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ORIGINAL ARTICLE

Preceding birth interval, timing and number of antenatal contacts in Africa, 2010–2020

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Background: Utilization of adequate and quality prenatal healthcare services confers critical benefits to women and their unborn children. However, utilization rates remain low in many countries in Africa. Several studies have attempted to understand the primary drivers behind these low statistics. This article contributes to this discourse by examining the associations between birth interval and timing and number/frequency of antenatal care visits in Africa.

Methods: We pooled data from the publicly available Demographic and Health Surveys conducted in the last decade (2010–2020) for 32 African countries. Data were analysed using descriptive proportions and mixed effect binary logistic regression.

Results: The results illustrate moderate significant associations between spacing on the most recent birth by ≥36 months and early (first trimester) first antenatal care contact in both our bivariate (odds ratio [OR] 1.18, p<0.001) and multivariate (OR 1.106, p<0.001) analyses. The benefits on optimal antenatal contacts predicted on spacing are also noticed with birth intervals of 24–35 months (OR 1.08, p<0.001) and ≥36 months (OR 1.48, p<0.001).

Conclusions: Optimal birth spacing is beneficial for ANC utilization in terms of timing and total number of contacts. Post-partum family planning/contraceptive use can be an effective pathway to prolonging birth intervals. We argue that maternal and child health programmes strengthen prioritizing contraceptive use between births.

Keywords: adequate, ANC visits/contacts, birth interval, prenatal, SSA.

Introduction

Antenatal care (ANC) is one of the key proven healthcare interventions for the prevention and management of pregnancy or birth-related complications, which account for most poor maternal and child health outcomes. ANC offers a critical platform within the continuum of reproductive healthcare for pregnant women to receive preventive and supportive care and information during the prenatal period. ANC also allows for early screening and identification of potential risks associated with pregnancy and, in turn, implementation of timely interventions to avert fatal outcomes.[1] With a few exceptions,[2] there is general concurrence[3–5] that adequate ANC utilization has a consequential association/impact on reduced adverse pregnancy outcomes. Focused ANC (FANC), which until 2016 was the model around the world, recommended four ANC contacts as optimal for improved maternity outcomes. Relying on current knowledge, in 2016 the World Health Organization (WHO) recommended eight contacts for enhanced outcomes, but maintaining the first contact within the first trimester of pregnancy.[1]

Despite the known benefits of timely and optimal coverage of ANC on maternal and child health, progress in improving ANC coverage among pregnant women has been slow, particularly in low- and middle-income countries (LMICs). According to the United Nations Children's Fund (2021)[6], the proportion of pregnant women 15–49 years of age who received ANC at least four times increased by only 10% between 2007 (58%) and 2020 (68%). Wide disparities in ANC coverage continue to exist, with lower ANC coverage in southern Asia (49%) and sub-Saharan Africa (SSA; 53%). With the persisting commitment to improve maternal and child health through the Sustainable Development Goals, there is the need for concerted effort in understanding factors that affect ANC utilization to help tackle the unacceptably high pregnancy-related preventable adverse outcomes for mothers and their children.

Birth interval is one factor that can impact maternal and child health outcomes. Whereas there is no consensus on the optimal birth interval, many experts or consultative groups, including a WHO technical consultative group, agree that a 24-month interval between births provides significant benefits to women and their children.[7] Indeed, studies have found an increased risk of poor pregnancy outcomes, including preterm birth, low birthweight and small for gestational age, associated with shorter birth intervals.[8,9] Existing literature seems to draw more on the biological mechanisms in explaining the link between birth intervals and pregnancy outcomes, including maternal nutritional depletion, folate depletion, cervical insufficiency, vertical transmission of infections, suboptimal lactation related to breastfeeding and pregnancy overlap, among others, while less research effort has been invested towards understanding some behavioural dimensions of the problem.[9–13]

One such important but much less explored behavioural hypothesis is the effect of birth interval on women's pregnancy-related health services utilization. Yet the preceding interval between the last birth and the next pregnancy could influence a pregnant woman's decisions and behaviours regarding ANC service utilization and subsequent pregnancy outcomes. For instance, women with shorter preceding intervals may entertain some sense of protection against potential risks of non-utilization of ANC based on recent pregnancy experiences. On the other hand, in contexts such as SSA, where abuse and disrespect during maternity care is pervasive,[14] women with shorter birth intervals may be reluctant to access ANC for fear of being abused by health providers for not practicing adequate birth spacing.

Notwithstanding the rich and large volume of scholarship on determinants of ANC utilization,[3,15] little is known about the relationship between the preceding birth interval and ANC utilisation. The evidence on the relationship between birth interval and ANC utilization is scarce. Indeed, previous attempts[16,17] have only examined this relationship partially or indirectly, with birth interval often merely treated as a covariate rather than a key variable of interest. While alluding to the lack of previous studies on the relationship between birth interval and ANC attendance, Heaman et al.[18] considered their findings linking shorter birth interval with inadequate ANC as new knowledge for improving ANC service utilization in Manitoba. Our aim in this article is to further analyse the relationship between the preceding birth interval and ANC attendance using analogous datasets from 32 African countries.

Methods

Data for this article were culled from Demographic and Health Surveys (DHS) conducted in 32 African countries between 2010 and 2020. The DHS adopts a comparable methodology in data collection, cleaning and coding that easily facilities cross-country/regional analysis. The first phase of sampling involves demarcating regions/counties/provinces into urban and rural zones. From the urban and rural areas, enumeration areas (EAs)/clusters are chosen and from each cluster/EA, a predetermined number of households are selected through a simple random technique. Eligible women 15–49 y of age (in the majority of countries) who voluntarily consent are recruited and interviewed; response rates usually average 95% (range 87–99.3).[19] The surveys conform to in-country protocols for granting ethical approval for research involving humans.

Variables

The main independent variable for this paper is the interval preceding recent births and the outcome variables were timing of the first ANC and the number of ANC visits. These variables were based on the most recent birth (before survey) and the intention was to avoid potential recall biases associated with births occurring >5 years prior to the surveys. Birth interval is measured in months for the purposes of this analysis and was divided into four groups:[20] ≤17, 18–23, 24–35 and ≥36 months. Timing of the first ANC was categorised into first trimester or otherwise, while the number of ANC visits was grouped into three or less and four or more. Although in 2016 the WHO revised the focused ANC model from four to eight visits, the recent surveys from all but six countries in this analysis were conducted before the implementation of the new 2016 WHO ANC model. It is unlikely that these countries had started full implementation of the new recommendations. This is particularly important in light of the retrospective nature of the DHS methodology. Our analysis was therefore based on the old recommendations of a minimum of four visits. Other explanatory/independent variables included in the multivariable models were household wealth, maternal education, area of residence (urban, rural), marital status, pregnancy intentions (wanted, mistimed and unplanned) and parity (nulliparity, low parity [1–4] and grand multiparity [≥5]).

Data analysis

A two-step approach was employed in analysing the data. The first involved descriptive statistics reporting proportions for the timing of ANC and the number of ANC visits. Next, mixed effects binary logistic regression was used to estimate the effect of birth interval on the two outcomes (timing and number of ANC visits) separately. Mixed effects binary logistic regression was used because the DHS datasets are based on a complex survey design with unequal weighting at the country and cross-country levels.[21–23] The mixed effects regression belongs to the generalized linear mixed models that allow us to account for the complex sampling processes.[24] In each case, two models were estimated. Model 1, in Tables 2 and 3, focused on the bivariate relationship birth interval (≤17, 18–23, 24–35 and ≥36 months) and timing of the first ANC and optimal visits. Model 2 (Tables 2 and 3) were multivariable models aimed at clarifying the net effect of birth interval on the outcomes, while controlling for other documented predictors of ANC. Random effects are reported at the country level.

Table 1. Proportion of women reporting first trimester ANC and at least four visits, by background characteristics

	First trimester		>4 visits	
Characteristics	%	n	%	n
Preceding birth interval (months)				
≤17	37.4	9512	49.5	11 319
18–23	35.6	19 048	48.9	22 485
24–35	36.2	57 927	51.8	66 411
≥36	41.6	90 522	60.0	98 624
Country, year				
Angola, 2015/16	44.6	13 980	57.6	17 678
Benin, 2017/18	57.3	7889	52.6	8766
Burkina Faso, 2017/18	47.5	8588	49.5	8655
DR Congo, 2013	18.9	9825	45.3	11 214
Congo, 2011	48.5	5834	73.8	6429
Cote d'Ivoire, 2011	31.2	4914	43.4	5392
Cameroon, 2014	47.8	5633	64.8	6395
Egypt, 2014	85.6	10 371	83.5	11 447
Gabon, 2012	58.8	3805	69.2	4093
Ghana, 2014	65.5	4161	86.5	4272
Gambia, 2019	50.1	5741	80.7	5747
Guinea, 2018	33.9	4705	35.7	5383
Kenya, 2014	18.4	13 996	54.3	14 898
Comoros, 2012	63.6	1830	58.9	1730
Liberia, 2019	72.4	4167	86.7	4185
Lesotho, 2014	42.4	2468	74.8	2576
Mali, 2019	47.2	4869	43.1	6246
Malawi, 2015	26.1	13 194	51.0	13 389
Mozambique, 2011	15.4	7038	55.2	7516
Nigeria, 2018	24.6	16 398	57.3	21 465
Niger, 2013	29.1	12 938	33.2	15 290
Namibia, 2014	42.6	3790	80.2	3126
Rwanda, 2019	60.8	6036	47.6	6166
Sierra Leone, 2019	46.2	7249	89.7	6540
Senegal, 2019	63.4	4096	53.9	4306
Chad, 2014	44.5	6506	28.5	10 928
Togo, 2013	27.5	4650	55.5	5001
Tanzania, 2015	22.9	6914	49.7	7019
Uganda, 2016	30.4	10 061	60.1	10 219
South Africa, 2016	50.4	2858	80.6	2942
Zambia, 2018	38.0	7269	64.9	7305
Zimbabwe, 2015	40.4	4564	76.4	4823
Wealth quintile				
Poorest	36.1	49 020	46.4	59 915
Poorer	37.0	47 101	52.1	54 005
Middle	37.7	45 920	57.6	50 046
Richer	40.8	43 423	63.2	45 866
Richest	50.0	40 873	72.5	41 309
Highest education				
None	36.1	71 301	42.3	90 046
Primary	34.9	77 686	56.1	82 531
Secondary	46.9	67 272	73.7	68 577
Higher	61.4	10 046	87.8	9953

Table 1. Continued

	First trimester		>4 visits	
Characteristics	%	n	%	n
Age cohort (years)				
15–19	35.0	17 145	52.9	19 321
20–24	39.3	51 226	57.3	56 207
25–29	41.6	58 290	58.6	64 237
30–34	41.7	45 680	58.7	50 424
35–39	40.2	32 972	57.5	36 642
40–44	38.2	15 890	54.2	18 193
45–49	35.6	5134	50.4	6117
Residence				
Urban	45.7	81 132	69.4	84 167
Rural	36.9	145 205	51.1	166 974
Marital status				
Never in union	40.1	19 209	63.7	20 207
Married	40.1	150 947	55.9	169 465
Living with partner	40.8	39 217	59.5	42 952
Formerly in union/living with a man	37.6	16 964	57.0	18 517
Pregnancy intentions				
Wanted then	42.3	156 325	57.3	176 243
Wanted later	36.8	48 149	58.1	50 970
No more	36.9	14 553	55.1	16 036
Parity				
Nulliparous	41.4	1561	56.7	1772
Low multiparous	43.2	135 159	61.4	146 032
Grand multiparous	35.3	89 617	51.3	103 337
Total	40.0	226 337	57.2	251 141

Results

Descriptive results

Preceding birth intervals

Of the total of 290 816 involved in the surveys, 226 337 and 251 141 had usable records on the timing of their first ANC contact and the number of ANC visits, respectively. As shown in Table 1, more than 8 in 10 women across all 32 countries spaced their most recent birth by at least 24 months (24–35 months, 32%; ≥36 months, 51%) compared with about 16% of women who spaced their most recent birth by <24 months. The proportion of women who spaced their recent birth by ≥36 months ranged from 35% in Chad to 74% in Zambia.

ANC outcomes and background characteristics of women

The results (Table 1) on ANC attendance show that 4 in 10 women attended their first ANC within the first trimester of pregnancy, ranging from 18% in Kenya to 85% in Egypt. The mean number of ANC visits was 4.2, with the highest (8.9) and lowest (2.1) mean number of ANC visits observed in Egypt and Chad, respectively.

The results generally suggest improvements in ANC outcomes (ANC in the first trimester and ≥4 ANC visits) with increasing

Table 2. Mixed effects binary logistic regression on early (first trimester) ANC visits

	Model 1		Model 2	
Variables	OR	95% CI	OR	95% CI
Preceding birth interval (months)				
≤17	1	1 to 1	1	1 to 1
18–23	0.921**	0.875 to 0.970	0.929**	0.882 to 0.980
24–35	0.943*	0.901 to 0.987	0.959	0.915 to 1.004
>36	1.182***	1.131 to 1.236	1.106***	1.056 to 1.158
Wealth quintile				
Poorest			1	1 to 1
Poorer			0.980	0.951 to 1.010
Middle			0.930***	0.902 to 0.960
Richer			0.952**	0.921 to 0.985
Richest			1.142***	1.098 to 1.187
Highest education				
None			1	1 to 1
Primary			0.979	0.955 to 1.003
Secondary			1.444***	1.405 to 1.485
Higher			2.132***	2.009 to 2.262
Age cohort (years)				
15–19			1	1 to 1
20–24			1.050	0.966 to 1.140
25–29			1.219***	1.122 to 1.323
30–34			1.388***	1.277 to 1.509
35–39			1.436***	1.318 to 1.565
40–44			1.429***	1.306 to 1.563
45–49			1.337***	1.207 to 1.481
Residence				
Urban			1	1 to 1
Rural			0.882***	0.860 to 0.906
Marital status				
Never in union			1	1 to 1
Married			0.948*	0.899 to 1.000
Living with partner			0.990	0.937 to 1.047
Formerly in union/living with a man			0.874***	0.821 to 0.930
Pregnancy intentions				
Wanted then			1	1 to 1
Wanted later			0.879***	0.856 to 0.902
No more			0.900***	0.866 to 0.935
Parity				
Nulliparous			1	1 to 1
Low multiparous			0.959	0.729 to 1.260
Grand multiparous			0.695**	0.529 to 0.914
_cons	0.519***	0.494 to 0.544	0.571***	0.427 to 0.763
var(_cons[v021])	1.113***	1.093 to 1.134	1.088***	1.071 to 1.104
var(_cons[v012])				
N	177 009		171 329	

Exponentiated coefficients.
*p<0.05, **p<0.01, ***p<0.001.
Model 1, bivariate model; model 2, multivariate model.

Table 3. Mixed effects binary logistic regression on optimal (≥4 visits) ANC visits

Variables	Model 1 OR	Model 1 95% CI	Model 2 OR	Model 2 95% CI
Preceding birth interval (months)				
≤17	1	1 to 1	1	1 to 1
18–23	0.971	0.928 to 1.016	1.008	0.961 to 1.058
24–35	1.079***	1.037 to 1.123	1.162***	1.114 to 1.213
>36	1.480***	1.423 to 1.540	1.420***	1.361 to 1.482
Wealth quintile				
Poorest			1	1 to 1
Poorer			1.117***	1.087 to 1.148
Middle			1.198***	1.164 to 1.233
Richer			1.211***	1.173 to 1.249
Richest			1.244***	1.197 to 1.293
Highest education				
None			1	1 to 1
Primary			1.700***	1.662 to 1.738
Secondary			3.175***	3.087 to 3.265
Higher			6.334***	5.843 to 6.867
Age cohort (years)				
15–19			1	1 to 1
20–24			1.244***	1.155 to 1.340
25–29			1.476***	1.370 to 1.589
30–34			1.688***	1.565 to 1.820
35–39			1.813***	1.678 to 1.960
40–44			1.746***	1.610 to 1.894
45–49			1.732***	1.579 to 1.899
Residence				
Urban			1	1 to 1
Rural			0.690***	0.673 to 0.708
Marital status				
Never in union			1	1 to 1
Married			0.930**	0.882 to 0.982
Living with partner			0.999	0.944 to 1.057
Formerly in union/living with a man			0.867***	0.815 to 0.923
Pregnancy intentions				
Wanted then			1	1 to 1
Wanted later			0.938***	0.915 to 0.963
No more			0.865***	0.834 to 0.897
Parity				
Nulliparous			1	1 to 1
Low multiparous			1.123	0.875 to 1.441
Grand multiparous			0.903	0.704 to 1.160
_cons	0.940	0.878 to 1.007	0.497***	0.382 to 0.648
var(_cons[v021])			1.053***	1.044 to 1.062
var(_cons[v012])	1.029***	1.013 to 1.044		
N	198 839		192 652	

Exponentiated coefficients.
*$p<0.05$, **$p<0.01$, ***$p<0.001$.
Model 1, bivariate model; model 2, multivariate model.

preceding birth intervals. Regarding the timing of ANC contact, women who attended their first ANC within the first trimester of the index pregnancy increased from 37% among those with a preceding interval of ≤17 months to about 42% among those with a preceding birth interval of ≥36 months. A similar pattern was observed regarding the recommended minimum number of four ANC visits by women during their pregnancy. The proportion of women who reported to have had at least four ANC contacts during their most recent pregnancy increased from about 50% among those with a preceding birth interval of ≤17 months to 60% among those with a preceding interval of ≥36 months.

Variations in the two ANC outcomes were observed across background characteristics of women considered in the analysis. For instance, attendance of the first ANC within the first trimester increased from 36% among the poorest women to 50% among the richest women. Similarly, the proportion of women with four or more ANC visits increased from about 46% among the poorest women to about 73% in the richest group. The differences by education on both first trimester ANC contact as well as the number attained favoured better educated women (61% and 88%, respectively). Except for those 25–29 and 30–34 y of age, both the first ANC visit and number of ANC visits varied across all other age cohorts.

More urban (46%) than rural (37%) women attended their first ANC within the first trimester. The same was the case for the number of ANC visits (69% vs 51%). While the proportion of women who attained four or more ANC visits varied considerably by marital status, the proportion of women who attended their first ANC visit in the first trimester was similar across the marital categories apart from those formerly in unions. Regarding pregnancy intentions, most women who attended ANC in their first trimester of pregnancy wanted their most recent pregnancy at the time it occurred (42%), whereas those attending four or more ANC visits were mostly women who wanted their most recent pregnancy later (58%). Both the first ANC visit and the number of ANC visits were dominated by low multiparous women (43% and 61%, respectively).

Multivariate results

Birth spacing and first ANC contact

Our bivariate model in Table 2 shows some beneficial relationship between the preceding birth interval and the first ANC visit in the first trimester, and this is more significant with a birth interval of ≥36 months; women who spaced births by this duration were about 1.18 times ($p<0.001$) more likely to initiate the first ANC contact in the first trimester compared with those who spaced for <18 months. Adjusting for socio-economic factors, the benefits of long birth intervals decrease slightly (OR 1.106, $p<0.001$), but remain statistically significant.

Our analyses on other socio-economic predictors reveal their already known effects on ANC initiation. For instance, there is an upward improvement in early ANC initiation/contact with increasing household wealth. The likelihood of first trimester ANC initiation increases to approximately 14% for the fifth quintile women with reference to the first quintile. Similar effects are observed for formal education, where women with higher education are >100% (OR 2.13, $p<0.001$) inclined to seek ANC services in their first trimester compared with those without formal education. Age also has significant positive consequences on early ANC visits. In contrast, we observed significant negative effects of residence, marital status, pregnancy intentions and parity on early first ANC visits.

Birth spacing and optimal ANC utilization

Table 3 presents the models on preceding birth interval and optimal use of ANC services. We show that spacing births by ≥24 months has significant positive effects on the optimal number of ANC contacts. For example, women who reported an interval of 24–35 months (OR 1.08, $p<0.001$) and ≥36 months (OR 1.48, $p<0.001$) were more likely to comply with four or more visits. Controlling for model confounders, the magnitude of odds reduced slightly, but the statistical significance remains unchanged (Table 3).

Our estimation of the effect of other factors (socio-economic) on the optimal number of ANC visits follows the earlier pattern observed for timing of initiating the first contact. However, the magnitudes of the relationships are larger in these estimates. For example, a higher household wealth quintile increased the chances of optimal contacts by about twofold compared with the model on initiating the first visit. The effects of education are even stronger—women with more education are three times more likely to record optimal FANC compared with uneducated women.

Discussion

In this article we pooled DHS data from 32 African countries to examine how the preceding birth interval of women may affect their initiation of ANC visits within their first trimester of pregnancy and their attainment of an optimal number of ANC visits over the period of pregnancy. Our findings support earlier reports[25–27] that longer preceding birth intervals increase the probability of women both initiating ANC visits within their first trimester of pregnancy and obtaining an optimal number of ANC visits. Despite controlling for the impacts of other possible confounders, our study showed that women with preceding birth intervals >35 months were more likely to initiate ANC early (within the first trimester). These positive associations were even more pronounced when considering the WHO-recommended optimal number of four ANC visits for pregnant women. Here, our findings suggest that preceding birth intervals of at least 24 months are beneficial for attainment of at least four ANC visits.

One plausible interpretation for the overall positive consequence is that longer intervals allow women to better prepare for the next child/pregnancy and thus they are more motivated to utilize ANC services. In other words, any concerns about sibling competition, which characterizes shorter birth intervals, is reduced such that there is no younger child to care for, which has the potential of hindering the general personal management of women, including making time for ANC. Again, the findings could reflect some sociocultural connotations that may surround the length of preceding birth intervals of women; while delayed return to pregnancy/childbirth is often more acceptable, a rapid return to pregnancy following a preceding birth may be socially undesirable and embarrassing in some societies.[28] As such, women with longer preceding birth intervals may be more comfortable with any form of social and health interactions, including the use of prenatal interventions. Women with shorter birth intervals, particularly those not on post-partum contraception, may feet-drag in returning to the same provider for ANC. Also, with a long time lag between pregnancies, women may feel the need to attend ANC clinics to learn new trends in maternal and newborn care practices for improved outcomes. This is more plausible if the long interval was unintended, occasioned by prolonged resumption of conception or experiences of spontaneous abortion. Women in this category are likely to prioritise prenatal services with early initiation and subsequent increased use of services.

Regarding other factors, our findings reiterate the persistent weight of socio-economic factors on maternal and child health.[25] On the one hand, the benefits of timeliness and adequacy of prenatal visits are better understood and complied with as women become more educated.[29] On the other hand, wealth provides greater access to prenatal health services, especially continuity of ANC visits. The influence of financial resources on frequent ANC utilization[25] could explain why we found larger wealth effects on the optimal number of ANC visits. As previously established, we found pregnancy intentions (unwanted and mistimed) to have negative effects on both early initiation and adequacy of ANC. This could be due to several factors, including late detection, negative or low vulnerability perception and abortion contemplation by women who experience unintended pregnancies. We are presently unable to pinpoint any plausible explanation, but we know that pregnancy intentions do not remain fixed throughout the duration of a pregnancy. Intentions for these women probably changed based on emerging or new reproductive circumstances, triggering enhanced use of ANC services.

We acknowledge some limitations in this study, beginning with the usual disclaimer of non-causality in the use of cross-sectional surveys. Also, we did not account for the complex nature of the survey data. While it is an appropriate approach for single-country data analysis, some logistical and data constraints make this difficult in multicountry analysis. In multicountry analysis, weights must be de-normalized and new weights computed as a function of the total population of the sampled women at the time of the survey. Unfortunately, we could not obtain reliable national estimates of the population of women 15–49 y of age at the time of the survey for each country. Nonetheless, by designating a country as a random intercept in our models, we feel confident that the results closely reflect the composite picture as regards our variables of interests. Another limitation that we should state is that the dataset did not have questions on women's reasons for the duration of intervals. This constrains us from isolating the actual pathways through which birth spacing/intervals affects prenatal services utilization. That notwithstanding, we have attempted to offer some plausible trajectories through which the observed findings may be unfolding. Qualitative studies/mixed methods studies will be useful in unmasking the 'black box' fully.

Conclusions

This article highlights strong associations between birth spacing/interval and the timing and number of ANC visits. We conclude that encouraging long birth intervals (a minimum of 24 months) through increased use of contraceptives may contribute to efforts at improving the utilization of ANC services, which in turn may advance women and children's health.

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Ethical approval: We relied on publicly available secondary datasets. However, all the respective surveys received approval from relevant in-country ethics review bodies.

Data availability: Data used for this paper are publicly available and can be accessed here: https://dhsprogram.com/data/available-datasets.cfm.

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