CROSS-SECTIONAL STUDY

Bottle-Weaning Recommendations Among Pediatricians and Pediatric Dentists

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Abstract: ***Purpose:*** *The purpose of this study was to determine how pediatricians (MDs) and pediatric dentists (PDs) interpret professional associations' guidelines for weaning of bottle-fed infants and assess ensuing provider recommendations.* ***Methods:*** *A survey was sent to 11,479 MDs and PDs.* ***Results:*** *721 MDs and 1,005 PDs responded, yielding an overall response of 1,726 (15 percent). MDs (88 percent) and PDs (87 percent) responded that weaning is a transitional time period with both a start and a finish. Most MDs (76 percent) and PDs (62 percent) selected 12 and 15 months, respectively, for finishing weaning. Both MDs (91 percent) and PDs (89 percent) answered that complete bottle unavailability represented weaning cessation. MDs (71 percent) and PDs (84 percent) strongly agreed on importance for a pediatrician's weaning recommendations, with MDs more frequently giving recommendations (two to three visits) than PDs (one to two visits).* ***Conclusions:*** *Guidelines relating to bottle-fed infants are not uniformly understood by MDs and PDs. Bottle-weaning recommendations of MDs and PDs vary. There are well-documented risks of prolonged bottle use. Thus, development of clear, preventive guidelines that address the timely and complete removal of a bottle are warranted.* *(Pediatr Dent 2019;41(4):271-8.E53-E54) Received September 6, 2018 / Last Revision April 23, 2019 Accepted April 23, 2019*

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After birth, infants are fed breast milk or commercial infant formula as their primary source of nutrition. Eventually, milk or formula becomes inadequate for a child's nutritional needs and the introduction of complementary foods becomes necessary for sufficient growth and development requirements[1]. Weaning has been described as the transitional process from only milk or formula consumption through a progressive introduction of complementary family foods (solids) and liquids.[1-3] Historically, breast milk has been the exclusive source of nutrition for early infancy; however, formula (necessarily contained in a bottle) may serve for some as the sole[3,4] or partial source of sustenance; thus, an infant may be breastfed, bottle-fed or both. For an exclusively bottle-fed infant, the term weaning has also been used to describe the removal of bottle. Infants usually consume less breast milk or formula as their eating of solid foods and drinking from a cup increases.[5,6]

A considerable percentage of infants are bottle-fed beyond 12 months of age. Twenty-two percent of 24 month olds were bottle users (18.9 percent were bedtime bottle users and 10.5 percent were regular bottle users), according to a longitudinal study of 6,750 children by Gooze et al.[7] An analysis by Brotanek et al. using National Health and Nutrition Examination Survey (**NHANES**) III data of 2,121 children showed that only one-third ceased bottle use before 13 months.[8] Bonuck et al. examined NHANES III data of 3,027 children and demonstrated a mean age of bottle-weaning at 18.78 months and mean age for introducing solids at 5.79 months.[4] A study by Kaste and Gift indicated that 19.9 percent of children used a bottle at age 24 months and 9.3 percent bottle use at 36 months.[9]

Prolonged bottle-feeding has been shown to be associated with childhood overweight and obesity,[4,7,10] iron-deficiency,[8,11,12] early childhood caries,[9,13,14] and behavioral challenges related to bottle attachment.[15] Hispanic ethnicity, urban residence, low parental education, lack of dental visits in the past year,[9] and higher prevalence of iron deficiency among Mexican American children[8] were associated with prolonged bottle-feeding in toddlers. Therefore, the timely removal of a bottle as an aspect of infant feeding may be important to the overall health of a child.

Table 1 represents a review of professional associations' guidelines that demonstrates the contemporary and historical variability of ages for weaning.[5,13,16-21] Earlier resources generally suggest more explicit bottle-weaning instructions that were omitted from more recent versions. The 1997 *Guidelines for Health Supervision III*[21] contained detailed instructions on when to definitively discontinue bottle-feeding. The 2002 *Bright Futures*[20] indicates that a four-month-old should be able to fall asleep by himself without breast or bottle and specifically reject at-will drinking from the bottle during the day. The 2002 *Feeding Infants*[5] indicates a clear start and finish to bottle use. It also contains an extensive detailed description of "weaning from a bottle," remarking on the gradual nature of weaning and the risks of prolonged bottle use and suggesting to "totally wean babies off the bottle and onto a cup by 12 to 14 months of age." An explicit mention of an age to have finished bottle use was found in neither the 2008[18] nor 2017[6] editions of *Bright Futures*.

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Considering the variability of published weaning guidelines, health care providers may be unclear about best practices for weaning. Knowledge, interpretation, and implementation of guidelines related to bottle-fed infants by pediatricians (**MDs**) and pediatric dentists (**PDs**) may not be uniformly understood or established.

The purposes of this study were to: (1) determine how pediatricians and pediatric dentists interpret guidelines related to bottle-fed infants; and (2) assess their implementation of weaning recommendations. While educational, socioeconomic, social, and other considerations all contribute to complex infant-feeding practices,[22,23] it was not the aim of this study to address either breastfeeding or these other factors.

Methods

Study population. This study was reviewed by the Tufts Medical Center/Tufts Health Science Institutional Review Board, Boston, Mass., USA. Email addresses for practicing MDs and PDs in the United States or Canada were obtained from the American Academy of Pediatrics (**AAP**) and American Academy of Pediatric Dentists (**AAPD**). We reviewed an AAP "general pediatrics" membership list of approximately 63,770 and undertook a systematic sampling approach whereby survey invitations were sent to every tenth name on each state or province membership list. Physician pediatric specialties other than only "general" (e.g., subspecialties such as pediatric oncology and neurology) and residents/fellows were designed to self-exclude with the first survey question (see **Supplemental Electronic Appendix: Survey Questions**). Survey invitations were sent to 6,337 AAP members. We also obtained a panel of 5,142 AAPD members (approximately 82 percent of the eligible membership; the remaining 18 percent eligible members did not have email addresses) and sent survey invitations to all of these members, for a total of 11,479 emails sent with an invitation to participate in the study.

Questionnaire development. A literature review served as guide in developing survey questions, as previously published survey questions were not available. The survey consisted of demographic questions, bottle-weaning opinions/beliefs, and practice-based questions (Appendix). Six PDs or residents reviewed the survey for three criteria: (1) face validity; (2) content validity; and (3) reliability. For face validity, six pediatric dentists or residents reviewed the survey to ensure that questions were easily understood, simple, useful, and necessary. These individuals were not asked to complete the questionnaires but to offer their opinions on each question (whether they were comfortable answering the questions, had any trouble with the questions, and if they had any additional feedback). For content validity, six pediatric dentists or residents with knowledge of bottle-weaning were given the same survey and asked to rate the importance of each question using a five point Likert scale (five equals very important, four equals important, three equals moderately important, two equals of little importance, and one equals not important), and whether the questions should be included or excluded from the survey (zero equals exclude, one equals unsure, two equals include). For test-retest reliability, six PDs or residents were given the survey at two separate points in time, approximately two weeks apart. Any revisions needed after face, content, and reliability validation were made and submitted to the Institutional Review Board for review prior to administration of survey.

Due to the variability of definitions for weaning practices, it was challenging to design unbiased study questions. During pretesting methodology, it was found that having individual questions specify "bottle-weaning" may have been leading. Therefore, only a single initial parameter statement was included: "All questions refer to a normally developing healthy infant or child fed primarily by bottle (containing formula and/or breastmilk)." Furthermore, questions were designed to be common and suitable to both the AAP and AAPD professions'

Table 1. AGE RECOMMENDATIONS FOR BOTTLE-WEANING

Resource title	Year	Age to start (months)*	Age to finish (months)*	Page(s)
Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents (4th ed.)[6]	2017	6	No mention	162
Pediatric dentistry. Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies[13]	2017	No mention	12-18	60
Pediatrics: Maintaining and improving the oral health of young children. Policy statement[16]	2014	No mention	12	1226
Bright Futures in Practice: Oral Health—Pocket Guide (2nd ed.)[17]	2014	9-10	12-14	32, 44, 72
Bright futures: guidelines for health supervision of infants, children, and adolescents (3rd ed.)[18] and Pocket Guide[19]	2008	6, 9, or 12	12 or 15	362, 376, 390, 391, 392, 401, 403 (no mention in pocket guide)
Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents (2nd ed., rev)[20]	2002	4-6, 9, 12	12	85, 91, 95, 98, 115
Feeding Infants: A Guide for Use in the Child Nutrition Programs[5]	2002	6, 8, 12	12-14	35, 41, 61
Feeding Behaviors in Infancy and Early Childhood: Guidelines for Health Supervision III[21]	1997	6	12-15	47, 50, 53, 57, 65, 72

* Due to differing terminology, may be inferred by authors.

scope of general understanding. The 2014 AAP policy statement recommends weaning by 12 months of age, while the AAPD has recommended completion of bottle-weaning by 12 to 18 months of age (Table 1).

Data collection. An electronic version of the questionnaire (Appendix) was constructed using the online survey tool Qualtrics (Qualtrics, Provo, Utah, USA). The survey was composed of one qualifying, three demographic, and up to 11 knowledge and/or practice-based questions. The first knowledge-based question had either two or five subquestions, depending on the response. Age-based questions were designed to match recommended Bright Futures well-child medical visits.[18] As Bright Futures is endorsed by the AAP, board-certified pediatricians likely know these guidelines well. Initial invitation emails were sent by Qualtrics, with reminder emails sent to non-respondents seven and 14 days after the initial invitation. The survey was open for 21 days in September 2015. Survey recipients had the option with every email request to decline participating in the survey, and questions (except for the qualifying question) could be skipped. All responses were confidential and deidentified without IP address or link to email addresses. However, in order to send reminders to non-respondents, the Qualtrics program internally recorded who had responded, but these data were not accessible to researchers. Only nonidentifiable aggregated data were downloaded from Qualtrics. There was no compensation for completion. The final sample size was determined solely by recipients' decision to respond to the survey.

Statistical analysis. A sample size calculation was conducted using the statistical software package R (version 3.1.2; R Foundation for Statistical Computing, Vienna, Austria). The calculation determined that, with a sample size of N equals 278 within a given group (AAP or AAPD), the percentage of responses in each category could be estimated with a corresponding standard error of no more than three percent. Noting that the AAPD panel is 5,142 and assuming a 10 percent response rate, surveying these AAPD members yielded an expected sample size of 0.10 multiplied by 5,142 equals 514, thereby meeting (and exceeding) the desired sample size of 278 and thus exceeding the desired level of precision. The AAP general pediatrics membership is approximately 63,770; hence, inviting approximately 10 percent (or 6,377) of these AAP members to take the survey, and assuming a 10 percent response rate, yielded an expected sample size of 0.10 multiplied by 6,377 equals 637, again exceeding the desired level of precision. For all questions, this level of precision was indeed exceeded based on the obtained sample size.

Data were downloaded from Qualtrics and analyzed using SPSS Statistics 22.0 software (IBM Corp., Armonk, N.Y., USA). We computed descriptive statistics and comparisons between groups (MDs versus PDs). Nominal data were analyzed using the chi-square test (or Fisher's exact test in the case of sparse expected cell counts); ordinal data were analyzed using the Mann-Whitney U test. *P*-values less than 0.05 were considered statistically significant. Missing data were handled by pairwise deletion: for each analysis, all subjects with valid data for the variables pertinent to that analysis were included, even if those subjects were missing other variables not involved in the analysis at hand.

Table 2. PARTICIPANT CHARACTERISTICS

Characteristic	Pediatricians N (%)	Pediatric dentists N (%)	Total N (%)*
Board certification			
Yes	653 (92.4)	725 (72.6)	1,378 (80.8)
No	54 (7.6)	274 (27.4)	328 (19.2)
Length of practice (years)			
0-10	255 (36.2)	492 (49.2)	747 (43.8)
11-20	217 (30.8)	237 (23.7)	454 (26.6)
21-30	141 (20.0)	160 (16.0)	301 (17.7)
>30	92 (13.0)	111 (11.1)	203 (11.9)
Practice setting			
Private practice only	430 (60.8)	711 (71.2)	1,141 (66.8)
Academic institution only	122 (17.2)	53 (5.3)	175 (10.3)
Mostly private practice, part-time academic institution	52 (7.3)	144 (14.4)	196 (11.5)
Mostly academic, part-time private practice	9 (1.3)	40 (4.0)	49 (2.9)
Mostly (nonacademic) institutional or public health	51 (7.2)	31 (3.1)	82 (4.8)
Mostly or only military	3 (0.4)	6 (0.6)	9 (0.5)
Other	41 (5.8)	14 (1.4)	55 (3.2)

* The total was not the same for each variable/question due to missing responses.

Results

Response rates and participant characteristics. Responses were received from 721 MDs, yielding a response rate of 11.4 percent (721 out of 6,337). Responses were received from 1,005 PDs, yielding a 19.5 percent (1,005 out of 5,142) response rate. Total usable responses were 1,726 in the final analytic sample, yielding an overall 15.0 percent (1,726 out of 11,479) response rate. MDs comprised 41.8 percent of respondents, and 58.2 percent of respondents were PDs. Eighty-four percent of completed survey durations were seven minutes or less. Most respondents in both groups had been practicing less than 21 years and were in private practice (Table 2).

Bottle-weaning start and finish responses (Table 3). There was widespread agreement that weaning is a transitional period of time with both a start and a finish (MDs answer transitional weaning equal 88.4 percent and PDs equal 87.2 percent). When asked "At what approximate age do you recommend to start weaning?" there was a statistically significant difference in the distribution of responses ($P<0.001$), with 49.2 percent of MDs and 57.9 percent of PDs indicating 12 months. For an event marking weaning start, 52.0 percent of MDs indicated the introduction of a cup and 34.5 percent indicated the introduction of both solid food and cup, whereas 41.6 percent of PDs indicated the introduction of a cup and 43.9 percent indicated the introduction of both solid food and cup ($P<0.001$). Most MDs (80.6 percent) and PDs (82.5 percent) specified three months or less as the average weaning time period. We observed a significant difference ($P=0.038$) when MDs and PDs were asked "how long of an average time period do you recommend for weaning?" Approximately one-third of MDs (34.3 percent) and PDs (33.7 percent) said three months, while approximately one quarter of MDs (25.2 percent) and one-third of PDs (31.8 percent) said one to two

months. For age by which to finish weaning, we observed significant differences among the responses between PDs and MDs (P<0.001). The most common response from MDs was 15 months (40.7 percent), whereas the most common response from PDs was 12 months (33.0 percent). When asked for an event marking that weaning was finished, most MDs (90.8 percent) and PDs (88.7 percent) responded "neither daytime nor nighttime bottle use (complete unavailability of bottle)."

Bottle-feeding characteristics (Table 4). There was a diversity of responses indicating an age to sleep through the night without any feeding; MDs recommended an earlier age than PDs, and PDs were most likely to give no age (P<.001). When asked about recommending only water at night in a bottle, 79.1 percent of MDs and 96.6 percent of PDs answered affirmatively (P<0.001). Most MDs (78.3 percent) and PDs (72.3 percent) specified either 12 or 15 months for an age when complete unavailability of the bottle will be most easily achieved, with the largest percentage choosing 12 months (P=0.001). When asked at how many separate visits are weaning recommendations given, most MDs specified two or three while most PDs responded one or two (P<0.001).

Clinicians' interpretations (Table 5). Most MDs (70.7 percent) and PDs (84.1 percent) strongly agreed about the importance of a MDs to give weaning recommendations (P<0.001). However, there were a smaller percentage of MDs (55.0 percent) and PDs (57.8 percent) that strongly agreed

Table 3. RESPONSES OF PEDIATRICIANS AND PEDIATRIC DENTISTS: BOTTLE-WEANING START AND FINISH

Variable	Response	Group N (%) *		*P*-value †
		Pediatrician	Pediatric dentist	
Weaning is	A transitional period of time with both a start and a finish	612 (88.4)	860 (87.2)	0.178
	An approximate single starting point in time	26 (3.8)	29 (2.9)	
	An approximate single finishing point in time	43 (6.2)	86 (8.7)	
	Other	11 (1.6)	11 (1.1)	
Age to start weaning (months)	<6	6 (1.0)	4 (0.5)	<0.001
	6	54 (9.1)	33 (3.9)	
	9	169 (28.4)	142 (16.9)	
	12	293 (49.2)	485 (57.9)	
	15	22 (3.7)	28 (3.3)	
	18	3 (0.5)	17 (2.0)	
	>18	5 (0.8)	4 (0.5)	
	Do not recommend an approximate age to start weaning	43 (7.2)	125 (14.9)	
Weaning starts when	Cup (small, nospill training, or "sippy") has been introduced	306 (52.0)	345 (41.6)	<0.001
	Solid food has been introduced	27 (4.6)	89 (10.7)	
	Both solid food and cup have been introduced	203 (34.5)	364 (43.9)	
	Other	52 (8.8)	32 (3.9)	
Time period for weaning (months)	<1	118 (21.1)	130 (17.0)	0.038
	1-2	141 (25.2)	243 (31.8)	
	3	192 (34.3)	258 (33.7)	
	≥4	109 (19.5)	134 (17.5)	
Age to finish weaning (months)	<12	10 (1.6)	34 (3.8)	<0.001
	12	216 (35.2)	293 (33.0)	
	15	250 (40.7)	257 (28.9)	
	≥18	88 (14.3)	163 (18.4)	
	Do not recommend an approximate age to finish weaning	50 (8.1)	141 (15.9)	
When weaning is finished	Neither daytime nor nighttime bottle use (complete unavailability of bottle)	556 (90.8)	788 (88.7)	0.236
	No daytime bottle use, but bottle is used at night (limited use of bottle)	9 (1.2)	11 (1.2)	
	Time of bottle use not important, only that cup (small, nospill training, or "sippy") and/or solid foods have been introduced	29 (4.7)	65 (7.3)	
	Other	18 (2.9)	24 (2.7)	

* The total was not the same for each variable/question due to missing responses. Questions here are paraphrased for brevity; survey question and parameters are available in Appendix.

† *P*-value=the difference between groups (pediatricians or pediatric dentists) using chi-square test.

about the importance of pediatric dentists to give weaning recommendations. When asked for an opinion of whether there are clearly understandable guidelines for weaning we observed a wide array of contrasting responses within the two groups. We found a variety of responses for whether weaning implies introduction of solid food. MDs (91.3 percent) and PDs (87.7 percent) either strongly agreed or agreed that weaned implied complete unavailability of the bottle.

Discussion

Our survey indicates that, for a bottle-fed infant, both MDs and PDs predominantly recommended that weaning start at the age of nine to 12 months and finish by 12 to 15 months, with neither daytime nor nighttime bottle use (that is, complete unavailability of bottle). There was widespread agreement that weaning is a transitional period of time with both a start and a finish.

To the best of our knowledge, results of this nature have not been published since 1991, Koranyi et al.[24] Surveyed practitioners were asked whether there are clearly understandable guidelines for weaning, and there was a wide array of contrasting responses within the two groups, with less than half indicating any agreement. This finding is consistent with Sim et al.[25] and Chung et al.,[26] who noted that misunderstandings of providers and students over various guidelines can be obstacles to recommendations.

The great majority of both MDs and PDs strongly agreed on the importance of MDs to give weaning recommendations, and there is near unanimity if agreed responses are included. For both groups, there was less importance for PDs to give weaning recommendations, and MDs gave more frequent weaning recommendations than PDs. It may be that PDs are less likely to offer advice when they perceive that it may contradict the nutritional and feeding recommendations of MDs, and especially so when consistently unified guidelines are perceived as unavailable. Most MDs provided weaning recommendations over two or three visits, while most PDs gave them over one or two visits. The differences in responses from these two groups may be associated with differences in visit schedules. Well-child visits to MDs between six months and two years old are at nine months, 12 months, 15 months, 18 months, and two years. By contrast, visits to PDs are at six-month intervals during this time.

For a bottle-fed infant, only a small percent of provider responses indicated that weaning implied only introduction of solid foods, but rather, was also associated with introduction of a cup within a transitional period. Bright Futures[6] recognizes this transition as very individualized and recommends to introduce solid foods at six months. Bright Futures,[6] an AAP policy statement,[27] and World Health Organization Guidelines[28] support variations of "continuation of breastfeeding for one year or longer as mutually desired by mother and infant." It is possible that such statements relating to breastfeeding are conflated by some with exclusive bottle-feeding practices. However, the relation of breastfeeding with bottle supplementation (of either breast milk and/or formula) may be a challenge for associated advice.

A consistent recommendation among all reviewed sources was no bottle or cup use in bed for sleep time, but if a bottle was used in bed it should only contain water.[5,13,16-18,21] In this study, PDs were significantly more likely than MDs to recommend using only water at night in a bottle. However, MDs were more likely than PDs to mention an age by which to sleep through the night without any feeding, and MDs generally recommended earlier ages than PDs. There is a common occurrence of night waking at certain ages[6]; thus, parents may use the bottle inappropriately as a nighttime sleep aid which may contribute to prolonged[7] use of the bottle.

We have noted inconsistency of published weaning age recommendations (Table 1). Some

Table 4. RESPONSES OF PEDIATRICIANS AND PEDIATRIC DENTISTS: BOTTLE-FEEDING CHARACTERISTICS

Variable	Response	Group N (%) *		*P*-value†‡
		Pediatrician	Pediatric dentist	
Age for sleeping through the night without any feeding (months)	<6	105 (16.4)	52 (5.7)	<0.001†
	6	272 (42.5)	151 (16.6)	
	9	128 (20.0)	126 (13.8)	
	12	52 (8.1)	245 (26.9)	
	15	7 (1.1)	31 (3.4)	
	18	2 (0.3)	25 (2.7)	
	>18	1 (0.2)	6 (0.7)	
	Do not recommend an age for sleeping through the night without any feeding	73 (11.4)	275 (30.2)	
Do you recommend using only water in a bottle at night	Yes	497 (79.1)	875 (96.6)	<0.001†
	No	131 (20.9)	31 (3.4)	
Age when complete unavailability of bottle will be most easily achieved (months)	<6	2 (0.3)	5 (0.6)	0.001
	6	11 (1.7)	13 (1.4)	
	9	27 (4.3)	46 (5.1)	
	12	278 (43.8)	438 (48.5)	
	15	219 (34.5)	215 (23.8)	
	18	69 (10.9)	132 (14.6)	
	>18	22 (3.5)	40 (4.4)	
	Other	7 (1.1)	14 (1.6)	
Over how many separate visits do you give weaning recommendations	0	30 (4.7)	148 (16.4)	<0.001‡
	1	90 (14.1)	334 (37.1)	
	2	229 (35.9)	307 (34.1)	
	3	218 (34.2)	82 (9.1)	
	4	36 (5.7)	4 (0.4)	
	5	12 (1.9)	4 (0.4)	
	>5	22 (3.5)	21 (2.3)	

* The total was not the same for each variable/question due to missing responses. Questions here are paraphrased for brevity; survey question and parameters are available in Appendix.

† *P*-value=Fisher's exact test. ‡ *P*-value=chi-square test.

authors state or imply the term weaning as the introduction of: (1) a cup; (2) complementary solid foods/liquids; (3) a gradual reduction of bottle frequency use; or (4) a combination of any of these. Some use weaning as a clearly delineated age-based range in which to start and finish removal from exclusively breast milk and/or formula, with or without mention of a cup or complementary solid foods/liquids. Others may not use the term weaning at all and instead refer only to complementary foods. While some imply weaning as only a finishing age, others have no clearly stated finishing age and may offer only a range at which to start.

Table 5. RESPONSES OF PEDIATRICIANS AND PEDIATRIC DENTISTS: CLINICIANS' INTERPRETATIONS

Variable	Response	Group N (%)*		*P*-value†‡
		Pediatrician	Pediatric dentist	
It is important for a pediatrician to give weaning recommendations	Strongly agree	449 (70.7)	760 (84.1)	<0.001†
	Agree	164 (25.8)	122 (13.5)	
	Neither agree nor disagree	18 (2.8)	21 (2.3)	
	Disagree	3 (0.5)	1 (0.1)	
	Strongly disagree	1 (0.2)	0 (0.0)	
It is important for a pediatric dentist to give weaning recommendations	Strongly agree	344 (55.0)	521 (57.8)	0.168‡
	Agree	167 (26.7)	256 (28.4)	
	Neither agree nor disagree	89 (14.2)	93 (10.3)	
	Disagree	20 (3.2)	28 (3.1)	
	Strongly disagree	5 (0.8)	4 (0.4)	
There are clearly understandable guidelines for weaning	Strongly agree	90 (14.3)	103 (11.5)	0.607‡
	Agree	175 (27.7)	251 (28.0)	
	Neither agree nor disagree	189 (30.0)	279 (31.1)	
	Disagree	157 (24.9)	235 (26.2)	
	Strongly disagree	20 (3.2)	30 (3.3)	
Weaning implies introduction of solid food	Strongly agree	50 (7.9)	62 (6.9)	<0.001‡
	Agree	122 (19.4)	295 (32.9)	
	Neither agree nor disagree	161 (25.6)	288 (32.1)	
	Disagree	234 (37.2)	218 (24.3)	
	Strongly disagree	62 (9.9)	33 (3.7)	
Weaning implies introduction of a cup (small, nospill training or "sippy")	Strongly agree	179 (28.5)	167 (18.6)	<0.001‡
	Agree	315 (50.2)	498 (55.5)	
	Neither agree nor disagree	79 (12.6)	147 (16.4)	
	Disagree	40 (6.4)	70 (7.8)	
	Strongly disagree	15 (2.4)	16 (1.8)	
"Weaned" implies complete unavailability of bottle	Strongly agree	390 (62.0)	497 (55.1)	0.024‡
	Agree	184 (29.3)	294 (32.6)	
	Neither agree nor disagree	25 (4.0)	65 (7.2)	
	Disagree	26 (4.1)	38 (4.2)	
	Strongly disagree	4 (0.6)	8 (0.9)	

* The total was not the same for each variable/question due to missing responses. Questions here are paraphrased for brevity; survey question and parameters are available in Appendix.

† *P*-value using chi-square test. ‡ *P*-value using Mann-Whitney U test.

At five years old, Gooze et al. found that obesity was linked with prolonged bottle use.[7] Using a larger bottle volume size was related to significantly greater weight change, according to Wood et al.[29] Bonuck et al. found a three percent-associated greater risk of overweight with each month of delayed bottle-weaning[4]. 13.9 percent and 18.5 percent of two- to five-year-olds and two- to 19-year-olds, respectively, are obese.[30] Among infants and toddlers from birth to age two years, 8.1 percent were at or above the 95th percentile.[31] Providers are increasingly presented with young children who are overweight or obese and still using the bottle well past any guideline or recommended age.[4,7-9] Lack of guideline specificity may contribute to increasing childhood overweight/obesity, and there is strong evidence of overweight tracking from childhood into adulthood.[2,32] The risks of overweight or obesity for many respiratory, metabolic, and cardiovascular diseases have been documented elsewhere.[33]

This study's findings (within its design) suggest that, from the perspectives of MDs and PDs, a description of weaning could be similar to the following: Bottle-weaning for a normally developing healthy infant or child fed primarily by bottle (containing formula and/or breastmilk) is a transitional period of time with both a start and a finish. Bottle-weaning is started when both solid food and/or cup have been introduced at nine to 12 months old and finishes at 12 to 15 months old, with neither daytime nor nighttime bottle use (i.e., complete unavailability of bottle). Most practitioners believe that complete unavailability of the bottle will be most easily achieved by 12 to 15 months old.

It was not the aim of this study to address breastfeeding, except to clarify that, for purposes of the survey, breast milk could be contained in a bottle. There are instances where a health care provider could justifiably recommend prolonged bottle-feeding, but herein those circumstances were not intended to be considered, as indicated by our survey parameter statement. An important limitation is that the surveyed subjects are associated, at least via contact information, with professional societies who make guidelines; therefore, views that

may differentiate from the establishment may not be detected. Although the survey questions were validated, there may be questions that appear vague or double-barreled to the respondents. In addition, the response rate was relatively low. This study did not consider auxiliary personnel who, in some cases, may be giving (and clarifying) bottle-weaning advice on behalf of physicians and dentists. Furthermore, the survey was administered only to those with email addresses.

These are impactful results that emphasize the importance of revising current guidelines on the way MDs and PDs give recommendations for a bottle-fed child. As practitioners whose primary role is prevention of disease, we seem to confront a significant interpretation problem for weaning. Perhaps more recent guidelines are intentionally vague given ambiguity in the evidence base; however, given the risks of prolonged bottle use, such ambiguity may not be helpful. The following considerations are respectfully suggested as potentially beneficial for guideline authors:

1. Explicitly state an age by which the bottle should be completely unavailable.
2. Clarify recommendations against nighttime bottle (with emphasis on contents if nocturnal use is unavoidable) and age by which nighttime feeding of any type is inappropriate.
3. Clarify guidelines to distinguish the start and finish of bottle-weaning.
4. Elucidate terms (e.g., weaned, weaning, prolonged bottle use, and nighttime bottle use, bottle-weaning).
5. Communicate the benefits of weaning at an earlier age (e.g., behavior, taste/texture development, and future disease prevention).

It is imperative that health care professionals come to a clear consensus in order to make sound and consistent public health preventive guidelines for providers, parents, and caretakers. Duration of bottle use is a modifiable practice, and it is possible to decrease exposure to prolonged bottle use as a potential risk for disease.

The use of a bottle is multifactorial; thus, it may be difficult to conduct a prospective study using randomization or a placebo group. Nonetheless, some studies could be developed to further assess weaning and associated factors: conflation of advice for breast-fed and bottle-fed children, correlation of sugar-containing contents with cup introduction and awareness of recommended (e.g., juice) volume limitations, nocturnal waking and consoling feeding patterns potentially contributing to prolonged bottle-feeding, bottle volume size, alteration of taste/texture preferences into adolescence and adulthood associated with prolonged bottle use, dietary habits, and effect of parenting styles.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Guidelines related to bottle-fed infants are not uniformly understood by pediatricians and pediatric dentists. However, there are some shared perceptions of weaning, notably that it is a process defined by both a start and finish.
2. Bottle-weaning recommendations among MDs and PDs vary.
3. Given the well-documented risks of prolonged bottle use, development of clear preventive guidelines that address the timely and complete removal of a bottle from a bottle-fed child are warranted.

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Supplemental Electronic Appendix

Survey qualifying and demographic questions

A. *I am:*
- a. A practicing general pediatrician in the United States or Canada
- b. A practicing pediatric dentist in the United States or Canada
- c. Neither of the above; for example, I am one of the following: {if selected, Qualtrics will end survey}
  - — A medical doctor or dentist no longer practicing
  - — A medical doctor or dentist currently in my residency/fellowship in pediatrics
  - — A medical doctor or dentist with other than general pediatrics as my practicing specialty (e.g., pediatric oncology, pediatric neurology, family medicine)
  - — A practitioner primarily practicing outside of the United States or Canada
  - — Other

Aa. {This question only appears if answer A."a" selected above}
I am board certified in "General Pediatrics" by the American Board of Pediatrics (ABP)
- a. Yes
- b. No

Ab. {This question only appears if answer A."b" selected above}
I am board certified by the American Board of Pediatric Dentistry (ABPD)
- a. Yes
- b. No

B. *Number of years that you have been practicing after having completed pediatric residency/fellowship:*
- a. 0-10 years
- b. 11-20 years
- c. 21-30 years
- d. >30 years

C. *How would you best describe your practice setting?*
- a. Private practice only
- b. Academic institution only
- c. Mostly private practice, part-time academic institution
- d. Mostly academic, part-time private practice
- e. Mostly [nonacademic] institutional or public health
- f. Mostly or only military
- g. Other

Survey questions

Please select one answer per question; you may skip questions.

All questions refer to a normally developing, healthy infant or child fed primarily by BOTTLE (containing formula and/or breast milk).

1. *With which concluding statement do you most strongly agree? Weaning is...*
   - a. A transitional period of time with both a start and a finish
   - b. An approximate single starting point in time
   - c. An approximate single finishing point in time
   - d. Other, please specify: _____

1a. {This question only appears if answer 1. "a" or "b" selected above}
At what approximate age do you recommend to start weaning?
- a. <6 months
- b. 6 months
- c. 9 months
- d. 12 months
- e. 15 months
- f. 18 months
- g. >18 months
- h. Do not recommend an approximate age to start weaning

1b. {This question only appears if answer 1. "a" selected above}
From start to finish, how long of an average time period do you recommend for weaning?
- a. <1 month
- b. 1 month
- c. 2 months
- d. 3 months
- e. 4 months
- f. 5 months
- g. 6 months
- h. >6 months

1c. {This question only appears if answer 1. "a" or "b" selected above}
With what event do you believe weaning has started?
- a. cup (small, no-spill training, or "sippy") has been introduced
- b. solid food has been introduced
- c. both solid food and cup have been introduced
- d. Other, please specify: _____

1d. {This question only appears if answer 1. "a" or "c" selected above}
At what approximate age do you recommend to finish weaning?
- a. <6 months
- b. 6 months
- c. 9 months
- d. 12 months
- e. 15 months
- f. 18 months
- g. >18 months
- h. Do not recommend an approximate age to finish weaning

Survey continued on next page.

1e. {This question only appears if answer 1. "a" or "c" selected above} *With what event do you believe weaning is finished?*

a. neither day-time nor night-time bottle use (complete unavailability of bottle)
b. no daytime bottle use, but bottle is used at night (limited use of bottle)
c. time of bottle use not important, only that cup (small, no-spill training, or "sippy") and/or solid foods have been introduced
d. Other, please specify: _____

2. *On average, at how many separate visits for a single individual patient do you give weaning recommendations?*

a. 0
b. 1
c. 2
d. 3
e. 4
f. 5
g. >5

3. *At what approximate age do you recommend sleeping through the night without any feeding?*

a. <6 months
b. 6 months
c. 9 months
d. 12 months
e. 15 months
f. 18 months
g. >18 months
h. Do not recommend an age for sleeping through the night without any feeding

4. *If a parent indicates that a bottle is used at night, do you recommend using only water?*

a. Yes
b. No

5. *Assuming normal development, by what age do you believe complete unavailability of bottle will be most easily finished?*

a. <6 months
b. 6 months
c. 9 months
d. 12 months
e. 15 months
f. 18 months
g. >18 months
d. Other, please specify: _____

6. *Please check the most appropiate box for each statement*

Statement	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is important for a pediatrician to give weaning recommendations.	❍	❍	❍	❍	❍
It is important for a pediatric dentist to give weaning recommendations.	❍	❍	❍	❍	❍
There are clearly understandable guidelines for weaning.	❍	❍	❍	❍	❍
Weaning implies introduction of solid food.	❍	❍	❍	❍	❍
Weaning implies introduction of cup (small, no-spill training or "sippy").	❍	❍	❍	❍	❍
"Weaned" implies complete unavailability of bottle.	❍	❍	❍	❍	❍