

## ARTICLE



# Achieving healthy people 2030 breastfeeding targets in the United States: challenges and opportunities

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**OBJECTIVES:** To estimate the national and states-specific gaps in breastfeeding rates in the United States for achieving the Healthy People 2030 (HP2030) targets, which are: 42.4% of infants to exclusively breastfeed through 6th months, and 54.1% of infants to breastfeed through 12th month of age.

**STUDY DESIGN:** The differences between the HP2030 breastfeeding targets and the respective state-specific baseline rates in the 2022 National Immunization Survey report for infants born in 2019 were computed.

**RESULTS:** The gaps in breastfeeding rates for achieving either of the two HP2030 targets varied greatly. Relative to their 2019 baseline estimates, 7 U.S. states need to increase breastfeeding rates between 100% and 207%, 27 states between 50% and 99%, 9 states and 2 territories between 20% and 49% and the remaining 7, between 0% and 19%.

**CONCLUSIONS:** Thirty-four of 50 (68%) states face huge gaps in achieving the HP2030 breastfeeding targets.

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## INTRODUCTION

The Healthy People 2030 (HP2030) program has set national objectives for the United States to increase the proportion of infants to exclusively breastfeed through 6th months of age to 42.4% (6-month target), and to continue breastfeeding through 12th month of age to 54.1% (12-month target) [1]. Exclusive breastfeeding is defined as feeding only breastmilk, no solids, and no water or no other liquids.

The Healthy People Program is a U.S. Federal Government effort, which develops health-related targets for the nation to achieve every 10 years. To formulate the HP2030 breastfeeding targets, the Program used earlier data from the National Immunization Survey (NIS) conducted by the Centers for Disease Control and Prevention (CDC), along with extensive literature reviews, and motivated by a desire to advance the health of the nation.

Since continued breastfeeding offers numerous health benefits to the mother and her infant, the American Academy of Pediatrics Section on Breastfeeding has issued a new policy statement retaining its endorsement for exclusive breastfeeding through 6th month, and continued breastfeeding for at least 12 months. Now the policy also recommends continued breastfeeding *as long as mutually desired by the mother and the child for 2 years or beyond* [2].

Although the breastfeeding initiation rates are high in the U.S., most women do not breastfeed exclusively for the first 6 months, or continue to breastfeed their infants through the first 12 months, as reported by the latest NIS released on August 1, 2022 [3]. Among the infants born in 2019, the national rate estimate for 6th month exclusive breastfeeding was 24.9% and the estimate for breastfeeding through the 12th month was 35.9%, with wide variation among the states [3].

Therefore, for achieving the HP2030 targets, many states may need to overcome substantial gaps in breastfeeding rates. However, the extent of state-specific gaps has not been reported. This study assesses the state and territory-specific gaps in breastfeeding rates for achieving the HP2030 targets.

## MATERIALS AND METHODS

The results from the 2022 NIS data [3] were used for analyses in this study. The NIS results provide the national, state, and territory-level breastfeeding estimates for 2019 live births for all 50 states, Puerto Rico, and the District of Columbia (henceforth referred to as “states”).

The NIS adapts a random-digit-dialling, complex sampling method for the survey to estimate the current national, state, selected local level, and some US territory level vaccination coverage rates for US infants and children. Since July 2001, breastfeeding questions have been added to the NIS to monitor rates of breastfeeding at national and state levels by birth year. The 2022 NIS report contains responses from the members of households with children aged 19–35 months, and who were born in 2019 calendar year.

The NIS determines the sample sizes to provide the statistical precision required to estimate vaccination coverage as well as breastfeeding prevalence for each survey area. The NIS webpage provides additional details about the survey methods and analytical techniques [4].

The NIS does not collect information on gestational age. However, the inclusion of preterm births in the survey of households with surviving infants at 19–35 months is unlikely to have affected the overall rates of breastfeeding. This is because, in 2019, 10.23% of U.S. births were preterm, and 0.66% were extremely preterm (<28 weeks of gestation) [5]. These are small numbers among the relatively small survey samples that ranged between 250 and 1200.

Two methods were used to express gaps in achieving the HP2030 targets. One was by subtracting the target rates from the 2019 respective state-specific breastfeeding estimates [3], and the second was calculating

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the percentage differences relative to state's 2019 baseline rates. As for example: In 2019, 27.3% of infants born in California were exclusive breastfed through 6 months of age. Therefore, to achieve the HP2030 6-month target of 42.4%, California must overcome a 15.1% gap, or 55.3% gap relative to the state's 2019 baseline ( $15.1/27.3 \times 100 = 55.3\%$ ).

As its usual practice, NIS publishes the national and state-specific breastfeeding rates as mean  $\pm$  1/2 of 95% confidence intervals (CI) due to the relatively small sample sizes and large CIs [3], which was retained while reporting the results in this paper. However, to test the statistical significance among the states, the widths of the mean  $\pm$  full 95% CIs were compared. If the widths overlapped, the respective mean values were declared not to be significantly different from each other, and if they did not overlap, they were declared to be significantly different.

## RESULTS

Table 1 provides the number of responses to the 2022 NIS survey along with the national and state-specific mean rates ( $\pm$ one-half of 95% CI) [3]. The results are sorted in an ascending order for the mean breastfeeding values for the 6th and 12th month breastfeeding estimates. The table footnote also lists the states and territories that had achieved HP2020 targets by 2019.

The state-specific rates for the two breastfeeding measures of interest varied greatly. The 6th month exclusive breastfeeding rate was the lowest for West Virginia, and highest for Minnesota. Similarly, the 12th month breastfeeding rate was lowest for West Virginia and highest for Hawaii (which had already achieved the 12th month target of 54.1%).

Figure 1 shows the gaps for achieving the 6th and 12th month targets. The U.S. national gaps for the two targets (arrows) were: 17.5% and 18.2%, respectively (rounded to 18%). Figure 1 also show that the extent of gaps for achieving the two HP2030 targets ranged greatly among the states. The states within the parenthesis marks at the left ends of the graphs need to overcome significantly larger gaps compared to those in the parenthesis marks at the right ends of the graphs.

Figures 2 and 3 show the geographic distribution of the percentage gaps relative to their respective 2019 mean rates. Both figures show that the gaps for achieving the HP2030 breastfeeding targets vary greatly. The gaps to achieve either of the targets ranged between 100% and 207% for 7 states; between 50% and 99% for 27 states; between 20% and 49% for the 9 states and 2 territories; and between 0% and 19% for the remaining 7 states. The gaps were higher in the southern, industrial eastern, and midwestern states compared to those in the Atlantic-northeastern, northern, and Pacific northwestern states.

## DISCUSSION

The results of this study (Table 1 and Figs. 1–3) show that a large number of U.S. states face huge gaps for achieving the HP2030 breastfeeding targets [3]. Therefore, these states may need to develop regional programs for enhancing continued breastfeeding for achieving the worthy goals of HP2030.

Why such a large variation in the gaps to achieve the HP2030 targets? The obvious reason is the variation in the baseline breastfeeding rates. And explaining regional variations in breastfeeding requires data on the distribution of associated variables noted above across the states. Such data are not available, and studies are urgently needed to rectify this knowledge gap.

Even in states with high mean breastfeeding rates, there could be regions having suboptimal breastfeeding rates. Thus, addressing the generic and local factors impeding the continuation of breastfeeding would be critical to achieving 2030 breastfeeding targets—a 'one-size fits all' approach may not work.

The NIS survey [3] identified several specific socio-demographic factors such as gender, race/ethnicity, maternal education, maternal age, poverty-to-income ratio, marital status, and geographic location affecting breastfeeding continuation in the U.S. (Table 2). Race and ethnicity are also important factors affecting breastfeeding continuation beyond the immediate postpartum period, as shown in the supplementary material Table.

Other factors known to negatively influence the duration of breastfeeding include mode of delivery, work and workplace issues, the unavailability of lactation consultants especially in rural areas have also been noted as factors negatively affecting breastfeeding durations [6].

Improving breastfeeding rates can also help achieve another HP2030 target—reducing the U.S. infant mortality rate (IMR) to 5.0 deaths for 1000 live births [1]. A recent study from the CDC using linked birth and death certificates reported that "any" breastfeeding resulted in a 26% reduction in post-perinatal deaths in the U.S. [7] This is the first report to show an association between breastfeeding and reduced IMR in an industrialized nation, such as the U.S.

How to enhance continued breastfeeding beyond the immediate postpartum period? Two recent studies highlight potential opportunities. Using a sample of 33,121, Kogan et al. [8] showed that the prevalence of infants "ever breastfed" and "breastfed for at least six months" were higher in states that have enacted one or more legislative policies geared to promoting breastfeeding. They also noted that sociodemographic and maternal factors did not account for most of the variations in the breastfeeding rates [8].

In another study, the researchers examined the associations between workplace leave length and breastfeeding initiation and continuation at 1, 2, and 3 months in a cohort of 12,301 postpartum women [9]. Approximately two thirds (66.2%) of women reported taking less than 3 months of leave. A shorter leave length (<3 months), paid or unpaid, was associated with lower prevalence of continued breastfeeding at 2 and 3 months of postpartum. These findings support the expert opinion that regional laws and legislative policies positively influence breastfeeding rates [10].

Besides the length of postpartum maternal leave, a friendly workplace environment would be conducive to continued breastfeeding, just as an unfriendly workplace environment would be detrimental [11–15]. Similarly, advertising commercial formulas in the prenatal clinics had a negative impact on the duration of breastfeeding [16]. South African scientists report that many infant formula manufacturing companies have been using a variety of covert marketing techniques to entice women to stop breastfeeding and purchase commercial infant formula to feed their infants [17].

Hospitals caring for postpartum women could require all units to have standardized counseling sessions, and to the extent possible, offer help to overcome barriers to continued breastfeeding for individual families. The hospitals might also implement the *Ten Steps to Successful Breastfeeding* recommended by the Baby-Friendly USA [18].

Strengths of this study include the use of the latest NIS data [3] to compute the gaps in breastfeeding rates for achieving the HP2030 targets [1]. However, this study has limitations. The baseline breastfeeding data were obtained from a cohort of women delivering live births in the 2019 calendar year. Therefore, it is possible that the rates could have improved since then and the actual gaps reported here could be overestimates.

Additionally, the target year of birth for the 2022 NIS survey was 2019—before the outbreak of COVID-19 pandemic. The potential impact of the pandemic-related adverse effects such as shut down, social isolation, loss of job and income on breastfeeding

**Table 1.** Rates for Ever Breastfed, any Breastfeeding at 12th month, and Exclusive Breastfeeding at through 6 Months of Age for U.S. by State Among Children Born in 2019 (Percentage  $\pm$  half 95% Confidence Intervals)<sup>a</sup>.

STATES	Number Responding to the Survey (Sample Size)	Exclusive Breastfeeding <sup>c</sup> through 6 Months Mean $\pm$ ½ of 95% Confidence Intervals	STATES	Number Responding to the Survey (Sample Size)	Breastfed at 12 Months Mean $\pm$ ½ of 95% Confidence Intervals	Ever Breastfed Mean $\pm$ ½ of 95% Confidence Intervals
US National <sup>b</sup>	20217	24.9 $\pm$ 1.1	US National <sup>b</sup>	20906	35.9 $\pm$ 1.2	83.2 $\pm$ 1.0
West Virginia	238	13.8 $\pm$ 4.6	West Virginia	245	19.2 $\pm$ 5.0	59.8 $\pm$ 7.0
Mississippi	483	15.6 $\pm$ 4.0	Mississippi	497	22.2 $\pm$ 4.6	69.4 $\pm$ 5.6
Florida	347	18.2 $\pm$ 6.8	Florida	360	23.0 $\pm$ 7.0	71.0 $\pm$ 8.7
Georgia	318	18.7 $\pm$ 5.8	Alabama	290	23.7 $\pm$ 6.2	71.1 $\pm$ 6.8
South Carolina	314	19.3 $\pm$ 4.9	Louisiana	454	24.2 $\pm$ 5.2	71.1 $\pm$ 6.4
Alabama	281	21.0 $\pm$ 5.9	South Carolina	327	26.0 $\pm$ 5.5	80.6 $\pm$ 5.6
Kentucky	328	21.2 $\pm$ 4.8	Nevada	421	27.6 $\pm$ 5.2	83.8 $\pm$ 4.7
Indiana	260	21.5 $\pm$ 5.9	Oklahoma	258	27.9 $\pm$ 6.3	77.3 $\pm$ 6.1
North Carolina	356	22.1 $\pm$ 6.2	Arkansas	446	29.2 $\pm$ 5.8	74.9 $\pm$ 5.4
Louisiana	436	22.2 $\pm$ 5.2	Indiana	270	30.3 $\pm$ 6.5	85.9 $\pm$ 5.0
Nevada	411	22.3 $\pm$ 5.2	Tennessee	473	31.5 $\pm$ 5.4	78.8 $\pm$ 5.4
Rhode Island	269	22.9 $\pm$ 6.4	Ohio	484	32.2 $\pm$ 5.3	79.5 $\pm$ 5.0
Oklahoma	249	23.2 $\pm$ 5.9	Michigan	416	32.2 $\pm$ 5.8	83.1 $\pm$ 5.2
New York	834	23.4 $\pm$ 4.1	Rhode Island	275	33.3 $\pm$ 6.7	82.4 $\pm$ 5.6
New Jersey	361	23.5 $\pm$ 5.9	Georgia	328	33.7 $\pm$ 6.9	82.6 $\pm$ 6.4
Ohio	467	23.7 $\pm$ 5.0	New Jersey	378	33.8 $\pm$ 6.3	82.5 $\pm$ 5.8
Texas	1186	24.0 $\pm$ 3.7	Missouri	452	34.0 $\pm$ 6.0	78.3 $\pm$ 6.0
Arizona	253	24.0 $\pm$ 6.6	Connecticut	421	34.1 $\pm$ 5.3	84.2 $\pm$ 4.5
Arkansas	440	24.4 $\pm$ 5.7	North Carolina	362	34.2 $\pm$ 7.2	83.4 $\pm$ 6.4
Pennsylvania	808	24.6 $\pm$ 5.0	North Dakota	343	34.4 $\pm$ 6.7	85.7 $\pm$ 5.0
Missouri	442	24.6 $\pm$ 5.8	Kentucky	336	34.5 $\pm$ 5.8	74.7 $\pm$ 5.7
Tennessee	466	24.9 $\pm$ 5.2	Texas	1219	34.8 $\pm$ 4.1	84.1 $\pm$ 3.6
Delaware	254	25.0 $\pm$ 6.1	Delaware	265	34.9 $\pm$ 6.7	83.6 $\pm$ 5.5
Michigan	409	25.1 $\pm$ 5.8	Pennsylvania	828	35.2 $\pm$ 5.6	74.8 $\pm$ 5.5
Virginia	507	25.8 $\pm$ 6.8	Puerto Rico	688	35.3 $\pm$ 5.1	86.2 $\pm$ 3.9
Nebraska	252	26.0 $\pm$ 7.0	Illinois	649	35.4 $\pm$ 4.6	84.9 $\pm$ 3.9
Connecticut	406	26.3 $\pm$ 4.9	New York	870	36.3 $\pm$ 4.6	86.7 $\pm$ 3.6
Iowa	251	27.0 $\pm$ 6.9	District of Columbia	429	36.8 $\pm$ 5.4	87.7 $\pm$ 4.1
Wyoming	291	27.2 $\pm$ 6.5	Nebraska	258	37.7 $\pm$ 7.8	86.1 $\pm$ 6.2
California	715	27.3 $\pm$ 4.8	South Dakota	363	37.8 $\pm$ 6.1	88.9 $\pm$ 4.2
Utah	322	27.3 $\pm$ 6.3	Iowa	266	38.2 $\pm$ 7.6	82.4 $\pm$ 6.4
North Dakota	339	27.4 $\pm$ 6.2	Kansas	370	39.5 $\pm$ 7.0	87.1 $\pm$ 5.0
Hawaii	316	27.7 $\pm$ 5.4	Colorado	285	39.6 $\pm$ 8.2	94.0 $\pm$ 4.7
Illinois	626	28.3 $\pm$ 4.4	Virginia	532	40.1 $\pm$ 7.5	83.3 $\pm$ 6.5
Maine	274	28.7 $\pm$ 5.7	Arizona	261	40.4 $\pm$ 7.6	85.4 $\pm$ 5.7
Maryland	763	28.9 $\pm$ 4.6	Idaho	348	40.7 $\pm$ 6.4	93.5 $\pm$ 3.4
New Mexico	357	29.0 $\pm$ 6.2	Maine	280	41.0 $\pm$ 6.2	86.6 $\pm$ 4.4
South Dakota	351	29.1 $\pm$ 5.7	Wyoming	299	41.3 $\pm$ 7.4	92.4 $\pm$ 3.8
District of Columbia	412	29.2 $\pm$ 5.1	New Hampshire	287	42.5 $\pm$ 6.7	82.2 $\pm$ 5.5
Kansas	361	29.2 $\pm$ 6.5	New Mexico	370	42.8 $\pm$ 6.6	83.4 $\pm$ 5.2
Massachusetts	344	29.2 $\pm$ 7.0	Montana	270	42.9 $\pm$ 6.5	83.5 $\pm$ 5.6
Washington	490	29.5 $\pm$ 5.3	Maryland	792	43.0 $\pm$ 5.0	88.5 $\pm$ 3.4
Idaho	334	30.4 $\pm$ 6.4	California	752	43.6 $\pm$ 5.2	89.9 $\pm$ 3.4
Alaska	292	30.9 $\pm$ 6.3	Oregon	314	44.0 $\pm$ 6.7	87.2 $\pm$ 5.3
Wisconsin	249	31.3 $\pm$ 6.7	Utah	332	44.1 $\pm$ 6.6	91.4 $\pm$ 4.0

Table 1. continued

STATES	Number Responding to the Survey (Sample Size)	Exclusive Breastfeeding <sup>c</sup> through 6 Months Mean ± ½ of 95% Confidence Intervals	STATES	Number Responding to the Survey (Sample Size)	Breastfed at 12 Months Mean ± ½ of 95% Confidence Intervals	Ever Breastfed Mean ± ½ of 95% Confidence Intervals
New Hampshire	280	31.8 ± 6.3	Massachusetts	354	44.2 ± 7.4	80.0 ± 6.5
Colorado	277	32.1 ± 8.0	Wisconsin	260	45.1 ± 7.3	87.5 ± 5.5
Oregon	301	34.2 ± 6.6	Minnesota	343	46.3 ± 7.0	91.9 ± 3.8
Montana	259	34.3 ± 6.5	Washington	510	47.4 ± 5.7	93.7 ± 2.9
Puerto Rico	676	35.2 ± 5.2	Alaska	307	50.9 ± 6.7	92.9 ± 3.5
Vermont	312	36.2 ± 6.0	Vermont	326	54.0 ± 6.3	91.8 ± 3.5
Minnesota	326	36.5 ± 7.1	Hawaii	331	54.1 ± 6.3	90.1 ± 3.9

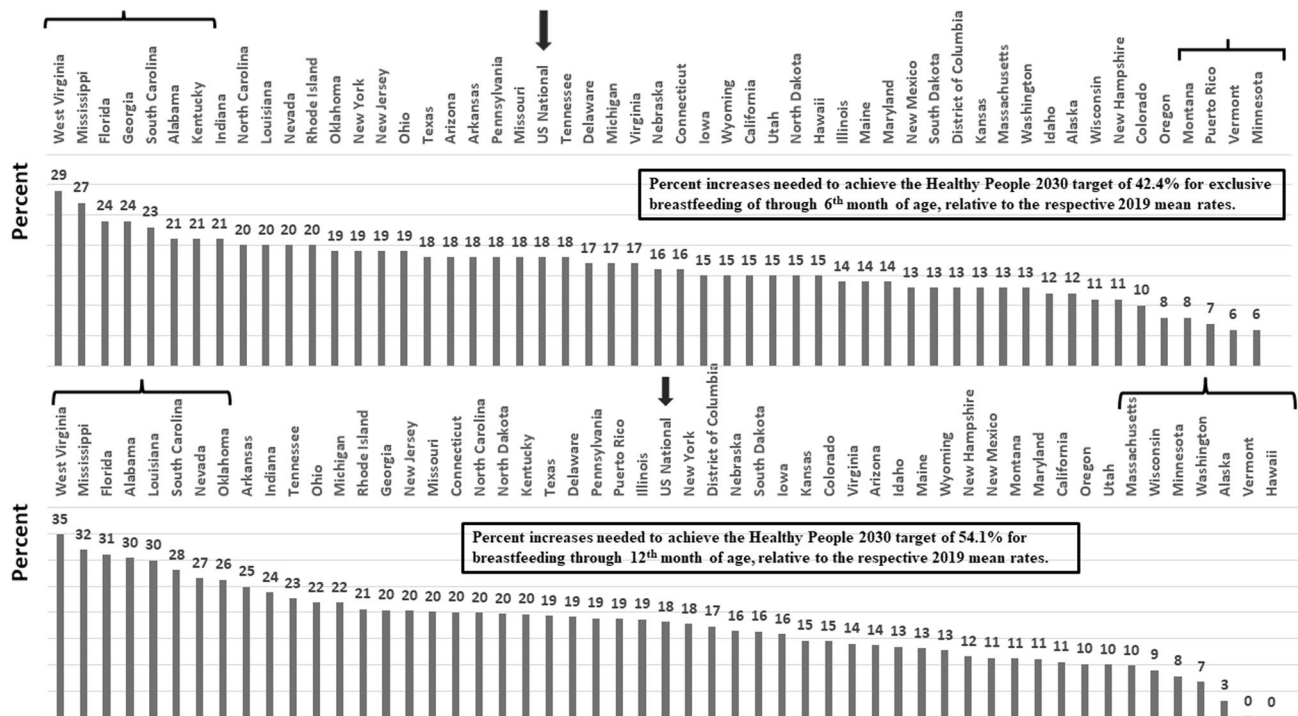
<sup>a</sup>Table adapted from the CDC, National Immunization Survey, 2022 report (citation #3). The data are estimates of breastfeeding rates in the U.S. for births occurring in the 2019 calendar year, the latest data available for analyses. The report presents the results from all 50 states, the District of Columbia and Puerto Rico. The data are shown in an ascending order for breastfeeding mean values.

<sup>b</sup>The U.S. National breastfeeding estimates excluded results from U.S. territories to be consistent with the analytical methods for the establishment of HP2030 breastfeeding targets.

<sup>c</sup>Exclusive breastfeeding is defined as ONLY breast milk—NO solids, no water, and no other liquids.

The HP2020 target for 6 months exclusive breastfeeding was 25.5%, and for any breastfeeding at 12 months of age was 34.1%. By 2019, the 6 month target had been achieved by 26/50 states, Puerto Rico, and the District of Columbia (see the above table, from Virginia 25.8% to Minnesota 36.5%).

The HP2020 target of 34.1% for any breastfeeding at 12th month was reached by 33/50 states, Puerto Rico and the District of Columbia (see the above table, from Connecticut 34.1% to Hawaii 54.1%).

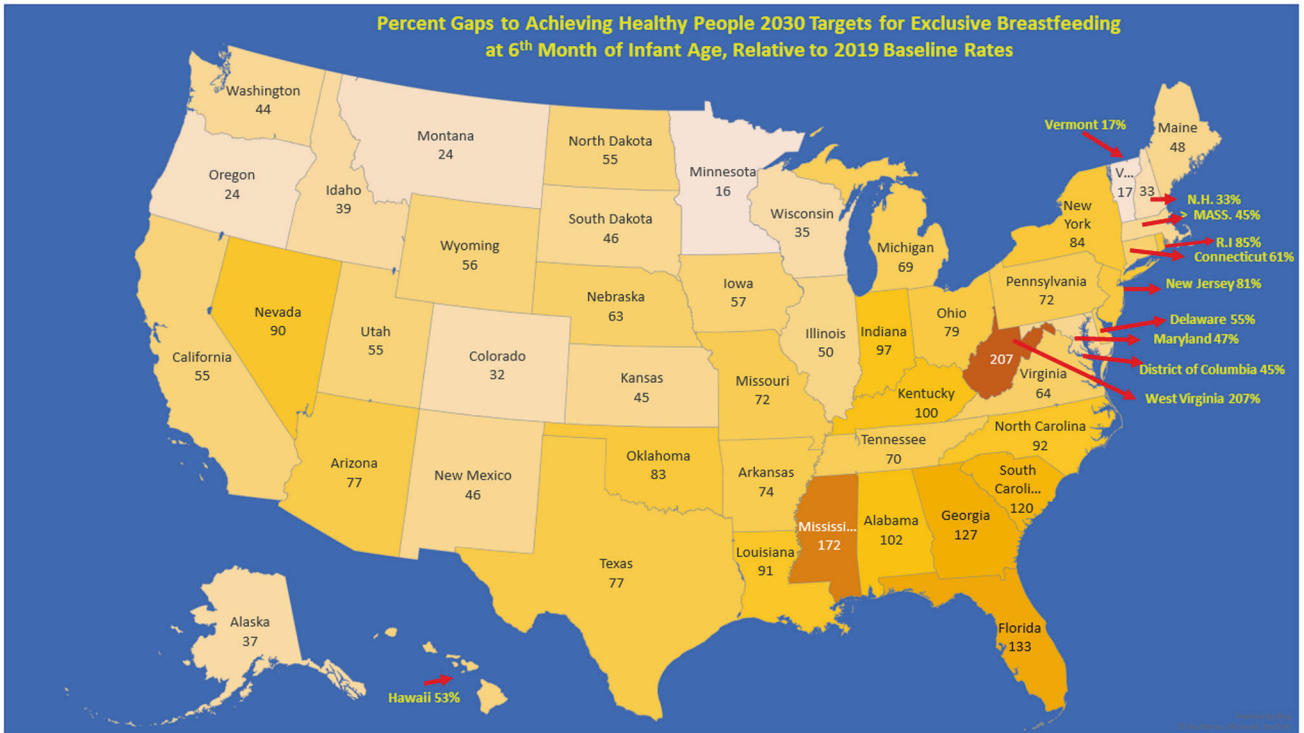


**Fig. 1 Gaps for Achieving HP2030 Breastfeeding Targets.** The percent gaps for achieving the HP2030 targets for exclusive breastfeeding through the 6th month (upper panel) and breastfeeding through the 12th month (lower panel). The differences between the respective target values and the 2019 baseline mean rates for the U.S. (arrows), 50 individual states, Puerto Rico and the District of Columbia, arranged in descending order from left to right. The gaps among the states within the parenthesis marks at two ends of both graphs were significantly different. These states were—to achieve the 6-month target (upper panel), West Virginia, Mississippi, Florida, Georgia, South Carolina, Alabama, and Kentucky (left end of the graph) encounter significantly larger gaps compared to those of Montana, Puerto Rico, Vermont, and Minnesota (right end of the graph); to achieve the 12-month target (lower panel), West Virginia, Mississippi, Florida, Alabama, Louisiana, South Carolina, Nevada, and Oklahoma (left end of the graph) encounter significantly larger gaps compared to those of Massachusetts, Wisconsin, Minnesota, Washington, Alaska, Vermont, and Hawaii (right end of the graph). The data were rounded using the general algebraic rules.

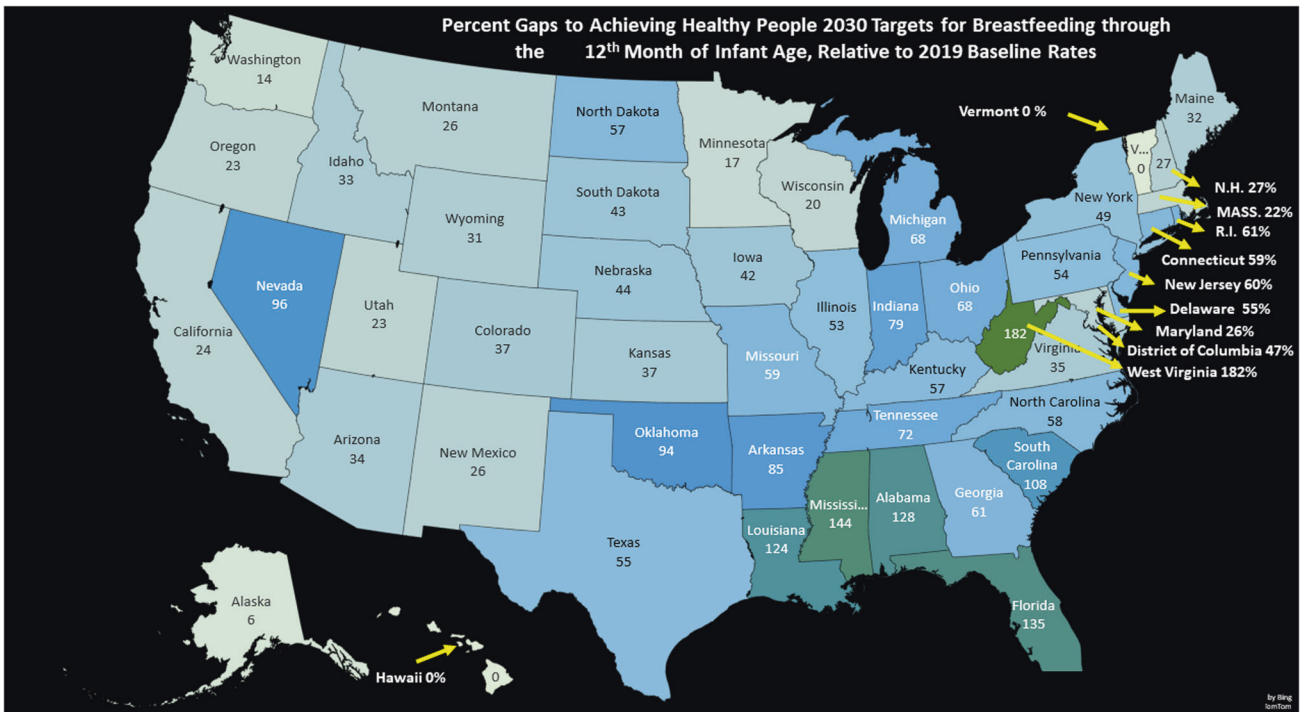
practices remain to be studied. It is possible that the enforced stay-at-home policies might have encouraged more women to breastfeed for longer durations. However, poverty, food insecurity and depression due to the pandemic-related isolation might have

had an opposite effect on breastfeeding practices. These issues are important topics for future studies.

In conclusion, the data presented in this study show that 34/50 (68%) states in the U.S., need to overcome significant gaps,



**Fig. 2 Geographic distribution of the percentage gaps for achieving the 6-month HP2030 target relative to states' respective 2019 rates.** The numbers within the state boundaries are the percentages values. For technical reasons, Puerto Rico (7%) is not represented in the figure. All data were rounded using the general algebraic rules.



**Fig. 3 Geographic distribution of the percentage gaps for achieving the 12-month HP2030 target relative to state's respective 2019 rates.** The numbers within the state boundaries are the percentages values. For technical reasons Puerto Rico (19%) is not represented in the figure. The data were rounded using the general algebraic rules.

and Puerto Rico and the District of Columbia need to overcome modest gaps for achieving the 2030 Healthy People breastfeeding targets. Understanding the state and region-specific barriers, implementing remedial measures, and

developing policies and regulations to support breastfeeding services could be invaluable in helping to overcome those gaps and achieve the HP2030 targets, positively impacting the nation's health.

**Table 2.** Rates of Exclusive Breastfeeding by 6 months and any Breastfeeding at 12 months by Socio-demographics among Children Born in 2019 (Percentage  $\pm$  half 95% Confidence Interval)<sup>a</sup>.

Socio-demographic Factors	Any Breastfeeding			Exclusive Breastfeeding			
	n	Ever Breastfed Mean $\pm$ ½ of 95% Confidence Intervals	Breastfed at 6 months Mean $\pm$ ½ of 95% Confidence Intervals	Breastfed at 12 months Mean $\pm$ ½ of 95% Confidence Intervals	Exclusive Breastfeeding through 3 Months Mean $\pm$ ½ of 95% Confidence Intervals	Exclusive Breastfeeding through 6 Months Mean $\pm$ ½ of 95% Confidence Intervals	
US National	20906	83.2 $\pm$ 1.0	55.8 $\pm$ 1.3	35.9 $\pm$ 1.2	20217	45.3 $\pm$ 1.3	24.9 $\pm$ 1.1
Gender							
Male	10668	83.3 $\pm$ 1.4	55.5 $\pm$ 1.8	36.1 $\pm$ 1.7	10306	44.6 $\pm$ 1.8	24.4 $\pm$ 1.5
Female	10238	83.1 $\pm$ 1.5	56.2 $\pm$ 1.8	35.7 $\pm$ 1.7	9911	46.1 $\pm$ 1.8	25.5 $\pm$ 1.6
Race/Ethnicity							
Hispanic	3991	83.0 $\pm$ 2.3	51.4 $\pm$ 2.9	33.2 $\pm$ 2.7	3903	43.8 $\pm$ 2.9	23.5 $\pm$ 2.5
Non-Hispanic White	11465	85.3 $\pm$ 1.3	59.9 $\pm$ 1.7	39.4 $\pm$ 1.6	11060	49.0 $\pm$ 1.7	26.9 $\pm$ 1.5
Non-Hispanic Black	2144	74.1 $\pm$ 3.7	44.0 $\pm$ 3.7	24.1 $\pm$ 2.8	2075	36.3 $\pm$ 3.5	19.1 $\pm$ 2.8
Non-Hispanic Asian	1119	90.8 $\pm$ 2.9	70.2 $\pm$ 4.9	45.7 $\pm$ 5.1	1076	42.5 $\pm$ 5.1	28.5 $\pm$ 4.5
Non-Hispanic Hawaiian/Pacific Islander	113	NA	NA	NA	112	NA	NA
Non-Hispanic American Indian/Alaska Native	295	NA	NA	NA	291	NA	NA
2 or more races	1779	82.7 $\pm$ 3.4	57.1 $\pm$ 4.3	38.1 $\pm$ 4.2	1700	47.4 $\pm$ 4.3	27.0 $\pm$ 3.8
Maternal Education							
Less than high school	1117	71.6 $\pm$ 4.4	39.2 $\pm$ 4.9	26.6 $\pm$ 4.5	1089	34.7 $\pm$ 5.0	19.8 $\pm$ 4.3
High school graduate	3588	73.4 $\pm$ 2.6	39.7 $\pm$ 2.7	23.4 $\pm$ 2.3	3478	36.1 $\pm$ 2.7	18.6 $\pm$ 2.2
Some college or technical school	5225	85.7 $\pm$ 1.7	54.2 $\pm$ 2.4	34.2 $\pm$ 2.4	5079	45.6 $\pm$ 2.5	23.8 $\pm$ 2.2
College graduate	10976	91.5 $\pm$ 1.1	71.9 $\pm$ 1.6	47.7 $\pm$ 1.7	10571	54.1 $\pm$ 1.8	31.2 $\pm$ 1.6
Maternal Age							
Under 20	123	NA	NA	NA	121	NA	NA
20–29	5691	79.9 $\pm$ 2.1	45.0 $\pm$ 2.3	27.9 $\pm$ 2.1	5526	40.9 $\pm$ 2.4	20.4 $\pm$ 1.8
30 or older	15092	84.9 $\pm$ 1.2	61.1 $\pm$ 1.5	39.7 $\pm$ 1.5	14570	47.4 $\pm$ 1.5	27.1 $\pm$ 1.4
Poverty Income Ratio <sup>b</sup>							
Less than 100	3577	74.0 $\pm$ 2.7	41.1 $\pm$ 2.8	24.9 $\pm$ 2.4	3499	37.8 $\pm$ 2.9	19.3 $\pm$ 2.3
100–199	3885	80.1 $\pm$ 2.4	49.9 $\pm$ 3.0	31.5 $\pm$ 2.8	3778	41.3 $\pm$ 3.0	22.3 $\pm$ 2.5
200–399	5454	85.3 $\pm$ 1.9	59.0 $\pm$ 2.4	39.1 $\pm$ 2.4	5279	48.4 $\pm$ 2.5	28.5 $\pm$ 2.3
400–599	3840	90.7 $\pm$ 2.1	68.4 $\pm$ 3.2	46.4 $\pm$ 3.0	3665	51.8 $\pm$ 3.2	28.3 $\pm$ 2.6
600 or greater	4150	91.6 $\pm$ 1.5	70.4 $\pm$ 2.7	44.3 $\pm$ 2.8	3996	51.9 $\pm$ 2.8	29.0 $\pm$ 2.5
Marital Status <sup>c</sup>							
Married	15160	88.6 $\pm$ 1.1	66.1 $\pm$ 1.5	44.0 $\pm$ 1.5	14596	50.5 $\pm$ 1.5	29.3 $\pm$ 1.4
Unmarried	5746	74.1 $\pm$ 2.1	38.7 $\pm$ 2.2	22.4 $\pm$ 1.9	5621	36.8 $\pm$ 2.3	17.8 $\pm$ 1.8
Geographic Location							
Metropolitan <sup>d</sup>	17552	83.8 $\pm$ 1.1	56.6 $\pm$ 1.4	36.6 $\pm$ 1.3	16959	45.7 $\pm$ 1.4	25.2 $\pm$ 1.2
Non-metropolitan	3354	78.5 $\pm$ 2.8	49.7 $\pm$ 3.3	29.7 $\pm$ 3.0	3258	42.3 $\pm$ 3.4	22.7 $\pm$ 3.1

NA Estimates not available because the 95% CI was mostly greater than 10.

<sup>a</sup>Table adapted from the CDC, National Immunization Survey, 2022 report (citation #3).

<sup>b</sup>Poverty Income Ratio = Ratio of self-reported family income to the federal poverty threshold value depending on the number of people in the household.

<sup>c</sup>Unmarried includes never married, widowed, separated, divorced, and living with partners.

<sup>d</sup>Metropolitan area is defined by the Census Bureau.

## DATA AVAILABILITY

The author is willing to share the data used in this manuscript, available as Microsoft Excel files.

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## AUTHOR CONTRIBUTIONS

TNKR conceived the study, carried out the data analyses, interpreted the results, and wrote the manuscript.

## COMPETING INTERESTS

The author is the Deputy Editor for the *Journal of Perinatology*. The author is Program Officer in the Office of the Director, National Institutes of Health. However, the opinions presented in this paper are those of the author alone. They do not necessarily represent those of the US Government, the Department of Health and Human Services, or the National Institutes of Health.

## ADDITIONAL INFORMATION

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