very well-written paper offering a rare, up-to-date and robust view of the status if religiosity in the UK – albeit slightly skewed towards White, Christian

populations. There is a good literature on the health outcomes of religiosity in the USA, especially in relation to mental health and it is commendable that the authors have addressed these issues in the UK context – although focusing on a particular region of England.

Some key factors to consider further are the potential limitation of focusing on religious attendance as an indicator of belief or religiosity. This is because the literature on the sociology of religion has documented well how religious attendance is primarily a feature of Christian practice, for example in Islam: regular attendance at the mosque is not a compulsory facet of the faith.

In addition, regarding the positive correlation between high socio-economic status (like degree level education) and RSBB outcome measures, there is some key literature such as by Norris and Inglehart from the 1990s about welfare security and religiosity that this paper does not refer to. Discussing the findings of this paper in relation to studies such as these, even though they are now old is still important for building the scholarly basis of this paper. Two final observations: it is not entirely clear why there is a focus on pregnant women, some more explanation of this would be helpful. The paper also does not disaggregate religious and ethnic minority groups clearly, and uses the term “non-white”. This hides the cultural nuances the study seeks to address. The relative significance of religious outcomes such as attendance versus affiliation could also be better discussed in the paper. These are matters that could be helpful examined in a future paper.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Religion, social policy, middle east, social assistance, voluntary sector

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Aug 2023

Daniel Smith

We thank the author for their positive review and their thoughtful and constructive comments. We have responded to the reviewer's main suggestions in turn below, with the reviewer's original comments in standard font and our responses in italics.

One reason not explored in the paper [regarding the observed positive association between socioeconomic position and RSBB] is the close social and political association between the Church of England and the British middle class which might account for the findings regarding higher socio-economic status. This does not however, help to explain ethnic minority religious beliefs and orientations in the rest of the UK.

Thanks for raising this important point. This has now been added to the discussion: "Alternatively, the close social, political and historical connections between the Church of England (the main religious affiliation in this population) and the British ruling and middle classes may also potentially account for the observed positive associations between socioeconomic position and RSBB."

Some key factors to consider further are the potential limitation of focusing on religious attendance as an indicator of belief or religiosity. This is because the literature on the sociology of religion has documented well how religious attendance is primarily a feature of Christian practice, for example in Islam: regular attendance at the mosque is not a compulsory facet of the faith.

A section on this has now been added to the discussion in the paragraph on generalisability: "[...] aspects of religious practice are likely to vary by religious faith, which could not be explored in the present study, but ought to be taken into consideration in future work comparing across religions; regular religious attendance may be a more important feature of Christian practice compared to Islam, for example."

In addition, regarding the positive correlation between high socio-economic status (like degree level education) and RSBB outcome measures, there is some key literature such as by Norris and Inglehart from the 1990s about welfare security and religiosity that this paper does not refer to. Discussing the findings of this paper in relation to studies such as these, even though they are now old is still important for building the scholarly basis of this paper.

A reference to 'Sacred and Secular' by Norris and Inglehart has now been added to both the introduction and the discussion.

it is not entirely clear why there is a focus on pregnant women, some more explanation of this would be helpful.

An explanation of this, and a warning that it may potentially limit generalisability to the wider adult population, has been added to the discussion: "given that participants were the parental generation of a birth cohort the focus of this study is on pregnant women and their partners. Although religiosity in this cohort is somewhat stable over time (meaning these results are unlikely to be specific to pregnancy), it is possible that different sociodemographic patterning

with RSBB may be found in a more general adult population."

The paper also does not disaggregate religious and ethnic minority groups clearly, and uses the term "non-white". This hides the cultural nuances the study seeks to address.

Yes, unfortunately due to small sample sizes of minority ethnic groups (i.e., other than White), or religious faiths other than Christian, it was not possible to explore these important ethnic and religious nuances in any more detail. A section on this has been added to the generalisability paragraph of the discussion: "[...] due to small sample sizes we unfortunately had to combine all 'other than White' ethnic minority groups together, as well as all non-Christian religious affiliations (both ≤5% of the total sample). We were therefore unable to explore associations by different ethnicities, or by different religious faiths, in detail, potentially obscuring important differences between these groups". *Also, because it is a somewhat more inclusive term, throughout the paper we refer to 'other than White' ethnicities, rather than 'non-White' (other than in the short variable labels – e.g., 'nonWhiteEthnic' – in the tables and figures, which are purely for reasons of brevity, as 'otherThanWhiteEthnic' would have been too long).*

The relative significance of religious outcomes such as attendance versus affiliation could also be better discussed in the paper.

We have now included a section in the discussion mentioning how these different religious beliefs and behaviours may have different associations with subsequent health and behavioural outcomes: "For example, much work has suggested that religious attendance, rather than other aspects of RSBB, often has stronger associations with a range of health and behavioural outcomes, including mental health, prosocial behaviour and all-cause mortality, perhaps due to enhanced social support from religious networks and the transmission of religious norms."

Competing Interests: No competing interests were disclosed.

Reviewer Report 12 January 2023

https://doi.org/10.21956/wellcomeopenres.20786.r53897

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I believe that the article has improved and is an important contribution to the extant literature on the relevance of religiosity in mental health. In addition, the statistical assumptions in the article have been made clear and, thus, the article should provide grounds for future works focusing on the causal relations between religiosity/spirituality dimensions and mental health.

I have only one minor thing for the authors to address at this point:

1. "This body of work indicates that there is no simple association between socioeconomic position and RSBB. and Tthat ..." Punctuation and spelling can be easily revised.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, interreligious conflict, wellbeing, social identity

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 18 Aug 2023

Daniel Smith

We are delighted with the positive review and thank the reviewer for their input. We also apologise for the length of time taken to respond to the reviewer's comments; it took a while to find a further reviewer for this paper, and we thank this reviewer for their patience. We have now updated the minor typo/error noted by the reviewer.

Competing Interests: No competing interests were disclosed.

Version 1

Reviewer Report 05 December 2022

https://doi.org/10.21956/wellcomeopenres.19830.r53033

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The study aims to explore whether demographic and socioeconomic factors are related with RSBB in the parental generation of a prospective birth cohort data (the Avon Longitudinal Study of Parents and Children; ALSPAC). Although the authors employed a great number of variables, they claimed this work to be primarily descriptive. In addition, by examining variables that may cause RSBB the authors aim to inform future scholars the plausible confounders of the topic under study. Finally, the authors also explicitly stress that although the selection of their measures lean on some theoretical frameworks, they argue that socioeconomic factors employed as predictors can also be caused by RSBB. Thus, paving the way for a causality discussion in this matter.

There are several points which I would like to discuss regarding the manuscript.

1. Identifying confounders or mediators or suppressors need strong theoretical background. By only relying on statistical findings, researchers may not be able to provide a sound theoretical explanation to the findings. Thus, although the study is claimed to be descriptive in nature, there should be some theoretical notions behind the selection of the variables employed in the study.

   Further, the discussion on RSBB being the predictor or the dependent variable should involve a more in-depth literature review. After all, testing a causality in reality needs a strong theoretical background in determining the position of each variable involved. And I suppose it will be difficult to pick whether RSBB is a predictor or a dependent considering that each individual might be exposed to certain religious beliefs and behaviours during the first years of their life, while at the same time socioeconomic profile is also embedded within those first years of parenting.

2. There are many definitions of religiosity. The term should be defined to provide clear boundaries to readers.

3. There should be more justification provided on why such RSBB outcomes were the ones included in the study. Even when it is mainly because they were the only ones available in the dataset.

4. In the Discussion section (p.11 of the pdf), "These patterns were similar, but more nuanced, for education, with higher educational attainment linearly associated with religious attendance, but non-linearly associated with religious belief and affiliation..."

   This pattern is nowadays often observed in self-claimed religious countries, e.g., Indonesia. Can the authors provide an alternative explanation as to why this is also observed in the research area? Is religiosity becoming more vital in public sphere?

5. Still in the Discussion section (p.11), what do the authors mean by society-level differences in religiosity? Is there a different level of religiosity meaning in different layers of society?

6. The authors are encouraged to provide more plausible theoretical explanations than merely statistical figures. I understand that a significant finding accompanied with low beta coefficient, for example, may not offer a lot to talk about. However, when discussing certain findings, the authors can further explain the different facets of religious beliefs that are available in the literature. For instance, beliefs in particularistic teachings and beliefs in religious ingroup superiority. And how these might be necessary to further understand the differences found in the relations.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social psychology, interreligious conflict, wellbeing, social identity

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have

significant reservations, as outlined above.

Author Response 16 Dec 2022

Daniel Smith

We thank the author for their review and their constructive comments. We have responded to the reviewer's comments in turn below, with the reviewer's original comments in standard font and our responses in italics. There are several points which I would like to discuss regarding the manuscript.

1. Identifying confounders or mediators or suppressors need strong theoretical background. By only relying on statistical findings, researchers may not be able to provide a sound theoretical explanation to the findings. Thus, although the study is claimed to be descriptive in nature, there should be some theoretical notions behind the selection of the variables employed in the study.

   The theoretical basis detailing why sociodemographic factors may be expected to cause RSBB is given in the third paragraph of the introduction. However, we acknowledge that this theoretical justification was not especially detailed, and have expanded upon this in the revised version: "Research has identified three broad categories of variables which may cause RSBB (see 9,10): socioeconomic, cognition/psychology and cultural transmission. In this paper we focus on the first factor (in addition to demographic factors). A socioeconomic perspective suggests that RSBB may be heightened in times of stress, uncertainty or insecurity as a way for people to explain and understand these events and find meaning in the world[11-13]. This perspective posits that as material security increases, such as via well-functioning secular institutions, religiosity – broadly defined as encompassing a range of religious/spiritual beliefs and behaviours including religious belief, affiliation, attendance and prayer [Saraglou, 2011] – will decline. Therefore, socioeconomic and demographic factors – such as deprivation, lower social class, lower income and marginalised minority groups – are expected to be associated with heightened religiosity. Some evidence supports this view, finding a country-level association between increased material security and lower levels of religiosity[14], and that marginalised groups in US society, such as women, racial minorities and those from a lower socioeconomic position (SEP), are more likely to be religious[11]. Indeed, there is evidence that lower SEP, often proxied by educational attainment, is associated with higher levels of religiosity[15-17]. However, this effect is not replicated in all studies[9,10,18], and the association between socioeconomic factors and RSBB appears to vary by numerous factors, including, for example: i) by country, with a negative association between education and religiosity found overall, but the association was highly variable within countries, and in some countries was positive[16]; ii) by religious denomination, with associations between education and religious belief variable depending on the Christian denomination[18] (see also [19]); iii) by the RSBB outcome used, as in the US education often has a positive association with religious attendance, but a negative association with religious belief and frequency of prayer behaviours [Schwadel, 2011; Glaeser & Sacerdote, 2008]; and iv) by the socioeconomic factor explored, with education having a positive association with religious attendance but no association for income in the US [Glaeser & Sacerdote, 2008]. This body of work indicates that there is no simple association between socioeconomic position and RSBB. Studies may therefore need to examine this relationship on a case-by-case basis to

explore the strength and direction of these associations and to understand the reasons for these divergences." Furthermore, even if there is a strong theoretical justification, often these associations are not known with certainty and may differ for different studies (see the references cited in the introduction and discussion for numerous examples of this, e.g., different associations by country, or for different RSBB measures). For instance, in the present study there is a strong theoretical justification for thinking that socioeconomic factors may predict lower rates of religiosity, but here we found the opposite! We also note that theoretical justification isn't always necessary to identify causality (see VanderWeele, 2021), although theoretical justification for a given causal effect is of course important and provides additional support for a given causal effect.

Further, the discussion on RSBB being the predictor or the dependent variable should involve a more in-depth literature review. After all, testing a causality in reality needs a strong theoretical background in determining the position of each variable involved. And I suppose it will be difficult to pick whether RSBB is a predictor or a dependent considering that each individual might be exposed to certain religious beliefs and behaviours during the first years of their life, while at the same time socioeconomic profile is also embedded within those first years of parenting.

The aim of this section was not to claim definitively that causality may be bidirectional, but rather that this is an assumption on which our study rests and should be explored in future work. For instance, we have provided some potential examples of this – e.g., RSBB potentially causing marital status and education – and justification for why this effect may be plausible, and how this can be tested and explored in future work (i.e., making use of longitudinal data; VanderWeele, 2016). However, we do not feel that a detailed literature review of whether each sociodemographic factor may plausibly cause RSBB is necessary for making this point, especially given that the discussion is already quite long.

2. There are many definitions of religiosity. The term should be defined to provide clear boundaries to readers.

   We have now added a broad definition of 'religiosity' in the introduction: "religiosity – broadly defined as encompassing a range of religious/spiritual beliefs and behaviours including religious belief, affiliation, attendance and prayer…", and cited Saroglou (2011) to justify this definition.

3. There should be more justification provided on why such RSBB outcomes were the ones included in the study. Even when it is mainly because they were the only ones available in the dataset.

   We have provided additional justification for these RSBB outcomes in the methods section: "These RSBB outcomes were chosen because they cover a range of theoretically-important elements of religiosity (belief, affiliation and behaviour) and have been used extensively in previous research, allowing comparisons to previous literature.", and cited the following references in support of this (Saroglou, 2011; McAndrew & Voas, 2011).

4. In the Discussion section (p.11 of the pdf), "These patterns were similar, but more

nuanced, for education, with higher educational attainment linearly associated with religious attendance, but non-linearly associated with religious belief and affiliation..."

This pattern is nowadays often observed in self-claimed religious countries, e.g., Indonesia. Can the authors provide an alternative explanation as to why this is also observed in the research area? Is religiosity becoming more vital in public sphere?

Given the comments of both reviewers, we have provided a more extensive theoretical discussion of these results and potential explanations for these patterns of results. This new paragraph reads: "Additional research is required to understand these socially patterned results in greater detail and, in particular, why they differ from previous research and theoretical expectations, but we make some tentative suggestions here. One potential reason is that most of the previous work in this area has been conducted in the US, yet these associations are known to differ cross-culturally [Schwadel, 2015; Ruiter & van Tubergen, 2009]. The finding that education is positively associated with religious attendance is perhaps less surprising as it has been reported in the US previously [McFarland et al., 2011; Schwadel, 2011; Glaeser & Sacerdote, 2008] – although cross-cultural analyses do suggest an overall negative association between education and religious attendance [Ruiter & van Tubergen, 2009] – and could be explained by the known positive association between educational attainment and all forms of social interaction [Glaeser & Sacerdote, 2008]; as education is a proxy for socioeconomic position, this may also explain the positive association between religious attendance and other socioeconomic factors, such as income, occupational social class and area-level affluence. The positive associations between these socioeconomic factors and religious belief and affiliation are more surprising, however, as most previous research has found either negative [Schnabel, 2020; Hungerman, 2015] or null [Gervais et al., 2021; Willard & Cingl, 2017; Schwadel, 2011] associations with these RSBB measures. Although difficult to identify the precise reason(s), one potential explanation is the higher degree of state social support for the less affluent members of UK society [Alesina et al., 2004]. This may mean that the need for religion as a key source of emotional, social and psychological support when in a situation of material insecurity – as reported in various US samples [Schnabel, 2020; Taylor et al., 2017] – is weaker in the UK. A further, and not mutually exclusive, explanation could be due to differences in religiosity between the US and the UK, with the UK being much less religious than the US [Voas & Chaves, 2016]. Indeed, previous cross-cultural work has suggested that the negative association between education and religiosity is weaker in less religious countries, and in some cases even positive [Schwadel, 2015]; given the higher level of religious attendance among educated individuals within these societies, perhaps this attendance directly affects religious belief and affiliation [Schwadel, 2015]. These are of course very preliminary explanations, and we hope that future work will explore and understand these associations in greater detail.".

5. Still in the Discussion section (p.11), what do the authors mean by society-level differences in religiosity? Is there a different level of religiosity meaning in different layers of society?

We hope that the response above, which provides additional detail for how society-level differences – i.e., between the US (where most of the previous work was undertaken) and

the UK (where the current research was conducted) – may perhaps explain the observed results.

6. The authors are encouraged to provide more plausible theoretical explanations than merely statistical figures. I understand that a significant finding accompanied with low beta coefficient, for example, may not offer a lot to talk about. However, when discussing certain findings, the authors can further explain the different facets of religious beliefs that are available in the literature. For instance, beliefs in particularistic teachings and beliefs in religious ingroup superiority. And how these might be necessary to further understand the differences found in the relations.

As above, we hope that our more detailed discussion has provided sufficient detail regarding the theoretical interpretation and implications of these results. Literature cited in response to reviewer: Saroglou, V. (2011). Believing, bonding, behaving, and belonging: The big four religious dimensions and cultural variation. Journal of Cross-Cultural Psychology, 42(8), 1320-1340. McAndrew, S., & Voas, D. (2011). Measuring Religiosity Using Surveys: Survey Question Bank Topic Overview 4. (Survey Resources Network Question Bank). University of Surrey *VanderWeele, T. J., Jackson, J. W., & Li, S. (2016). Causal inference and longitudinal data: a case study of religion and mental health. Social psychiatry and psychiatric epidemiology, 51(11), 1457-1466. VanderWeele, T. J. (2021). Can sophisticated study designs with regression analyses of observational data provide causal inferences?. JAMA psychiatry, 78(3), 244-246.*

Competing Interests: None.

Reviewer Report 25 August 2022

https://doi.org/10.21956/wellcomeopenres.19830.r51326

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This paper sought to characterize the relationships between socioeconomic indicators and religious and spiritual beliefs in a large adult sample. The sample size is commendable and the project is important and interesting. For scholars who are not familiar with ALSPAC, the title of the paper is a little inaccessible and misleading - it is easy to think that this paper concerns a longitudinal dimension which it doesn't. The most important area that needs improvement in the current version of the paper is its theoretical basis which is unclear, and the empirical implications

or applications which are not discussed. Below I offer some additional suggestions for clarifications and ways to strengthen the paper and better contextualize it for interdisciplinary scholars. This is important in order to evaluate whether the paper is making a genuine contribution to the literature.

Firstly, although the authors caution against causal language, there are some instances when causal language is used. For instance, instead of “predictors” or “causes” (in the title and abstract and throughout the paper), “correlates” would be a more appropriate term here.

Secondly, the rationale behind the paper is a little unclear. At the moment it seems a little like this demographic analysis was done as part of a bigger project or to set up future papers, but it’s not clear why the authors chose to look at these associations here. Having the data to look at the associations is surely useful, but what is the theoretical basis for examining these relationships? Moreover, in the third paragraph of the introduction the authors allude to the fact that the effect may be more complex but in the end of reading the paper, it wasn’t clear that nuanced relationships and sub profiles were genuinely elucidated. The poor theoretical basis of the paper is its weakest aspect and even in the conclusion there is no theoretical synthesis to help psychologists understand why these relationships exist here and why they matter or are worthy of further investigation.

Thirdly, I would encourage the authors to add Bayes Factors to all of the core analyses. Bayes Factors can be easily computed in R using the package BayesFactor or on JASP which is free to download and user-friendly. Bayes Factors allow quantification of the evidential strength in the data for a particular hypothesis (e.g. that SES is negatively related to religious beliefs). This would substantially strengthen the paper and help add robustness to the correlational work and the limited R2 explained.

Fourthly, the emphasis on ‘p-values’ is very odd and I’ve never seen a figure like Figure 6 that is one purely of p values with no effect sizes. An explanation (and maybe reexamination) of this approach would be valuable.

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Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Psychology of religion, psychology of ideology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 16 Dec 2022

Daniel Smith

We thank the author for their review and their constructive comments. We also apologise for the length of time taken to respond to the reviewer's comments; it took a while to find a second reviewer for this paper, and we thank this reviewer for their patience. We have responded to the reviewer's comments in turn below, with the reviewer's original comments in standard font and our responses in italics.

For scholars who are not familiar with ALSPAC, the title of the paper is a little inaccessible and misleading - it is easy to think that this paper concerns a longitudinal dimension which it doesn't.

ALSPAC is a 'prospective cohort study', and best practice guidelines (e.g., STROBE; https://www.strobe-statement.org/checklists/) recommend that studies "Indicate the study's design with a commonly used term in the title or the abstract". While we see how 'prospective cohort study' could indicate a potential longitudinal dimension, upon reading the paper we hope that readers will quickly realise that we do not explore these associations longitudinally.

Firstly, although the authors caution against causal language, there are some instances when causal language is used. For instance, instead of "predictors" or "causes" (in the title and abstract and throughout the paper), "correlates" would be a more appropriate term here.

There are indeed some instances in this paper where causal language is used, such as in the abstract where we say: "We explored associations between possible demographic and socioeconomic causes of religious/spiritual beliefs and behaviours". We believe that this language is justified in this instance, as the aim of this paper is to describe various sociodemographic variables which may be used as confounders in future work; for a variable to be a confounder, it has to cause the exposure and the outcome (Hernán & Robins, 2020). If a variable is merely correlated with RSBB, it may be a confounder (if it causes RSBB), but could also be a mediator or

a collider (if it is caused by RSBB), or have no causal association if the correlation is due to an unmeasured third variable; this distinction is crucial when considering causality, as adjustment for confounders removes bias while adjustment for mediators and colliders results in increased bias (VanderWeele et al., 2021). Given this, and the theoretical expectation that socioeconomic factors are likely to cause RSBB (e.g., references 11-13 cited in the text), we believe that the use of causal language when selecting sociodemographic confounders is warranted. Of course, there is the possibility that these sociodemographic factors may also be caused by religion (in which case they may not only be confounders, but also potential mediators or colliders), which we discuss in detail in the discussion. We hope this provides sufficient justification for our choice of causal language when discussing the choice of potential sociodemographic variables, even though – as the reviewer acknowledges – we caution against interpreting the results of the analyses presented in this paper as unbiased causal effect estimates. To try and make this clearer and avoid any future misunderstandings, we have altered the last sentence of the introduction from: "Establishing causal links between these variables and RSBB is beyond the scope of this paper, and our aim here is more modest: to describe these broad associations and act as a platform to inform future research in this area." To: "While the selection of sociodemographic factors is based on causal considerations, our aim is not to estimate the unbiased causal effects between these sociodemographic variables and RSBB, and instead our aim here is more modest: to describe these broad associations and act as a platform to inform future research in this area.". Regarding the term 'predictors' (e.g., in the title), we would contend that 'prediction' is a non-causal term and is largely synonymous with 'associated' or 'correlated' (see, e.g., Hernán, 2018 and Shmueli, 2010). For instance, carrying a lighter predicts – is correlated with – whether someone smokes, but it does not cause smoking behaviour.

Secondly, the rationale behind the paper is a little unclear. At the moment it seems a little like this demographic analysis was done as part of a bigger project or to set up future papers, but it's not clear why the authors chose to look at these associations here. Having the data to look at the associations is surely useful, but what is the theoretical basis for examining these relationships? Moreover, in the third paragraph of the introduction the authors allude to the fact that the effect may be more complex but in the end of reading the paper, it wasn't clear that nuanced relationships and sub profiles were genuinely elucidated. The poor theoretical basis of the paper is its weakest aspect and even in the conclusion there is no theoretical synthesis to help psychologists understand why these relationships exist here and why they matter or are worthy of further investigation.

The theoretical basis detailing why sociodemographic factors may be expected to cause RSBB is given in the third paragraph of the introduction. However, we acknowledge that this theoretical justification was not especially detailed, and have expanded upon this in the revised version:

"Research has identified three broad categories of variables which may cause RSBB (see 9,10): socioeconomic, cognition/psychology and cultural transmission. In this paper we focus on the first factor (in addition to demographic factors). A socioeconomic perspective suggests that RSBB may be heightened in times of stress, uncertainty or insecurity as a way for people to explain and understand these events and find meaning in the world[11-13]. This perspective posits that as material security increases, such as via well-functioning secular institutions, religiosity – broadly defined as encompassing a range of religious/spiritual beliefs and behaviours including religious belief, affiliation, attendance and prayer [Saraglou, 2011] – will decline. Therefore, socioeconomic

and demographic factors – such as deprivation, lower social class, lower income and marginalised minority groups – are expected to be associated with heightened religiosity. Some evidence supports this view, finding a country-level association between increased material security and lower levels of religiosity[14], and that marginalised groups in US society, such as women, racial minorities and those from a lower socioeconomic position (SEP), are more likely to be religious[11]. Indeed, there is evidence that lower SEP, often proxied by educational attainment, is associated with higher levels of religiosity[15-17]. However, this effect is not replicated in all studies[9,10,18], and the association between socioeconomic factors and RSBB appears to vary by numerous factors, including, for example: i) by country, with a negative association between education and religiosity found overall, but the association was highly variable within countries, and in some countries was positive[16]; ii) by religious denomination, with associations between education and religious belief variable depending on the Christian denomination[18] (see also[19]); iii) by the RSBB outcome used, as in the US education often has a positive association with religious attendance, but a negative association with religious belief and frequency of prayer behaviours [Schwadel, 2011; Glaeser & Sacerdote, 2008]; and iv) by the socioeconomic factor explored, with education having a positive association with religious attendance but no association for income in the US [Glaeser & Sacerdote, 2008]. This body of work indicates that there is no simple association between socioeconomic position and RSBB. Studies may therefore need to examine this relationship on a case-by-case basis to explore the strength and direction of these associations and to understand the reasons for these divergences."

We have also added additional justification regarding the rationale of the study in the last paragraph of the introduction:

"This work is therefore primarily descriptive; by examining variables which may cause RSBB we can help inform the choice of confounders in future studies using these ALSPAC data. By analysing a range of RSBB outcomes and sociodemographic variables, this research will also provide a detailed exploration of how different measures of RSBB – including religious belief, affiliation and attendance – associate with various socioeconomic measures – including education, income, area-level deprivation and occupational social class. This research can assess whether these associations differ from one another, and also whether these results in a cohort of UK parents vary from those of previous research, most of which has been conducted in the US.". While this is a matter of opinion, we would disagree that "it wasn't clear that nuanced relationships and sub profiles were genuinely elucidated". No individual study can explore every nuance, but by examining three RSBB outcomes – religious belief, religious affiliation and religious attendance – in addition to a large range of sociodemographic factors, this study provides a detailed description of these associations and some of the nuances and complexities involved. This includes differences between the various RSBB measures, as well as between the different sociodemographic exposures; for instance, in general there was a positive association between most measures of socioeconomic position and the three RSBB outcomes, but this differed for education, where associations were non-linear for religious belief and affiliation (with degree-level education associated with less religious belief and Christian affiliation), yet broadly linear and positive for religious attendance (figure 5). Regarding theoretical synthesis in the discussion, as this paper is primarily descriptive, we intentionally avoided making strong theoretical/causal claims as more in-depth future work is needed for this. However, we did touch upon some theoretical implications in the discussion, which we have expanded upon in the revised manuscript: "Additional research is required to understand these socially patterned

results in greater detail and, in particular, why they differ from previous research and theoretical expectations, but we make some tentative suggestions here. One potential reason is that most of the previous work in this area has been conducted in the US, yet these associations are known to differ cross-culturally [Schwadel, 2015; Ruiter & van Tubergen, 2009]. The finding that education is positively associated with religious attendance is perhaps less surprising as it has been reported in the US previously [McFarland et al., 2011; Schwadel, 2011; Glaeser & Sacerdote, 2008] – although cross-cultural analyses do suggest an overall negative association between education and religious attendance [Ruiter & van Tubergen, 2009] – and could be explained by the known positive association between educational attainment and all forms of social interaction [Glaeser & Sacerdote, 2008]; as education is a proxy for socioeconomic position, this may also explain the positive association between religious attendance and other socioeconomic factors, such as income, occupational social class and area-level affluence. The positive associations between these socioeconomic factors and religious belief and affiliation are more surprising, however, as most previous research has found either negative [Schnabel, 2020; Hungerman, 2015] or null [Gervais et al., 2021; Willard & Cingl, 2017; Schwadel, 2011] associations with these RSBB measures. Although difficult to identify the precise reason(s), one potential explanation is the higher degree of state social support for the less affluent members of UK society [Alesina et al., 2004]. This may mean that the need for religion as a key source of emotional, social and psychological support when in a situation of material insecurity – as reported in various US samples [Schnabel, 2020; Taylor et al., 2017] – is weaker in the UK. A further, and not mutually exclusive, explanation could be due to differences in religiosity between the US and the UK, with the UK being much less religious than the US [Voas & Chaves, 2016]. Indeed, previous cross-cultural work has suggested that the negative association between education and religiosity is weaker in less religious countries, and in some cases even positive [Schwadel, 2015]; given the higher level of religious attendance among educated individuals within these societies, perhaps this attendance directly affects religious belief and affiliation [Schwadel, 2015]. These are of course very preliminary explanations, and we hope that future work will explore and understand these associations in greater detail.".

We hope these revisions provide additional justification for our study, in addition to better theoretical integration with the literature.

Thirdly, I would encourage the authors to add Bayes Factors to all of the core analyses. Bayes Factors can be easily computed in R using the package BayesFactor or on JASP which is free to download and user-friendly. Bayes Factors allow quantification of the evidential strength in the data for a particular hypothesis (e.g. that SES is negatively related to religious beliefs). This would substantially strengthen the paper and help add robustness to the correlational work and the limited R2 explained.

We thank the reviewer for this suggestion, but are hesitant about changing the analyses to this extent without strong justification. For instance, although there may be some benefits to Bayes Factors, essentially p-values and Bayes Factors attempt to measure the same thing: the strength of evidence for one model/hypothesis over another (Held & Ott, 2018). This means that there is likely to be little benefit here to using Bayes Factors over p-values, especially since the p-values reported here are based on the results of likelihood ratio tests (i.e., comparing a model with vs without the sociodemographic exposure), which is conceptually analogous to how Bayes Factors would be applied. Although p-values can of course be abused and misinterpreted – e.g., by being

arbitrarily dichotomised into 'significant' and 'non-significant' (which we have tried to avoid here) – given that they are more widely-used than Bayes Factors, we believe that the focus of p-values rather than Bayes Factors is appropriate for our study, and that adopting Bayes Factors would be unlikely to improve our inferences or dramatically alter our conclusions.

Fourthly, the emphasis on 'p-values' is very odd and I've never seen a figure like Figure 6 that is one purely of p values with no effect sizes. An explanation (and maybe reexamination) of this approach would be valuable.

We are somewhat puzzled by this statement, as our emphasis is not solely on p-values. While we certainly make use of p-values as a measure of evidence against the null hypothesis, we clearly provide measures of effect sizes via pseudo-R^2 values (figure 3 for mothers, figure S14 for partners), in addition to the relative risk ratio regression estimates from the multinomial models (with some results presented in the main text – e.g., figures 4 and 5 – and full results in the supplementary information). We made use of all of this information when interpreting these results, and clearly state this in the methods ("To provide a single p-value for each model to assess model fit, we ran two sets of likelihood ratio tests for each exposure-outcome combination: the first assessed whether inclusion of the exposure improved model fit relative to an age-only model (or an empty model, where age was the exposure); the second assessed whether inclusion of an interaction term between age and the exposure improved model fit relative to the model with no interaction. […] To give an indication of the increase in model fit resulting from inclusion of the exposure, we calculated the difference in McFadden's pseudo-R2 value between the model with vs without the exposure (or with vs without the interaction term, for interaction models)."). We also refer to this in the results ("Thus, although the majority of exposures were below the Bonferroni-adjusted p-value threshold, the amount of variance explained by these exposures is likely to be small") and the discussion ("Despite some highly significant associations (as indicated by p-values), the estimated variance explained using pseudo-R^2 values was relatively low, with a maximum value of 2.4%, highlighting that relatively little of the variation in RSBB is explained by individual demographic and socioeconomic factors."). Given the number of comparisons made, we felt that a figure of all the p-values (like figure 2), and a separate figure of all the effect sizes (like figure 3), was the clearest way to present this information. We also note that this kind of p-value plot is common in other areas where the focus is on summarising a large number of comparisons, and is similar to Manhattan-style plots (https://en.wikipedia.org/wiki/Manhattan_plot) for genome-wide (Turner, 2014) or exome-wide (Hernandez-Ferrer et al., 2019) association studies.

Finally, it would be useful if the abstract offered more substantive information about the direction of the finding and what this might mean or why the discrepancies exist between the present sample and past samples. Why is education and income positively related to RSBB outcomes here but not in other samples? Are there features of the sample that explain this? Such an elucidation would help the paper be better situated in the literature.

We have altered the conclusion section of the abstract, from: "These findings demonstrate that numerous demographic and socioeconomic factors are associated with RSBB in this population. While additional work is needed to assess whether any of these associations are causal, this descriptive paper can help inform future studies using this data by considering appropriate confounders and thus attempt to minimise bias that confounding may introduce." To: "The

observed positive association between socioeconomic position and RSBB is contrary to much previous theoretical and empirical work. Potential reasons for these differences are discussed, including cross-cultural variation in religiosity and state support, and differences between RSBB measures. This descriptive paper can also help inform future studies using these data regarding the consideration of appropriate confounders.".

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Competing Interests: None.