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# Breastfeeding initiation rate across Western countries: does religion matter?

## An ecological study.

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### **Abbreviations**

GDP: Gross Domestic Product; HDI: Human Development Index; SES: socioeconomic status; UK: United Kingdom; US: United States of America.

**Transparency declaration**

I, Jonathan Y Bernard affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

**Contributorship statement**

JYB designed the study, collected and analysed the data, and wrote a first draft. EC and MSK provided input in study design, data analysis and manuscript writing. All authors interpreted the results, revised the manuscript, and approved the final version to be submitted. JYB confirms that he had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## **ABSTRACT**

**Background:** Breastfeeding initiation rates remain below 80% in some Western countries. Many individual-level determinants are known, however, less is known regarding cultural and societal determinants, such as religion, that could explain population-level variations. We examined the correlations of the proportions of Catholics and Protestants with the breastfeeding initiation rates across and within Western countries.

**Methods:** Using publicly available data, we carried out an ecological study comparing the proportions of Catholics and Protestants with the rates of breastfeeding initiation. We correlated data at the country level, and additionally explored within-country data in five Western countries: France (Departments), Ireland (counties), United Kingdom (countries), Canada (provinces) and the United States (states). Our analyses accounted for human development index, gross domestic product and population density.

**Results:** We observed a negative correlation ( $\rho=-0.30$ ) between the proportion of Catholics and the rate of breastfeeding initiation in Western countries. This correlation was consistent when using within-country data in France ( $\rho=-0.27$ ), Ireland ( $\rho=-0.23$ ), the United Kingdom ( $\rho=-0.79$ ) and Canada ( $\rho=-0.62$ ). In the United States, the positive correlation ( $\rho=-0.26$ ) between a state's proportion of Catholics and its breastfeeding initiation rate was confounded by race, education and socioeconomic status. After controlling for education and SES, the state proportion of non-Hispanic White Catholics was negatively correlated ( $\rho=-0.62$ ) with the rate of breastfeeding initiation.

**Conclusions:** In this ecological study, we found consistent negative correlations between Catholicism and breastfeeding initiation rates. Qualitative and quantitative studies at the individual level are needed to confirm and explain our findings. Our results suggest that women living in a country or region where Catholicism has historically dominated are less

likely to initiate breastfeeding, and that breastfeeding promotion policies should be adapted to better fit populations' cultural and religious norms.

#### **What is already known about this subject?**

- Despite the World Health Organization's recommendations promoting breastfeeding, wide variations in breastfeeding initiation rates are observed among Western countries, with some reaching > 95%, while others remain < 80%.
- Many individual-level determinants of breastfeeding are known, such as maternal age, education, and previous breastfeeding experience.
- Less is known regarding cultural and societal determinants, such as religion, which could explain population-level differences between and within countries.

#### **What are the new findings?**

- In Western countries, the proportion of Catholics is negatively correlated with the rate of breastfeeding initiation.
- This negative correlation is also observed within countries in France, Ireland, United Kingdom and Canada, and among non-Hispanic Whites in the United States.
- Western countries with a higher proportion of Protestants are closer to meet the World Health Organization's recommendations.

#### **What are the recommendations for policy and practice?**

- Our study suggests religion as a population-level determinant of breastfeeding initiation in Western countries; this knowledge could help refine breastfeeding promotion policies in countries and areas with larger Catholic populations.
- More research is needed to understand potential underlying mechanisms relating breastfeeding practice to religious and cultural values and customs.

## INTRODUCTION

The presence of mammary glands and the female's ability to lactate/breastfeed are key features of all mammals, including humans.<sup>1 2</sup> Yet breastfeeding among modern humans is strongly influenced by cultural values, beliefs and customs, leading to variations in breastfeeding practices.<sup>3</sup>

Many studies reported benefits of breastfeeding (*vs* formula feeding) for the short- and long-term health of the offspring and the mother.<sup>4 5</sup> The World Health Organisation now recommends exclusive breastfeeding for 6 months and continued partial breastfeeding to 2 years.<sup>6</sup> In most countries, whether high- or low-income, rates of breastfeeding initiation exceed 90%, although its recommended exclusivity and duration are rarely attained. In Western countries, where initiation rates reached a low in the mid-20<sup>th</sup> century, considerable public health efforts have been made to promote and support breastfeeding. Countries from Northern Europe have since increased initiation rates to as high as 95%.<sup>7</sup> However, rates remain below 80% in several European countries, especially in Southern Europe (76%, 65% and 62%, respectively, in Spain, France, and Malta).<sup>7</sup> This apparent north-south gradient in breastfeeding initiation rates has a few notable counterexamples, including Ireland (46%), Northern Ireland (64%) and Poland (71%).<sup>7</sup> In Canada and in the United States (US), breastfeeding initiation rates were 87% and 75%, respectively, in 2010.<sup>8 9</sup> Canada has a strong west-east gradient, with Quebec and the Atlantic provinces reporting the lowest rates. The US has a prominent northwest-southeast gradient, with some south-eastern states reporting breastfeeding initiation rates below 30%; this state variation remains even after accounting for key determinants such as ethnicity and socioeconomic status (SES).<sup>10</sup>

A number of determinants of breastfeeding practices have been identified and categorised into five groups:<sup>11</sup> i) demographic (age, ethnicity, education, SES, employment), ii) psychosocial (maternal confidence, health belief, relative support), iii) health care factors and biomedical

constraints (promotion, training, individual health), iv) community attributes (social networks and norms/standards, peer support groups), and v) public policy (e.g., laws on maternity benefits). When asked, mothers who choose not to breastfeed mention individual-level determinants (lack of confidence, pain and difficulties, lack of milk, return to work, embarrassment to publicly breastfeed).<sup>12-15</sup> This makes it difficult to identify underlying determinants at the population level that are likely to explain between-country variations. Yet, as outlined by Bourdieu, individual norms and habits may be driven by sociocultural norms – *the habitus* – which can underlie individual choices.<sup>16</sup>

From a socio-anthropological standpoint, individual- and population-level determinants share systems of customs, beliefs and values, including religious culture. Religious culture may influence individual health practices, as highlighted by Durkheim and Weber in their seminal work on suicide rates and self-esteem in Catholics and Protestants.<sup>17 18</sup> Based on their theoretical framework, more recent studies have identified associations between sociocultural traits and individual health perceptions and practices.<sup>19-21</sup> Women's choice to breastfeed (or not) are therefore likely to be influenced by religious culture or adherence to traditional or modern values. We hypothesized that Catholicism and Protestantism may influence breastfeeding practice across and within countries, particularly in Western countries where these two religious cultures are historically grounded.

By collating publicly available online data, we carried out an ecological study to assess the association between the proportions of Catholics and Protestants and rates of breastfeeding initiation. Because such an approach requires sufficient statistical variability for both the independent and dependent variables, we focused on Western countries. We also studied within-country regional variations in five Western countries for which we found data: France, Ireland, United Kingdom (UK), Canada and the US.

## **METHODS**

### **Country data**

Country-level proportions of Roman Catholics and Protestants were gathered from the Pew Research Centre database<sup>22</sup> and, when missing there, from the *Central Intelligence Agency's* World Factbook 2013-2014.<sup>23</sup> Breastfeeding initiation rates were obtained from the online databases of the *World Health Organization*<sup>24</sup> and, for its members, from the *Organisation for Economic Co-operation and Development* (OECD).<sup>25</sup> The Gross Domestic Product (GDP) per capita was obtained from the *Central Intelligence Agency's* World Factbook 2013-2014,<sup>23</sup> and the 2014 Human Development Index (HDI) from the 2015 Human Development Report of the *United Nations Development Programme*.<sup>26</sup>

### **French Department data**

The proportions of Roman Catholics, Protestants and “no religion” in French Departments were obtained from data collected between 2003 and 2006 by the polling company *Institut français d'opinion publique* (Ifop, French Institute of Public Opinion).<sup>27</sup> This survey was based on a cumulative, representative sample of 91,559 interviews; data were available for 94 of the 101 French administrative Departments. Breastfeeding initiation rates by Department were obtained from the “Child Health Certificate on the 8<sup>th</sup> Day,” a national survey whose data are available on the website of the *Direction de la recherche, des études, de l'évaluation et des statistiques* (Dress, French Direction of Research, Studies, Evaluation and Statistics).<sup>28</sup> Yearly data over the period 2006-2013 were collated and averaged to smooth variations and overcome sporadic missing data for a few Departments. GDP (in 2005) and population density (in 2006) by Department were obtained from the *Institut national de la statistique et des études économiques* (Insee, National Institute of Statistics and Economic Studies).



### **Irish county data**

Religion proportions (Roman Catholics, Anglicans (Church of Ireland) and “no religion”), population density and GDP in Irish counties were collated from the Irish Census 2011 available on the *Central Statistics Office* website.<sup>29</sup> Breastfeeding initiation rates were from the *Perinatal Statistics Report 2011*.<sup>30</sup>

### **UK country data**

Religion proportions (Roman Catholics, Anglicans and “no religion”) in England, Wales, Scotland and Northern Ireland were obtained from their respective 2001 censuses.<sup>31-33</sup> Data on breastfeeding were obtained from the United Nations Children's Emergency Fund UK website.<sup>34</sup> Regional Gross Value Added in 2014 was obtained from data published by the Office for National Statistics, and population density was derived from the 2011 Census.

### **Canadian province data**

Religion proportions (Roman Catholics, Protestants and “no religion”) and breastfeeding data were collated on the Statistics Canada website, from the 2011 National Household Survey (religion) and the 2009-2010 Canadian Community Health Survey (breastfeeding).<sup>13 35</sup> GDP per capita in 2014 and population density in 2011 were also obtained from the Statistics Canada website.

### **US state data**

Proportions of Roman Catholics, Evangelical Protestants, Mainline Protestants and “no religion” in US states were obtained from the 2014 survey of the *Public Religion Research Institute*, available on the *American Values Atlas project* website.<sup>36</sup> That survey also includes ethnic-specific religion data (i.e., White Evangelical Protestants, Black Protestants, non-Hispanic White Catholics). State-level data on ethnicity proportion (state percentage of non-

Hispanic Whites, Hispanic Whites and Blacks), educational attainment (% of population with high school degree or less) and household income (% of population with <\$30,000/year) were also gathered on this website. State-level data on breastfeeding were from the *2010 National Immunization Survey* conducted by the *Centers for Disease and Control and Prevention*.<sup>9</sup> Ethnic-specific breastfeeding initiation rates by state were also available for non-Hispanic Whites ( $n=50$  states), Hispanic Whites ( $n=44$ ) and Blacks ( $n=26$ ).

### **Statistical analyses**

Frequency distributions for religion and breastfeeding initiation were visually inspected. Spearman's unadjusted and partial correlations were used to assess the relationship between country-level religion proportions of Catholics and Protestants and of breastfeeding initiation. This analysis was stratified by world sub-region and adjusted for GDP per capita and for HDI (separately, since GDP per capita is accounted for in the HDI). The Western sub-region was defined as European countries plus Cyprus, Canada, US, Australia and New Zealand.

Spearman (rank) correlation coefficients were used to compare religion proportions with breastfeeding initiation rates using within-country data, namely French Departments, Irish counties, UK countries, Canadian provinces and US states. For UK data, we used the more statistically powerful Pearson correlation coefficient because of the small number of countries. Correlations were adjusted for GDP per capita (to account for within-country economic wealth differences) and population density (to account for urbanisation, since population living in rural areas are usually older, less educated and more traditional in religious practice). We also plotted the proportion of Catholics (x-axis) against breastfeeding initiation rates (y-axis). For US states, the analysis was performed in both overall and by ethnicity and adjusted for state-level rates of low education and low SES (both factors being strongly related to both religion and breastfeeding initiation).

Analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, NC).

## RESULTS

The average proportions of Catholics and Protestants in Western ( $n=37$ ), Sub-Saharan African ( $n=37$ ), and Central and Southern American ( $n=18$ ) countries varied between 19% and 68% (**Table 1**). Although the Central and South American sub-region had the highest Catholic proportion ( $68 \pm 14\%$ ), and Sub-Saharan African sub-region the highest Protestant proportion ( $32 \pm 26\%$ ), the Western sub-region had the widest variability for both Christian religions. The Western sub-region also had the lowest breastfeeding initiation rate and the largest variability ( $87 \pm 12\%$ ); rates in the other sub-regions were around 95%.

Table 1: Country proportions of Catholics and Protestants and breastfeeding initiation rates by sub-region.

World sub-region	<i>n</i>	Catholic proportion (%)	Protestant proportion (%)	Breastfeeding initiation rate (%)
Western	37	40.2 ± 34.6	22.1 ± 28.2	87.2 ± 12.2
Sub-Saharan African	37	23.2 ± 18.8	32.5 ± 25.8	95.6 ± 3.7
Central and South American	18	68.3 ± 14.0	19.3 ± 11.4	95.2 ± 2.2
Asian	25	8.3 ± 24.6	2.4 ± 3.1	95.1 ± 3.7
North African and Middle Eastern	18	4.2 ± 7.2	0.7 ± 1.1	93.8 ± 3.6

Values are Mean ± SD.

In Western countries, the breastfeeding initiation rate was negatively correlated with the proportion of Catholics ( $\rho=-0.30$ ) and positively with the proportion of Protestants ( $\rho=0.31$ ) (**Table 2**). These correlations were unchanged ( $\rho=-0.30$ ) or enhanced ( $\rho=-0.40$ ) after controlling for GDP per capita and for HDI, respectively.

Table 2: Correlations between Catholic and Protestant proportions and breastfeeding initiation rates, by sub-region.

World sub-region	Catholic proportion	Protestant proportion
Western		<i>n=37</i>
Unadjusted	-0.30	0.31
Adjusted for GDP per capita	-0.30	0.42*
Adjusted for HDI	-0.30	0.40*
Sub-Sahara African		<i>n=37</i>

Unadjusted	0.03		-0.16
Adjusted for GDP per capita	0.17		-0.04
Adjusted for HDI	0.30		0.09
Central and South American		<i>n=18</i>	
Unadjusted	0.02		-0.16
Adjusted for GDP per capita	0.05		-0.32
Adjusted for HDI	0.02		-0.22
Asian		<i>n=24</i>	
Unadjusted	-0.38		-0.56
Adjusted for GDP per capita	-0.26		-0.49*
Adjusted for HDI	-0.34		-0.53**
North African and Middle Eastern		<i>n=18</i>	
Unadjusted	-0.24		-0.11
Adjusted for GDP per capita	-0.13		0.03
Adjusted for HDI	-0.15		0.01

Values are coefficient of Spearman correlation. P values: \* $<0.05$ , \*\* $<0.01$ . Abbreviations: GDP: gross domestic product; HDI: human development index.

The scatter plot of the negative relationship between Catholic proportion and breastfeeding initiation rate in Western countries is shown in **Figure 1**. This correlation was not observed in non-Western countries; however, the breastfeeding initiation rate in the most Christian country in Asia, the Philippines (81% Catholic), was lower than in the other Asian countries (87.7% vs 95.4% on average). To a lesser extent, this was also observed for Lebanon vs other North African and Middle Eastern countries (29% vs 3% Catholics, on average): 89% vs. 94% breastfeeding initiation.

Based on within-country data, negative correlations were observed between the proportion of Catholics and the breastfeeding initiation rate in French Departments ( $n=94$ ;  $\rho=-0.31$ ), Irish counties ( $n=26$ ;  $\rho=-0.41$ ), Canadian provinces ( $n=13$ ;  $\rho=-0.75$ ), and UK countries ( $n=4$ ;  $\rho=-0.78$ ) (**Figure 2**). These correlations remained strongly negative after controlling for GDP per capita and population density (**Table 3**). The direction and the strength of the (adjusted) correlations between breastfeeding initiation rates and proportions of Protestants were not consistent across the four countries. The proportions of “no religion” were positively correlated with breastfeeding initiation rates in Ireland ( $\rho=0.38$ ), the UK ( $\rho=0.93$ ) and Canada ( $\rho=0.74$ ), but weak and negative in France ( $\rho=-0.07$ ).

Table 3: Correlations between Catholic and Protestant proportion and breastfeeding initiation rates in French Departments, Irish counties and Canadian provinces.

	Catholic proportion	Protestant <sup>†</sup> proportion	No religion proportion
French Departments ( <i>n</i> =94)			
Unadjusted correlation	-0.31**	0.39***	-0.05
Correlation adjusted for GDP per capita	-0.29**	0.36**	-0.09
Correlation adjusted for GDP per capita and population density	-0.27**	0.32**	-0.07
Irish counties ( <i>n</i> =26)			
Unadjusted correlation	-0.34	0.02	0.55**
Correlation adjusted for GDP per capita	-0.23	0.20	0.33
Correlation adjusted for GDP per capita and population density	-0.23	0.19	0.38
UK countries ( <i>n</i> =4)			
Unadjusted correlation	-0.78	0.53	0.46
Correlation adjusted for GDP per capita	-0.93	0.86	0.47
Correlation adjusted for GDP per capita and population density	-0.79	-0.15	0.93
Canadian provinces ( <i>n</i> =13)			
Unadjusted correlation	-0.58*	-0.34	0.79**
Correlation adjusted for GDP per capita	-0.48	-0.37	0.76**
Correlation adjusted for GDP per capita and population density	-0.62*	-0.37	0.74**

Values are coefficient of Spearman correlation, except for UK countries (Pearson's correlation). P values: \* $<0.05$ , \*\* $<0.01$ , \*\*\* $<0.001$ . Abbreviations: GDP, gross domestic product; UK, United Kingdom. †Refers to all Protestant churches for France and Canada, to the Anglican Church of Ireland, and to all Anglican and Protestant churches for UK.

In the US, state-level rates of breastfeeding initiation were positively correlated ( $\rho=0.26$ ) with state-level proportions of Catholics and negatively correlated ( $\rho=-0.65$ ) with state-level proportions of Protestants (**Table 4**). After accounting for state-level rates of low education and low SES, the correlation with the proportion of Catholics was highly attenuated ( $\rho=0.06$ ), while the correlation with the proportion of Protestants almost halved ( $\rho=-0.37$ ). The breastfeeding initiation rate among non-Hispanic White Americans was negatively correlated with the proportion of White Catholics ( $\rho=-0.29$ ), while only weak correlations were observed with the proportions of White Evangelical ( $\rho=-0.13$ ) and White Mainline ( $\rho=-0.07$ ) Protestants. The negative correlation between the proportion of Protestants and breastfeeding initiation rate among all ethnicities was driven by the relationship between the state-level

proportion of Black Protestants and state-level rates of breastfeeding initiation among Blacks ( $\rho=-0.47$ ). This correlation was attenuated, however, after controlling for low education and SES ( $\rho=-0.23$ ). Finally, the state-level proportion of “no religion” was positively related to its breastfeeding initiation rate, even after controlling for low education and SES ( $\rho=0.43$ ).

Table 4: Correlations between proportions of Catholic, Protestant and no declared religion and breastfeeding initiation rates in the American states.

	Breastfeeding initiation rate among			
	All ethnicities ( <i>n</i> =50)	Non-Hispanic White ( <i>n</i> =50)	Hispanic White ( <i>n</i> =44)	Blacks ( <i>n</i> =26)
<b>Catholics</b>				
Total Catholics				
Unadjusted	0.26	0.19	-0.03	0.54
Adjusted for education	0.08	-0.02	-0.19	0.41*
Adjusted for education and SES	0.06	-0.04	-0.17	0.29
Non-Hispanic White Catholics				
Unadjusted	-	-0.01	-	-
Adjusted for education	-	-0.24	-	-
Adjusted for education and SES	-	-0.29	-	-
Hispanic White Catholics				
Unadjusted	-	-	0.21	-
Adjusted for education	-	-	0.06	-
Adjusted for education and SES	-	-	0.03	-
Black Catholics				
Unadjusted	-	-	-	0.23
Adjusted for education	-	-	-	0.24
Adjusted for education and SES	-	-	-	0.22
<b>Protestants</b>				
Total Protestants				
Unadjusted	-0.65***	-0.59***	-0.31*	-0.66***
Adjusted for education	-0.38**	-0.30*	0.07	-0.51**
Adjusted for education and SES	-0.37*	-0.30*	0.06	-0.38
White Evangelical Protestants				
Unadjusted	-	-0.51***	-	-
Adjusted for education	-	-0.14	-	-
Adjusted for education and SES	-	-0.13	-	-
White Mainline Protestants				
Unadjusted	-	-0.02	-	-
Adjusted for education	-	-0.05	-	-
Adjusted for education and SES	-	-0.07	-	-
Hispanic Protestants				
Unadjusted	-	-	0.01	-
Adjusted for education	-	-	0.00	-
Adjusted for education and SES	-	-	-0.04	-

Black Protestants				
Unadjusted	-	-	-	-0.47*
Adjusted for education	-	-	-	-0.39
Adjusted for education and SES	-	-	-	-0.23
No religion				
Unadjusted	0.63***	0.63***	0.34*	0.53**
Adjusted for education	0.43**	0.45**	0.02	0.31
Adjusted for education and SES	0.43**	0.45**	0.02	0.18

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Values are coefficient of Spearman correlation. P values: \* $<0.05$ , \*\* $<0.01$ , \*\*\* $<0.001$ . Abbreviations: SES, socioeconomic status.

## DISCUSSION

Using an ecological study design, we observed a strong negative correlation between the proportion of Catholics and the rate of breastfeeding initiation in Western countries. Countries in which the breastfeeding initiation rate was below 80% are historically Catholic (e.g., France, Poland and Ireland). This negative correlation was consistent when using within-country data in France, Ireland, the UK and Canada. In the US, the positive correlation between a state's proportion of Catholics and its breastfeeding initiation rate was confounded by ethnicity, low education and low SES: after controlling, the state proportion of non-Hispanic White Catholics was negatively correlated with its rate of breastfeeding initiation.

To our knowledge, ours is the first ecological study to assess the association between the proportions of Catholics and Protestants and breastfeeding initiation rates. Previously, one American multicentre study of 4166 families living in urban areas found that Conservative Protestants were more likely to breastfeed (odds ratio=1.60, 95% CI not given) than participants who declared no religious affiliation, after controlling for sociodemographic variables, including ethnicity and education.<sup>37</sup> Catholics were non-significantly less likely to breastfeed compared to participants without religion (odds ratio=0.80, 95% CI not given). Our ecological design has several strengths, including cost and convenience of using publicly accessible secondary data covering 135 countries in five world sub-regions, which would be infeasible using individual-level data. Moreover, in some countries, individual data on religion, when available, are highly sensitive and their collection is often forbidden by

authorities. Finally, the ecological design is appropriate for inferring relationships at the population level, such as the potential roles of national/regional policies and sociocultural differences.

The parallel limitation of our study is the so-called ecologic fallacy, whereby associations observed at the population level may not reflect relationships at the individual level. To at least partly overcome this limitation, we explored the association using within-country data in France, Ireland, UK, Canada and the US; the results of those analyses confirmed our findings. Our analysis for the US would have been even more informative if breastfeeding data had been aggregated at the county level, as we were able to find for religion. Finally, testing our hypothesis in Germany with Länder-level data would have been an additional asset to our study. Indeed, the Protestant religion originated in Saxony in the 16<sup>th</sup> century, before spreading to neighbouring areas with a previous Catholic tradition. Unfortunately, we were unable to find data on religion and breastfeeding at the Länder level.

Another study limitation is the lack of time-series data. Indeed, our data were cross-sectional snapshots taken in a recent period, while breastfeeding initiation rates in Western countries have been increasing for several decades. Correlating longitudinal data would have strengthened our ability to infer causality for the associations we observed. Nonetheless, we argue that religion proportions and religious culture change too slowly to have significant short-term consequences on breastfeeding practice. In fact, adherence or practice of religion, as declared by individuals, are proxies for values and beliefs reflected by religion. Individuals who declare not adhering to any religion, or adhering to one religion without practicing it, tend to maintain (perhaps unconsciously) the beliefs and values embedded through generations by their familial and national religious culture.<sup>38</sup> Hence, it is unlikely that using religion data from the mid-20<sup>th</sup> century would have changed our results. On the other hand, using breastfeeding data from the 1970s or 1980s could have impacted our results; we found



no detailed data to compare that temporal change between or within countries. A final limitation of our study is our inability to account for small religious minorities and for potential individual-level confounders such as maternal age, marital status and employment.

Our main finding is the negative correlation between the proportion of Catholics and the breastfeeding initiation rate among and within Western countries. Conversely, Protestantism was positively correlated with breastfeeding initiation rates in country-level analysis, although that correlation was less consistent using within-country data. It is unclear whether these opposite relationships are the consequence of “communicating vessels” or whether each of these two religious affiliations has an independent effect. Christian countries with higher proportions of Catholics tend to have lower breastfeeding initiation rates, whereas rates in predominantly Protestant and non-Christian countries are closer to one another. However, results in African and Central and Southern American countries, although mostly Christian, were not in line with those from Western countries.

Our explanation for these findings draws on both history and theology. First, populations in low-income countries never experienced a widespread shift from breast- to formula feeding, contrary to Western populations at the end of the 19<sup>th</sup> century.<sup>3 39</sup> Hence, breastfeeding remained the norm in low-income countries, because no affordable alternatives were available for most of the population, even in areas under Western colonial influence. Despite the colonial Christian influence, native populations also probably remained under the broad influence of their traditional beliefs and customs, especially animistic conceptions of the body that value the fertility and the nurturing status of women as symbols of strength, vitality and prosperity.<sup>40</sup>

In Europe, it has been reported that Catholic mothers were less likely to breastfeed than Protestant mothers during the 16<sup>th</sup> and 17<sup>th</sup> centuries.<sup>3</sup> In France, wet-nurses were commonly hired to feed infants, especially in Catholic families from the middle and upper classes.<sup>41</sup>

Non-breastfeeding mothers reported concerns about health, pain and body self-image to explain their choice, while sex and lactation were judged incompatible by the Catholic Church, with predictable consequences on breastfeeding practice in Catholic households.<sup>42</sup>

From the 19<sup>th</sup> century, the technological and industrial revolution provided new infant feeding alternatives, although they first led to high mortality rates due to poor hygienic conditions. At the end of the 19<sup>th</sup> century, sterile infant formula and running water became increasingly available and affordable for rural and lower-class urban populations.<sup>3</sup> Until the 1960s, infant formula was considered as safe as breast milk and a symbol of progress, improving women's conditions and, as a consequence, reducing breastfeeding rates to their lowest level in human history. Despite improvements in the nutritional composition of infant formulas, scientific studies began to report health benefits of breastfeeding,<sup>43</sup> and breastfeeding support movements emerged in the 1970s.<sup>3</sup> Prior to this recent promotion phase, it remains unclear whether Catholics and Protestants started from the same low baseline. In the 1970s, breastfeeding initiation rates were 36% in France, 11-24% in Ireland, 26% in Canada, 24% in the US and around 35% in Sweden.<sup>12 44-47</sup> Protestant countries then experienced a faster increase, as illustrated by the current statistics.<sup>7</sup> One plausible interpretation is that Protestants, through individual behaviours or public policies, may be more inclined to adopt scientific recommendations and quicker to implement new health promotion policies. As explained by Weber, the Protestant ethic promotes pragmatism and utilitarianism as ways to achieve modern progress and salvation.<sup>17</sup> In contrast, the Catholic ethic tends to be more sceptical towards novelty and therefore may be less adaptable and dynamic when faced with new scientific recommendations.<sup>40</sup> These two distinct conceptions of modern progress could influence modern society by promoting different values, which are then translated into different lifestyles and behaviours.<sup>48</sup> This could be mediated, among others factors, by the

societal acceptance of breastfeeding in public, which has been shown to be associated with breastfeeding practice in four European countries.<sup>49</sup>

## **CONCLUSION**

In conclusion, our ecological analysis suggests a new population-level factor influencing breastfeeding initiation across and within Western countries: the proportion of Catholics. This observation may help policy makers and healthcare professionals target at-risk populations and reinforce or adapt their breastfeeding promotional efforts according to sociocultural background. Individual-level studies are needed to confirm or refute our findings. Qualitative studies are also necessary to identify the sociocultural values and beliefs that mediate the relationships between a historically Catholic family or societal background and breastfeeding initiation. If confirmed at the individual level, our findings may help improve current breastfeeding promotion policies by focusing on the sociocultural expectations, values, and support needs concerning infant feeding.

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## **DATA SHARING STATEMENT**

The data collected online and used in this manuscript can be shared by the authors upon request.

## **COMPETING INTERESTS**

We have read and understood BMJ policy on declaration of interests and declare that we have no competing interests to declare.

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## **FIGURE LEGENDS**

Figure 1: Relationship between Catholic proportion (x-axis) and breastfeeding initiation rate (y-axis) in Western countries.

Figure 2: Relationship between Catholic proportions (x-axis) and breastfeeding initiation rates (y-axis) in French Departments (cyan), Irish counties (green), United Kingdom countries (purple) and Canadian provinces (red).