Changing Societal and Lifestyle Factors and Breastfeeding Patterns Over Time

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abstract

BACKGROUND: Breastfeeding is an important determinant of early infant immune function and potentially future health. Although numerous studies have reported rising breastfeeding initiation rates and duration, few longitudinally investigated the impact of shifting societal and lifestyle factors on breastfeeding patterns in developed nations.

METHODS: The Ulm Birth Cohort Study (UBCS) and Ulm SPATZ Health Study (SPATZ) cohorts consist of newborns and their mothers recruited, respectively, from 2000 to 2001 and 2012 to 2013 at the University Medical Center Ulm, Germany. Cox proportional hazards models were used to estimate crude and mutually adjusted hazard ratios for study effect (time trend) and individual risk factors on noninitiation and duration of predominant and total breastfeeding.

RESULTS: Compared with UBCS mothers, SPATZ mothers had lower cessation rates of both predominant breastfeeding by 4 months and total breastfeeding by 6 months: hazard ratio (95% confidence interval) 0.79 (0.67–0.93) and 0.71 (0.60–0.82), respectively. However, this crude time trend was limited to mothers with higher educational achievement. Similar time trend effects were observed among less educated mothers only after adjustment for early cessation risk factors. Mutually adjusted hazard ratios for individual risk factors were similar in both studies: low education, high BMI, smoking within 6 weeks of delivery, and cesarean delivery were associated with early breastfeeding cessation beginning at 6 weeks. In addition, actively abstaining from drinking alcohol was associated with lower rates of early cessation.

CONCLUSIONS: Our results suggest widening socioeconomic disparity in breastfeeding and potentially subsequent child health, which may require new targeted interventions.

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WHAT'S KNOWN ON THIS SUBJECT: Early breastfeeding cessation is associated with a number of demographic, lifestyle, and birth factors including maternal education, smoking, and cesarean delivery. Overall rates and duration of predominant and total breastfeeding have improved in most developed countries.

WHAT THIS STUDY ADDS: Socioeconomic disparities in breastfeeding practices have widened between mothers with lower and higher education. Although programs focusing on obesity, smoking, and cesarean delivery would benefit all mothers, programs tailored specifically toward less educated mothers may particularly reach women in need.

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Breast milk is internationally recognized as the optimal source for infant nutrition,[1] and long-term breastfeeding has been associated with numerous health benefits for both mother and child.[2,3] Therefore, mothers in most developed nations are recommended to exclusively breastfeed for the first 6 months of life, followed by a period of complementary breastfeeding up to 2 years of age.[1] Although initiation rates and average duration are generally increasing, wide variation in breastfeeding behavior is often observed across countries and demographic groups, making it difficult to identify how patterns are affected by changes in societal and lifestyle factors over time.

In Germany, retrospective studies indicate overall breastfeeding rates and duration of exclusive breastfeeding have steadily increased between 1987 and 2000 to become among the highest in Europe.[4] Despite improvement, the most recent data in southern Germany showed that only 41.7% and 51.6% of mothers were meeting minimum German recommendations for exclusive breastfeeding of at least 4 months[5] and feeding any breast milk at 6 months, respectively.[6] In these and other studies, breastfeeding behavior was negatively affected by a number of factors, including maternal education and smoking,[7,8] delivery complications,[9] and social support.[10]

Although these studies shed light on the roles of individual risk factors on early breastfeeding cessation, lack of an appropriate baseline population inhibits their use for time-trend analyses. Furthermore, the impact of health-relevant patterns of behavior related to pregnancy, such as smoking cessation and later resumption, on breastfeeding remain relatively unexplored.

In this study, we compare data obtained from duplicate birth cohorts recruited ~12 years apart to investigate the influence of demographic shifts over time in education, smoking, mode of delivery, maternal BMI, and parity on breastfeeding rates and duration. Another objective was to examine the influence of these factors, as well as alcohol consumption and return-to-work status, on noninitiation and breastfeeding cessation, allowing for time-dependent effects throughout lactation.

METHODS

Study Design and Population

Data were obtained from the Ulm Birth Cohort Study (UBCS) and the Ulm SPATZ Health Study,[11,12] 2 methodologically similar population-based birth cohort studies including newborns and their mothers recruited shortly after delivery in the University Medical Center Ulm, Southern Germany, respectively, from November 2000 to November 2001 and April 2012 to May 2013.[11,12] Exclusion criteria were outpatient delivery, maternal age <18 years, transfer of the newborn or the mother to intensive care immediately after delivery, and/or insufficient knowledge of the German (UBCS and SPATZ), Turkish, or Russian (both UBCS only) language. At baseline, the UBCS and SPATZ cohorts, respectively, included 1090 newborns of 1066 mothers (67% of all 1593 eligible families) and 1006 newborns of 970 mothers (49% of all 1999 eligible families). For the purposes of this analysis, the study populations were restricted to singleton term (gestational age ≥37 weeks) newborns. Ethical approval was obtained from the ethics board of Ulm University (UBCS: #98/2000; SPATZ: #311/11) and of the Physicians' Boards of the states of Baden-Wuerttemberg and Bavaria (both UBCS only). Participation was voluntary, and written informed consent obtained in each case.

Data Collection

Demographic data were collected by self-administered questionnaire at "baseline." Clinical pre- and perinatal data were respectively obtained from routine paper documentation updated at each obstetric appointment during pregnancy and electronic hospital records. Additional data were collected at 6 weeks and 6 months postdelivery by telephone interview or postal self-administered questionnaire (SPATZ only) if subjects could not be reached by telephone or had previously documented breastfeeding cessation. Additional follow-up was conducted at 1 and 2 years postdelivery by self-administered questionnaire.

Breastfeeding Definitions and Assessment

Predominant and any breastfeeding correspond to World Health Organization 2007 definitions.[13] Predominant breastfeeding required breast milk as the primary source of nutrition allowing for supplementation with certain liquids including water. Any breastfeeding required maternal report of breastfeeding regardless of additional foods. Mothers were asked to report if they currently fed their child any breast milk at each follow-up. Furthermore, the number of months and weeks (weeks and days at 6-week follow-up) postdelivery at cessation of predominant and any breastfeeding were assessed. For subjects lost to follow-up or with missing data, duration was censored at the last reported time of breastfeeding.

Covariates and Potential Confounders

The following covariates were selected based on a priori association with breastfeeding duration.

Maternal Age, Education, and Nationality

Maternal age at delivery was categorized as <30, 30 to 35, or >35 years. Maternal education was

based on reports of secondary school graduation and translated into years of schooling (≥12 years, <12 years). Maternal nationality was based on country of birth and defined as "German" or "Other" and investigated as a potential confounder.

Smoking and Alcohol Status

Smoking status (yes/no) and frequency (cigarettes per day) in the year before and during pregnancy were assessed at baseline. Current smoking status and frequency were assessed at each follow-up thereafter. Mothers who did not smoke before delivery and up to 6 months thereafter were classified "never smokers." Mothers who smoked before delivery were classified as (1) "abstinent smokers" if they reported not smoking up to 6 months postdelivery, (2) "resumed smoking" if smoking was reported at 6 months but not at 6 weeks, or (3) "continuous smokers" if smoking was reported at 6 weeks. An "undetermined" category was used to account for those whose status was unclear due to missing data.

Alcohol consumption (daily or occasionally) was assessed and defined similarly for SPATZ: (1) never drinkers, (2) abstinent drinkers, (3) resumed between 6 weeks and 6 months, (4) resumed by 6 weeks postdelivery, and (5) undetermined status due to missing data. For UBCS, alcohol consumption was only assessed at baseline.

BMI

BMI was calculated as (mass [kg]/height [m]^2) based on measurements at the mother's obstetric appointment at which pregnancy was clinically established if the appointment took place within the first 15 weeks of pregnancy (*n*, mean ± SD in weeks; SPATZ: 794, 9.0 ± 2.3, UBCS: 935, 8.5 ± 2.5) or self-reported weight before pregnancy (SPATZ: *n* = 35, UBCS: *n* = 49). BMI was categorized as underweight (<18.5), normal (18.5 to <25), overweight (25 to <30), or obese (≥30).

Return-to-Work Status

In SPATZ only, maternal working status during each month of life of the newborn was assessed at 6 months and 1 year by asking for the average number of hours per week worked in paid employment. Mothers were considered to have returned to work by the earliest month for which an average of ≥5 hours/week was reported and categorized as (1) not returning to work in the first 12 months or returning between months, (2) 1 and 3, (3) 4 and 6, (4) 7 and 12, or (5) undetermined for those with missing values for all 12 months. Sensitivity analyses were conducted using ≥20 hours per week as the cutoff.

Delivery Mode and Parity

Delivery mode (vaginal spontaneous, elective cesarean, emergency cesarean, or vaginal assisted delivery) and parity (0 or ≥1 birth before the study child) were ascertained from electronic hospital records.

Statistical Analyses

χ^2 and Kruskal-Wallis tests were performed to identify significant differences ($\alpha = .05$) in breastfeeding proportions and demographic differences across study cohorts. Kaplan-Meier plots and log-rank tests were used to assess predominant and any breastfeeding duration patterns across studies, as well as, bivariate associations with maternal demographic and lifestyle variables. Cox proportional hazards models were used to estimate crude, individually adjusted, and mutually adjusted hazard ratios of study effect on noninitiation and cessation of predominant and/or any breastfeeding at 6 weeks and 3, 4, 6, and 9 months postdelivery. Because of limitations of the proportional hazards model for mediation analysis,[14] models assessing mediation were checked against an alternative approach of modeling relative risks using a modified Poisson regression with robust variance estimation.[15] These models are not provided here because they did not lead to different conclusions. To assess potential bias resulting from missing data, means or proportions of subject characteristics included in mutually adjusted models were compared with 95% confidence intervals of the mean or proportion of the respective characteristic among the full study population within each study. Approximately 3.4% and 5.0% of subjects were missing data in UBCS and SPATZ, respectively, and no significant differences in characteristics were observed between study and analysis population in either cohort. All statistical analyses were performed by using SAS 9.3 (SAS Institute, Cary, NC).

RESULTS

Demographic characteristics and comparisons between UBCS and SPATZ are provided in Table 1. Notably, interstudy differences were observed for a number of demographic and breastfeeding characteristics. More than 85% and 90% of mothers, respectively, initiated predominant and any breastfeeding in both cohorts. Predominant and any breastfeeding rates appeared similar between cohorts up to 3 weeks postdelivery, after which rates in SPATZ remained higher until 4 months and throughout lactation, respectively (Fig 1A and 1B).

Crude hazard ratios for differences between the 2 studies (study effect/time trend) on breastfeeding cessation corresponded with the patterns described and were statistically significant at every modeled time point up to 6 months except noninitiation of predominant breastfeeding (see Table 2). In

separate models adjusted for single covariates, the association between study effect and breastfeeding behavior was primarily explained by differences in maternal education and partially by differences in smoking behavior and age at delivery (see Supplemental Table 5). In contrast, point estimates were driven away from the null, albeit marginally, when individually adjusted for maternal BMI or cesarean delivery. After mutual adjustment for all maternal demographic and lifestyle factors, estimates were slightly attenuated toward the null but remained significant for all modeled time points except initiation (see Table 2).

To investigate further why the mediating effect of education on time trend was no longer observed in mutually adjusted models, we tested for interaction. Significant *P* values for interaction between study effect and education were observed at every time point except initiation in mutually adjusted predominant and total breastfeeding models (data not shown). Kaplan-Meier plots stratified by study and education showed improvement in breastfeeding patterns between studies among mothers with higher education but nearly identical patterns among less educated mothers who were at greater risk for early cessation throughout lactation (see Fig 2A and 2B). In mutually adjusted models stratified by education, study effects similar to those observed in all-subject models were present for both less and more educated mothers, indicating time trend was confounded among mothers with less education by differences between studies in demographic and lifestyle factors (see Table 3).

In the more recent SPATZ cohort, for which more complete information on potential determinants of breastfeeding was available, the contribution of factors associated with breastfeeding cessation were evaluated in mutually adjusted models (see Table 4). Suboptimal BMI and elective cesarean delivery were independently associated with higher noninitiation and cessation rates, whereas emergency cesarean delivery and maternal education were only associated with higher cessation rates. In particular the strong associations with suboptimal BMI declined over time. The effect of smoking was dependent on smoking behavior or time smoking was resumed. Continuous smoking was associated with higher rates of noninitiation of predominant breastfeeding. Mothers who resumed smoking at 6 weeks postdelivery had significantly higher rates of both predominant and any breastfeeding at 4 and 6 months, respectively. A similar time-dependent association was

TABLE 1 Descriptive Characteristics of the 2000–2001 UBCS and 2012–2013 SPATZ Birth Cohorts

Descriptive Characteristic	2000–2001 UBCS, % (*n* = 989)	2012–2013 SPATZ, % (*n* = 856)	*P*
Education ≥12 y	37.7	60.9	<.001[a]
Alcohol consumed in year before pregnancy	67.8	69.5	.446
Alcohol consumption during lactation			NA
Never drinker	NA	23.1	
Abstinent drinker	NA	26.0	
Resumed at 6 wk to 6 mo	NA	20.5	
Resumed by 6 wk	NA	19.9	
Undetermined drinking	NA	10.5	
Smoked in year before pregnancy	32.5	27.1	.012[a]
Smoking during lactation			<.001[a]
Never smoker	66.4	71.5	
Abstinent smoker	11.7	10.6	
Resumed smoking	2.4	3.4	
Continuous smoker	13.4	6.1	
Undetermined smoker	6.0	8.4	
Prepregnancy BMI			.004[a]
Normal (≤18.5 to <25)	66.7	61.4	
Underweight (<18.5)	3.4	2.2	
Overweight (≤25 to 30)	21.4	23.4	
Obese (≥30)	8.5	13.0	
Delivery mode			<.001[a]
Vaginal spontaneous	80.0	67.1	
Elective cesarean	5.0	12.1	
Emergency cesarean	10.9	12.3	
Vaginal assisted	4.1	8.5	
Age at delivery, y			<.001[a]
<30	37.8	26.6	
30–35	39.3	43.0	
>35	23.0	30.4	
Returned to work after delivery			NA
No	NA	63.7	
Month 1–3	NA	5.3	
Month 4–6	NA	4.4	
Month 7–12	NA	8.3	
Undetermined	NA	18.3	
German nationality	79.8	85.2	.002[a]
Parity ≥1 birth	49.7	48.1	.490
Initiation of predominant breastfeeding	85.2	85.6	.829
Predominant breastfeeding at 4 mo[b]	65.5	64.5	.689
Initiation of any breastfeeding	91.6	94.7	.012[a]
Any breastfeeding at 6 mo[c]	58.6	67.2	<.001[a]

NA, not available.

[a] Significant *P* value.

[b] Restricted to subjects with noncensored data on predominant breastfeeding at 4-month data (UBCS *n* = 829; SPATZ *n* = 673).

[c] Restricted to subjects with noncensored data on any breastfeeding at 6-month data (UBCS *n* = 863; SPATZ *n* = 714).

TABLE 2 Crude and Mutually Adjusted Cox Proportional Hazard Ratios for Study Effect (2000–2001 UBCS vs 2012–2013 SPATZ) on Noninitiation and Cessation of Breastfeeding

Breastfeeding Behavior and Outcome	Hazard Ratio (95% Confidence Interval)	
	Crude	Mutually Adjusted[a]
Predominant		
Noninitiation	1.01 (0.78–1.30)	1.00 (0.76–1.31)
Cessation at 6 wk	0.76 (0.63–0.93)	0.79 (0.64–0.97)
Cessation at 4 mo	0.79 (0.67–0.93)	0.83 (0.69–0.99)
Any	0.68 (0.47–0.99)	0.75 (0.50–1.11)
Noninitiation		
Cessation at 6 wk	0.66 (0.52–0.84)	0.70 (0.54–0.90)
Cessation at 3 mo	0.71 (0.58–0.88)	0.73 (0.59–0.91)
Cessation at 6 mo	0.71 (0.60–0.82)	0.73 (0.62–0.86)
Cessation at 9 mo	0.75 (0.66–0.85)	0.79 (0.70–0.91)

[a] Mutually adjusted for maternal education, smoking, BMI, delivery mode, age, nationality, and first parity.

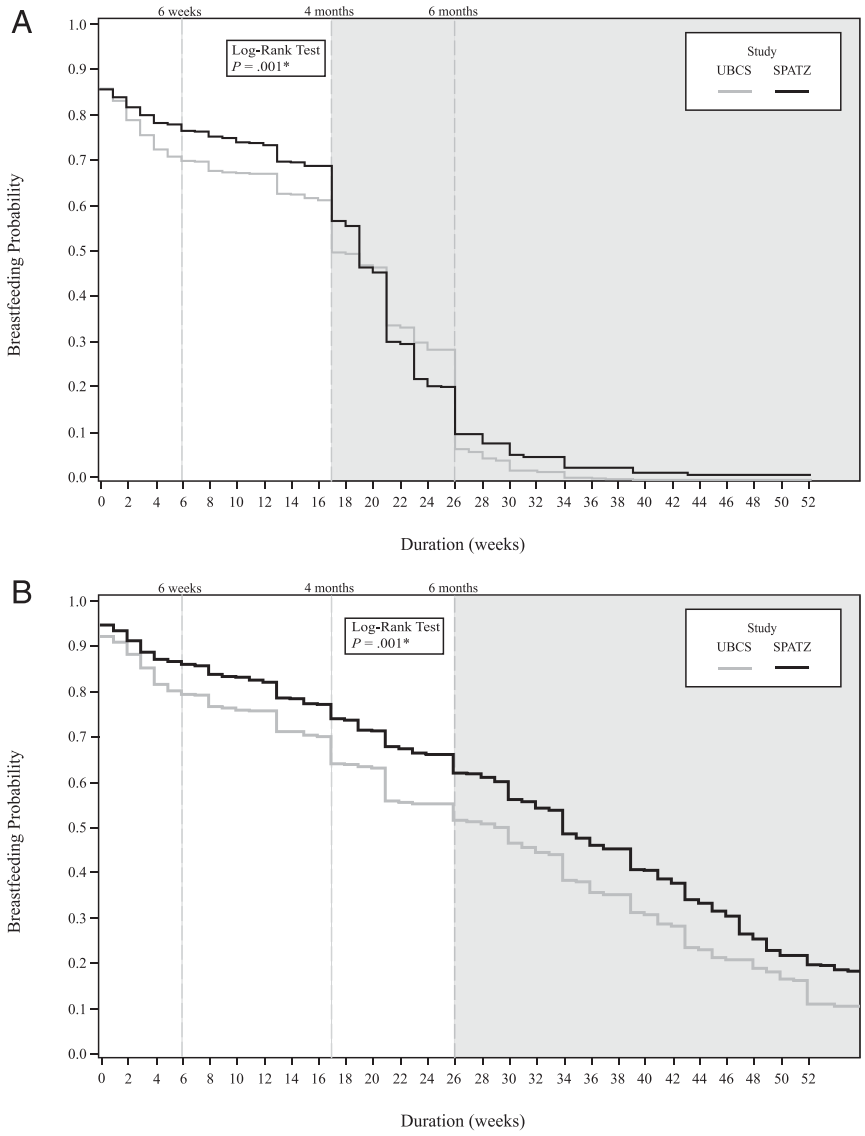

FIGURE 1
A, Duration of predominant breastfeeding in the 2000–2001 UBCS and 2012–2013 SPATZ cohorts. B, Duration of any breastfeeding in the 2000–2001 UBCS and 2012–2013 SPATZ cohorts. *Log-rank statistic for predominant breastfeeding up to 4 months (shaded area not included).

observed for resumption of alcohol consumption. Conversely, abstaining from drinking alcohol throughout lactation was strongly associated with lower risk of breastfeeding cessation. Returning to work did not affect breastfeeding cessation at any time; the significant results for the "undetermined" category are likely attributable to higher proportions of factors associated with breastfeeding cessation observed among mothers who lacked complete data (data not shown).

In the earlier UBCS cohort, in which we were not able to adjust for alcohol consumption or return to work status, we observed some similarities in associations for maternal education, suboptimal BMI, and smoking behavior, but not cesarean delivery (see Supplemental Table 6).

DISCUSSION

In our cohorts, we observed increased rates of initiation and duration of predominant and overall breastfeeding over an 11-year period among mothers with >12 years of education. In contrast, no significant change in breastfeeding behavior was observed among less educated mothers, which was largely explained by corresponding increases in the proportions of smoking, overweight and obesity, and elective cesarean delivery in this group. Of the personal and lifestyle risk factors we examined in both cohorts, none explained the time trend toward more positive breastfeeding patterns. In the latter cohort, actively abstaining from drinking alcohol was significantly associated with lower rates of early cessation, implying the importance of planned behavior in breastfeeding outcomes.

Although at least 1 retrospective study previously identified widening socioeconomic disparity in breastfeeding practices,[16] our study is among

the first to investigate the effects of demographic shifts on breastfeeding between 2 population-based cohorts recruited in the same maternity ward using nearly identical methodology thus providing a superior baseline for time-trend analysis. In addition, our study also accounts for time-dependent effects including smoking and alcohol consumption, which may change over the postpartum period thereby reducing misclassification of these risk factors in our models. Still, we did encounter some limitations. Although we were able to control for a number of a priori risk factors, we lacked psychosocial data pertaining to familial attitudes and support, which have also been previously associated with breastfeeding practices.[17] Furthermore, the impact of medical issues related to breastfeeding including lactation issues, counterindicative medications, and mastitis were not assessed.[18–20] It is likely these factors meaningfully contributed to early cessation rates. However, we observed similar patterns of association for individual risk factors in sensitivity analyses restricted to mothers successfully breastfeeding (>6 times/day) at 6 weeks postdelivery (data not shown). This implies validity of our results after any further influence on early breastfeeding cessation. Finally, 67% and 49% of eligible families enrolled in UBCS and SPATZ, respectively. Although these rates are respectable for a population-based study in this setting, some selection bias within each cohort cannot be completely ruled out because characteristics of nonparticipants were not ascertained.

Initial and 6-month breastfeeding rates observed in our cohorts corresponded well with results (89.5% and 51.6%, respectively)

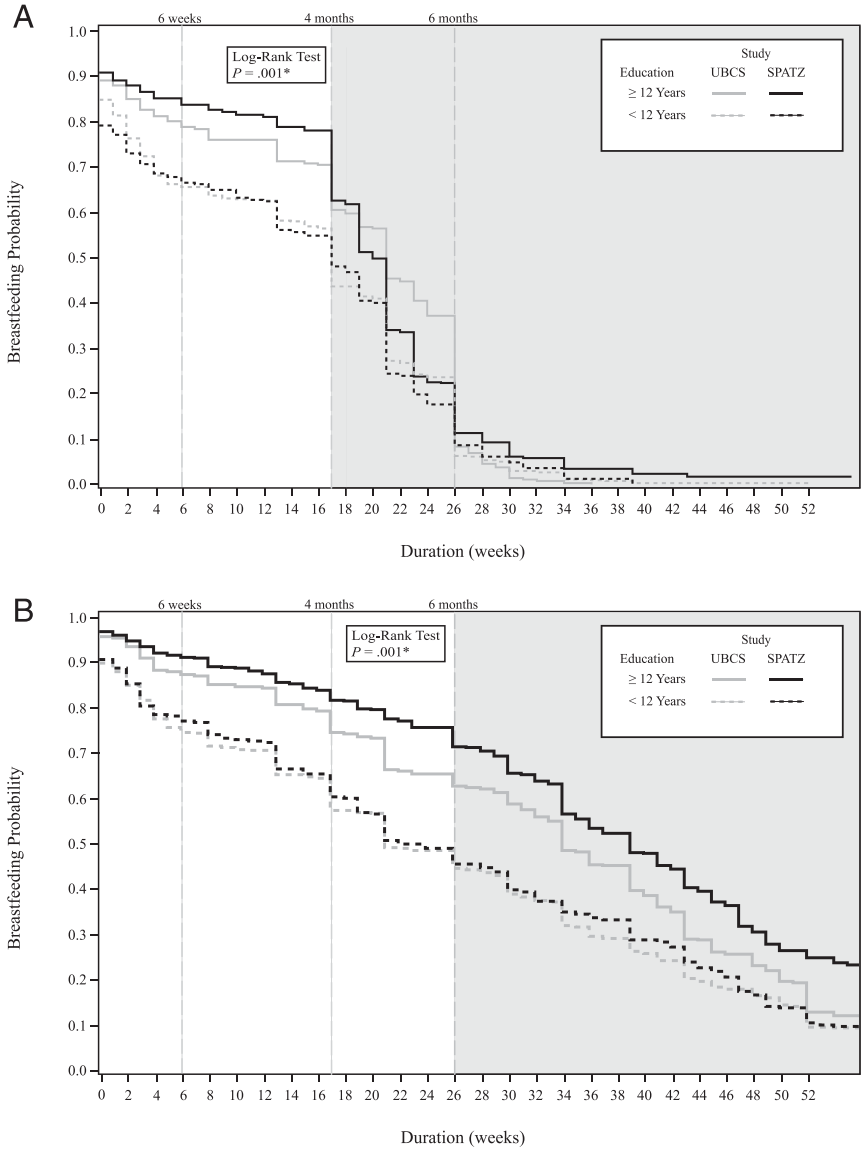

FIGURE 2

A, Duration of predominant breastfeeding in the in 2000–2001 UBCS and 2012–2013 SPATZ cohorts stratified by maternal education. B, Duration of any breastfeeding in the 2000–2001 UBCS and 2012–2013 SPATZ cohorts stratified by maternal education. *Log-rank statistic for predominant breastfeeding up to 4 months (shaded area not included).

reported in 2005 among Bavarian mothers.[6] However, breastfeeding initiation rates and duration were higher than those reported retrospectively and with largely longer recall periods in a nationwide cross-sectional survey conducted in 2003–2006.[4] Predominant breastfeeding patterns compared well between Ulm cohorts, however, were higher than the similarly defined "exclusive breastfeeding" at 4 months rate (41.7%) and lower than the "fully breastfed for at least 6 months" (~33%), respectively, reported in Bavaria and nationwide.[4,6] Therefore, initial and overall breastfeeding rates in our study may not be representative of areas outside of our study region and predominant rates may not be comparable to those reported using nonanalogous breastfeeding definitions.

The most striking feature of our data were an observed demographic shift marked by an ~60% increase in the proportion of higher educated mothers. This increase is only slightly higher than the 40% to 50% increase derived from statewide census data for Baden-Wurttemberg within women of corresponding age making substantial participation bias unlikely.[21] Furthermore, although we observed an expected decrease in overall smoking rates, the proportion of less educated mothers who smoked increased by 16%. This disparity is analogous to previously reported smoking trends in southern Germany.[22]

Our findings with respect to maternal education are somewhat supported by those of Scott et al, who reported no association between maternal education and initiation of predominant or overall breastfeeding in a similarly designed time-trend analysis of breastfeeding rates at hospital discharge among Australian mothers recruited 10 years apart.[23] They suggested "social inequalities in breastfeeding initiation are less apparent as breastfeeding initiation approaches universality," which may also have been the case in our study. In contrast, they reported no significant difference in total breastfeeding cessation by 6 months over time and no effect of education in the latter cohort.[17] However, the cohorts they examined had much larger proportions of higher educated mothers (86.9% and 96.5%) and no analysis of the effect on time trend was reported.

Differential results between mothers with higher and lower education may be indicative of widening socioeconomic gaps in breastfeeding attitudes, knowledge of the health benefits of long-term breastfeeding, or other unmeasured factors related to general education.[24,25] More educated mothers may also be more likely to seek medical advice and use available health services with regard to breastfeeding.[26] This theory may be supported by differences observed in SPATZ in relation to rates of noninitiation and early cessation associated with elective cesarean delivery, which have also been observed in other studies.[9] Among lower educated mothers, those who chose elective cesarean delivery were at significantly higher risk for noninitiation and early breastfeeding cessation up to 9 months postdelivery (data not shown). In contrast, no significant difference in early breastfeeding behavior was observed among higher educated mothers who had elective cesarean.

Despite overall improvement in breastfeeding patterns, little change was observed in associations between early breastfeeding cessation and individual and lifestyle factors over time. Prepregnancy obesity was independently associated with higher cessation rates by 6 weeks in both cohorts. These results support findings of recent studies conducted in other developed countries associating maternal obesity with higher risk of noninitiation and shorter breastfeeding duration.[27,28] Although reasons for this association remain unclear, some evidence suggests links to psychosocial factors including low self-efficacy among obese mothers.[29] Obese mothers may be more prone to delayed lactogenesis,[30] difficulty positioning the child for breastfeeding, and other issues including fatigue and mastitis.[31] Kohlhuber et al reported that previous breastfeeding experience may mediate this association.[32] Although we did not collect data specifically on previous breastfeeding experience in either cohort, effects were similar after adjustment for parity and within strata of primiparous and multiparous mothers, which may contradict this hypothesis.

Smoking and alcohol consumption during lactation were also associated with higher rates of early cessation but mostly only after resumption of the behavior. Although these associations may be due to reverse causation,[33] some studies suggest nicotine and alcohol in breast milk may affect milk volume,[34] infant behavior, and sleeping patterns, which could inhibit a willing mother's ability to breastfeed early on, thereby motivating earlier cessation.[35] Mothers who abstained from smoking up to 6 months displayed similar breastfeeding patterns to

TABLE 3 Crude and Mutually Adjusted Cox Proportional Hazard Ratios for Study Effect (2000–2001 UBCS vs 2012–2013 SPATZ) on Noninitiation and Cessation of Breastfeeding Stratified by Maternal Education

Breastfeeding Behavior and Outcome	Hazard Ratio (95% Confidence Interval)			
	Less Education (<12 Years)		More Education (≥12 Years)	
	Crude	Mutually Adjusted[a]	Crude	Mutually Adjusted[a]
Predominant				
Noninitiation	1.40 (1.02–1.92)	1.09 (0.78–1.54)	0.80 (0.52–1.24)	0.86 (0.55–1.34)
Cessation at 6 wk	1.02 (0.79–1.30)	0.81 (0.62–1.06)	0.73 (0.52–1.02)	0.80 (0.56–1.14)
Cessation at 4 mo	1.09 (0.87–1.35)	0.92 (0.73–1.15)	0.72 (0.54–0.95)	0.76 (0.56–1.01)
Any				
Noninitiation	0.91 (0.59–1.42)	0.72 (0.45–1.17)	0.68 (0.33–1.41)	0.77 (0.36–1.63)
Cessation at 6 wk	0.88 (0.66–1.18)	0.70 (0.51–0.95)	0.67 (0.44–1.04)	0.73 (0.47–1.14)
Cessation at 3 mo	0.92 (0.71–1.20)	0.73 (0.55–0.96)	0.74 (0.51–1.07)	0.81 (0.56–1.19)
Cessation at 6 mo	0.98 (0.81–1.20)	0.81 (0.66–1.00)	0.66 (0.51–0.85)	0.64 (0.49–0.83)
Cessation at 9 mo	0.93 (0.79–1.11)	0.82 (0.68–0.98)	0.79 (0.65–0.96)	0.76 (0.62–0.93)

[a] Mutually adjusted for maternal smoking, BMI, delivery mode, age, nationality, and first parity.

TABLE 4 Mutually Adjusted Cox Proportional Hazard Ratios for Noninitiation and Cessation of Breastfeeding in the 2012–2013-SPATZ Cohort

Risk Factor	Hazard Ratio (95% Confidence Interval)					
	Predominant Breastfeeding			Any Breastfeeding		
	Noninitiation	Cessation at 6 Weeks	Cessation at 4 Months	Noninitiation	Cessation at 6 Weeks	Cessation at 6 Months
Education						
≥12 y	ref	ref	ref	ref	ref	ref
<12 y	1.18 (0.75–1.87)	1.44 (1.00–2.09)	1.50 (1.10–2.05)	1.74 (0.83; 3.66)	1.87 (1.18–2.97)	1.66 (1.25–2.21)
Alcohol status						
Never drinker	Reference	Reference	Reference	Reference	Reference	Reference
Abstinent drinker	0.42 (0.19–0.94)	0.44 (0.23–0.84)	0.46 (0.27–0.78)	0.35 (0.07–1.74)	0.35 (0.13–0.96)	0.36 (0.21–0.63)
Resumed at 6 wk to 6 mo	0.76 (0.39–1.52)	0.96 (0.56–1.66)	1.14 (0.73–1.77)	0.77 (0.25–2.40)	0.86 (0.40–1.86)	1.63 (1.10–2.40)
Resumed by 6 wk	1.02 (0.58–1.78)	1.61 (1.00–2.57)	1.52 (1.01–2.30)	1.62 (0.68–3.87)	3.08 (1.71–5.55)	2.13 (1.46–3.12)
Undetermined	0.56 (0.28–1.13)	0.81 (0.43–1.50)	0.88 (0.51–1.52)	0.55 (0.17–1.74)	1.18 (0.55–2.54)	1.08 (0.65–1.80)
Smoking status						
Never smoker	Reference	Reference	Reference	Reference	Reference	Reference
Abstinent smoker	1.41 (0.74–2.67)	1.05 (0.63–1.77)	1.11 (0.71–1.73)	2.26 (0.90–5.68)	1.41 (0.76–2.60)	1.22 (0.82–1.80)
Resumed smoking	1.48 (0.57–3.87)	1.18 (0.53–2.62)	2.11 (1.20–3.70)	0.67 (0.09–5.35)	1.13 (0.43–2.95)	2.03 (1.21–3.38)
Continuous smoker	2.23 (1.18–4.19)	1.69 (0.99–2.88)	1.78 (1.12–2.82)	1.14 (0.41–3.21)	1.02 (0.51–2.04)	1.54 (0.99–2.39)
Undetermined	2.25 (1.10–4.58)	1.63 (0.89–2.98)	1.28 (0.75–2.18)	1.04 (0.34–3.25)	1.08 (0.54–2.16)	1.11 (0.67–1.84)
Prepregnancy BMI						
Normal (≤18.5 to <25)	Reference	Reference	Reference	Reference	Reference	Reference
Underweight (<18.5)	4.22 (1.85–9.61)	3.35 (1.60–7.01)	2.64 (1.30–5.37)	4.92 (1.59–15.23)	3.93 (1.59–9.72)	2.60 (1.25–5.43)
Overweight (≤25 to <30)	2.30 (1.43–3.71)	1.87 (1.28–2.73)	1.51 (1.09–2.09)	1.65 (0.76–3.61)	1.67 (1.04–2.67)	1.34 (0.99–1.81)
Obese (BMI ≥30)	2.85 (1.68–4.85)	2.37 (1.54–3.64)	1.98 (1.37–2.87)	2.05 (0.87–4.85)	2.09 (1.23–3.57)	1.76 (1.25–2.47)
Delivery mode						
Vaginal spontaneous	Reference	Reference	Reference	Reference	Reference	Reference
Elective cesarean	1.73 (1.08–2.77)	1.81 (1.21–2.72)	1.60 (1.11–2.31)	2.29 (1.11–4.73)	1.68 (1.02–2.77)	1.90 (1.36–2.66)
Emergency cesarean	1.55 (0.91–2.65)	1.87 (1.21–2.89)	1.96 (1.35–2.85)	1.83 (0.77–4.36)	1.54 (0.88–2.68)	1.66 (1.16–2.37)
Vaginal assisted	0.70 (0.24–1.97)	1.10 (0.55–2.17)	1.08 (0.62–1.88)	0.51 (0.07–3.96)	0.79 (0.31–2.05)	1.16 (0.72–1.88)
Returned to work after delivery						
Did not work	Reference	Reference	Reference	Reference	Reference	Reference
Month 1–3	0.92 (0.33–2.57)	0.54 (0.20–1.49)	0.72 (0.35–1.49)	1.58 (0.45–5.59)	0.93 (0.33–2.60)	1.24 (0.73–2.10)
Month 4–6	0.80 (0.28–2.29)	0.78 (0.33–1.82)	0.87 (0.42–1.81)	1.51 (0.41–5.51)	1.19 (0.50–2.84)	1.36 (0.80–2.30)
Month 7–12	0.46 (0.14–1.48)	0.72 (0.35–1.51)	0.83 (0.46–1.47)	NA	1.08 (0.46–2.57)	1.12 (0.67–1.87)
Undetermined	1.88 (1.03–3.43)	1.59 (0.94–2.70)	1.98 (1.23–3.18)	3.16 (1.24–8.01)	2.43 (1.28–4.61)	2.57 (1.64–4.04)

NA signifies not applicable (eg, no participants in the numerator).

nonsmokers, and, surprisingly, those who abstained from drinking alcohol were at significantly lower risk for early breastfeeding cessation even when compared with mothers who reported no history of drinking. Given the importance of the postpartum period for motivating long-term changes in health behavior, this finding supports need for stage-matched interventions including promoting continued smoking cessation before and after breastfeeding cessation.[36,37]

CONCLUSIONS

In our cohorts, longer duration of predominant and any breastfeeding observed over time were likely due to upstream events resulting in increased prevalence of higher general education among women and subsequent lower rates of individual risk factors including smoking and obesity. Among lower educated women, <50% met minimum predominant breastfeeding guidelines, whereas <30% met minimum guidelines for overall breastfeeding duration, rates far lower than those observed among higher educated mothers. These results suggest widening socioeconomic and subsequent health-related disparities, which may require specific interventions aimed at improving breastfeeding patterns in Germany and elsewhere. Although programs focusing on obesity, smoking, and cesarean delivery would benefit all mothers, programs tailored specifically toward less educated mothers are necessary.

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ABBREVIATIONS

HR: hazard ratio
UBCS: Ulm Birth Cohort Study
SPATZ: Ulm SPATZ Health Study

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