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ARTICLE

Computer-Based Documentation: Effects on Parent-Provider Communication During Pediatric Health Maintenance Encounters

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What's Known on This Subject

CBD has been evaluated in various practice settings but not pediatric settings. In those studies, CBD did not affect communication adversely. Its impact when a parent is present, in addition to the patient, is unknown.

What This Study Adds

This study demonstrates no detrimental impact of CBD on parent-physician communication when it is used for pediatric health maintenance visits. The study supports the continued exploration of this technology in pediatric practice and identifies future areas of investigation.

ABSTRACT

OBJECTIVE. The goal was to investigate the impact of a computer-based documentation tool on parent-health care provider communication during a pediatric health maintenance encounter.

METHODS. We used a quasiexperimental study design to compare communication dynamics between clinicians and parents/children in health maintenance visits before and after implementation of the ClicTate system. Before ClicTate use, paper forms were used to create visit notes. The children examined were ≤18 months of age. All encounters were audiotaped or videotaped. A team of research assistants blinded to group assignment reviewed the audio portion of each encounter. Data from all recordings were analyzed, by using the Roter Interaction Analysis System, for differences in the open/closed question ratio, the extent of information provided by parents and providers, and other aspects of spoken and nonverbal communication (videotaped encounters).

RESULTS. Computer-based documentation visits were slightly longer than control visits (32 vs 27 minutes). With controlling for visit length, the amounts of conversation were similar during control and computer-based documentation visits. Computer-based documentation visits were associated with a greater proportion of open-ended questions (28% vs 21%), more use of partnership strategies, greater proportions of social and positive talk, and a more patient-centered interaction style but fewer orienting and transition phrases.

CONCLUSIONS. The introduction of ClicTate into the health maintenance encounter positively affected several aspects of parent-clinician communication in a pediatric clinic setting. These results support the integration of computer-based documentation into primary care pediatric visits. *Pediatrics* 2008;122:590–598

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Key Words
medical charts, patient-physician interaction, electronic health records, pediatrics, structured-reporting systems, computer-based documentation

Abbreviations
CBD—computer-based documentation
RIAS—Roter Interaction Analysis System

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RECENT ADVANCES IN electronic health record technology have enabled computer-based documentation (CBD) of patient encounters. Despite numerous studies supporting its utility,[1–14] concerns remain regarding the use of CBD during patient encounters. For example, the presence of computers in examination rooms adds a potential distraction to patient-physician encounters and, according to a study by Gadd and Penrod,[15,16] may lead to concerns about patient-physician rapport. The situation can be further complicated by the presence of ≥1 child in pediatric office visits. Before the more-widespread availability of this technology in ambulatory settings, clinicians wondered whether focusing on the computer to enter data would cause parents to feel distanced from the clinicians.[17] Two studies noted that patterns of communication (but not content) are affected by the use of computers during examinations.[18,19]

A recent Israeli study[20] examined the effect of CBD use by general practitioners on visit communication. The study found that visits were longer when physicians gazed at computer screens and were engaged in active keyboarding.

However, there was significantly less dialogue between physicians and patients. Specific effects of screen gazing were inhibition of physician psychosocial questioning and reduced emotional responsiveness. However, use of the keyboard increased biomedical exchange, including more questions about therapeutic regimens, more patient education, and more biomedical counseling. Patient disclosure of medical information to the physician also increased with greater physician keyboarding.

Although these results suggest that CBD may negatively affect some aspects of communication, other studies suggest no impact. Because neither group of studies focused on pediatric health care, their results may not apply to encounters with parents and young children. Our overall goal was to understand how CBD use affects the quality of parent-provider communication.

METHODS

Software

Study participants used a software program called ClicTate,[21] which was developed by one of the authors (Dr Johnson). ClicTate allows clinicians to create electronic visit summaries by using a combination of free-text data input and "point-and-click" input based on standard data-entry approaches found in Microsoft Windows (Microsoft, Redmond, WA) applications. ClicTate displays documentation templates based on health supervision guidelines recommended by the American Academy of Pediatrics for 12 age-specific time frames, ranging from the age of 2 weeks to adolescence.[22] The program allows a health care provider to complete a clinical note in any order. ClicTate then generates a natural-language summary of the encounter. Once the note is complete, the provider saves it and imports it into the electronic medical record. Previous studies with ClicTate showed a high level of usability,[21] with no impact on parent or provider satisfaction.[23]

Study Design

We used a quasiexperimental design to study communication dynamics between pediatric residents and parents/children during health maintenance visits. Communication was studied before and after ClicTate system implementation. The study took place in an urban, hospital-based, pediatric teaching clinic. The preimplementation (control) group consisted of parents and providers who completed health maintenance visits in the clinic before ClicTate was implemented. Providers in this group documented visits by using paper encounter forms. The postimplementation (CBD) group consisted of parents and providers who completed health maintenance visits in the clinic beginning 1 year after the introduction of ClicTate. The 1-year gap provided time for clinic staff members and patients to become comfortable with ClicTate. During the postimplementation phase, health care providers were encouraged but not required to use ClicTate during the encounter. If they chose not to do so, then they generated an encounter summary through computer data entry after the encounter.

Institutional review board approval was obtained for all parts of this study. All parents signed informed consent forms and were given the option to turn off recording equipment at any time. This option was not exercised by any parent during the study.

Study Participants

Pediatric residents at all levels of training were instructed in the use of ClicTate. Initial clinic sessions for first-year residents (and residents transferring from other facilities) focused on an introduction to pediatric health maintenance encounters, with a combination of hands-on care and close supervision. In addition, as was the case well before an electronic health record was introduced, faculty supervisors modeled proper interviewing techniques with specific patients during clinic sessions.

Fifty-nine of 65 residents agreed to participate in this study. One resident withdrew from the study (because of the time required to complete exit surveys), and 6 residents did not wish to participate. The nonparticipant group included members from all 3 years of residency.

Health maintenance visits were eligible if the child was ≤18 months of age, was being seen by a consenting primary provider, was accompanied by his or her English-speaking parent, and had not participated previously in the study during another visit. Each encounter was audiotaped; a subset of encounters was videotaped for assessment of nonverbal communication.

A total of 205 CBD encounters were audiotaped over 12 months, beginning in November, to allow sufficient time for participants to become experienced with the system. Tapes were collected in batches and submitted for interaction coding after all were collected, because of the needs of the coding team. Early in the coding phase, tape analysis revealed 2 recordings that were of Spanish-speaking parents with a translator present. These tapes were excluded. In addition, 15 tapes were of poor quality (parent or provider inaudible), 39 ended abruptly, and 15 could not be analyzed because of mechanical noise occurring throughout the recording. Of the 134 tapes that remained, 37 tapes were missing additional supporting documents (16 missing resident exit surveys, 17 missing parent consent forms, and 4 missing parent exit surveys), and 4 tapes were recorded for the provider who withdrew from the study. Therefore, 94 recorded encounters were eligible for interaction analysis. The visits were distributed uniformly across all ages at which health maintenance visits occur (2 weeks and 1, 2, 4, 6, 9, 12, 15, and 18 months).

Control group visits were chosen randomly from a data set obtained in a previous audiotape study evaluating a training intervention to increase discussions about injury prevention anticipatory guidance.[24] The original study was conducted in the same pediatric clinic, using the same patient age group and the clinic's pediatric residents. During that phase, as well as in the intervention phase, only visits conducted with parents or legal guardians were included. We selected 149 of those visits at random, to represent typical health maintenance visits. We are not aware of any significant changes in clinic processes since that period, except for the introduction

of computer technology in examination rooms in the final year of the control study.

Data Analysis

This study assessed the effect of ClicTate use on parent and health care provider communication. Our primary outcomes of interest were changes in questioning style (proportions of questions that were open-ended in control and study groups) and patient-centeredness (degree to which communication emphasized open-ended questions and facilitators, empathic statements, and statements related to the psychosocial dimensions of care). Previous work by Wissow et al[25] with similar study subjects, although in a different setting (emergency department), provided baseline rates of attentive listening (part of patient-centeredness) of 16% (SD: 6.7%) and supportive statements of 6% (SD: 3.3%). A sample size of 93 encounters was necessary to detect a 10% change in attentive listening, and a sample size of 183 encounters was necessary to detect a 10% change in supportive statements, with a 2-tailed α of .05 and power of 80%. Results were analyzed by using Stata software (Stata Corp, College Station, TX).

Roter Interaction Analysis System

Audiotapes and videotapes were scored by using the Roter Interaction Analysis System (RIAS), which provides detailed quantitative and descriptive information about communication dynamics of a visit. The RIAS is a standardized system for analysis of medical communication, broadly derived from the seminal work of Robert Bales.[26] It uses 40 mutually exclusive and exhaustive categories of communication and has codes for each category. RIAS coding is applied to patient and provider dialogues taken directly from audiotape or videotape. RIAS codes are broadly organized according to the 4 primary functions of a medical visit, namely, (1) data gathering, (2) patient education and counseling, (3) responding to patient emotion, and (4) patient activation and partnership.[27] The work presented here used a version of RIAS tailored for pediatric studies, which includes 2 additional pediatric subcategories of codes within data gathering and patient education and counseling. These subcategories reflect anticipatory guidance and are physical development and social development. Physical development codes include routine and problematic issues related to language, cognitive, motor, and self-help development. Social development includes routine and problematic issues related to parenting, peer relations, and child and adolescent behavior. Table 1 presents the codes and examples of dialogue. A full description of RIAS can be found elsewhere (www.rias.org).

In addition to the presentation of individual codes and groupings of codes described above, we calculated a single summarizing patient-centered score. Various RIAS-based patient-centeredness formulas have been reported in the literature[20,25,28–31]; although there are some differences in individual codes included in the numerator or denominator of a given calculation, all share the same general approach. For instance, Mead and Bower[28] used 2 different formulas in a single study, with only minor variations in outcomes.

A detailed discussion of patient-centered measures and their conceptual underpinnings was provided by Roter et al.[32] Briefly, physician communication behaviors that encourage patients to talk are common to most patient-centered assessment approaches. These include open-ended questions and facilitators, empathic statements, and statements related to the psychosocial dimensions of care. Communication that tends to restrict, to control, or to direct patients, such as closed-ended questions and instructions, is generally seen as physician-centered. Although most investigators would agree that patient provision of psychosocial information is consistent with conceptions of patient-centeredness and communication of the patient narrative, it can be argued that patients' biomedical disclosures, particularly in response to a series of physician-directed, closed-ended questions, reflect physician dominance in the exchange.

We calculated patient-centeredness scores by using the method described by Mead and Bower.[28] In their work, a patient-centered interaction was characterized by patient- or provider-initiated psychosocial, emotional, and patient-focused discourse, questions asked by patients, and counseling given to patients by providers. We summed all scores related to these types of interactions (all patient and physician psychosocial categories, including anticipatory guidance in the social domain, plus all patient and physician emotional talk categories plus patient questions plus physician counseling, including all anticipatory guidance). This sum was divided by all talk that was not patient-centered (physician closed-ended questions plus physician orientations plus patient biomedical information).

Extent of Computer Use

The extent of computer use among the ClicTate group was initially assessed by rating levels of active keyboarding. We had 4 initial categories, that is, (1) none or barely noticed, (2) light typing during some dialogue or during pauses, (3) moderate typing during most of the dialogue and pauses, and (4) heavy typing throughout the encounter. However, later analysis showed that these variables were highly skewed, and the categories were reduced to 2 levels, that is, very light (which included none and barely noticed; $n = 40$; 41%) and moderate/heavy use ($n = 54$; 59%). The latter group was dominated by moderate users ($n = 41$; 44%) over heavier ones ($n = 13$; 15%).

RESULTS

Characteristics of Groups and Visits

Table 2 outlines the characteristics of the control and CBD groups. The number of male physicians was higher in the CBD cohort (44% vs 29%; $P = .02$), and there were fewer first-year residents in the CBD cohort than in the control cohort (29% vs 42%; $P = .04$). Visit lengths averaged 5 minutes longer in the CBD group. However, as shown in Table 3, the proportions of talk and silence

TABLE 1 **Sample RIAS Coding Categories Within Primary Medical Visit Functions**

Visit Function	Communication Behavior	Example of Dialogue
Data gathering	Question asking, open-ended	
	1. Medical condition	1. What can you tell me about the rash?
	2. Therapeutic regimen	2. How is he in taking the medicine?
	3. Lifestyle and self-care	3. What do you do to keep yourself healthy?
	4. Psychosocial issues	4. How about the baby's father?
	5. Anticipatory guidance, physical	5. How is he getting around?
	6. Anticipatory guidance, social	6. How is the play group going?
	Question asking, closed-ended	
	1. Medical condition	1. Does it seem to hurt him?
	2. Therapeutic regimen	2. Did you start him on the antibiotic?
	3. Lifestyle and self-care	3. Are you still smoking?
	4. Psychosocial issues	4. Is his father home?
	5. Anticipatory guidance, physical	5. Is he drinking from a cup yet?
	6. Anticipatory guidance, social	6. Does he play with any friends?
Patient education and counseling	Information-giving	
	1. Medical condition	1. His ear looks infected.
	2. Therapeutic regimen	2. I want him to get that test.
	3. Lifestyle and self-care	3. We have a moms' group here.
	4. Psychosocial issues	4. Be sure you get enough sleep.
	5. Anticipatory guidance, physical	5. He has started talking in sentences.
	6. Anticipatory guidance, social	6. Most kids that age play alongside others, not with them.
	Counseling	
	1. Medical condition and therapeutic regimen	1. Now that he's stable, lets think about how to get him on a more regular schedule.
	2. Lifestyle and psychosocial counseling, including problems of daily living, social relations, feelings, and emotions.	2. It is always tough when you're a single parent.
	3. Anticipatory guidance, physical and social	3. Give him time; he sounds like he's getting ready to start talking.
Building a relationship	Positive talk	
	Agreements, jokes, approvals, and laughter	1. You look great today!
		2. Yes, this is a good idea.
	Negative talk	
	Disagreements, disapproval, criticisms, and corrections	1. I don't think it worked at all.
		2. No, you gave me the other medicine last time.
	Social talk	
	Nonmedical chit-chat	Did you see the Titans last night?
	Emotional talk	
	1. Concern	1. I'm worried.
	2. Reassurance	2. I'm sure it will get better.
	3. Empathy-legitimating	3. It must be very hard.
	4. Partnership	4. I'll be with you all along.
	5. Self-disclosure	5. My own son went through this too.
Activating and partnering	Facilitating	
	1. Asking for patient opinions	1. How do you feel about trying this medicine first? What do you make of it? Do you follow me?
	2. Asking for patient understanding	2. You said it did seem to get better, right?
	3. Checking through paraphrases and interpretation	3. So, it sounds like you do see progress.
	4. Using back-channels	4. Uh-huh, right, go on, hmm.
Procedural talk	Orientation and transition	1. Get him up on the table.
		2. First I want to take a look and then we'll talk about the test results.
		3. Take this to the receptionist.
		4. Oh, so . . . .
		5. Well, now . . . .

were similar in the 2 types of visits, as measured by verbal density (control: 18.6 utterances per minute; CBD: 18.7 utterances per minute). A total of 243 encounter summaries were analyzed. The primary diagnoses varied widely and included acute conditions (otitis media and diarrhea) and items that were typical for well-child care visits, with or without chronic illnesses (eczema, sickle cell disease, and developmental delay).

Overall Communication

Types and frequencies of parent-provider interactions are shown in Tables 3–5. We found no difference in the provider/parent talk ratio between the cohorts after controlling for visit length. Parents and providers spoke approximately the same amounts in the various domains examined. However, the open/closed question ratio overall was higher in the CBD group (CBD: 28% open-

TABLE 2 **Control and CBD Group Characteristics**

	Control	CBD	*P*
Sample size, *N*	149	94	NS
Resident (PGY 2–3), *n* (%)	87 (58)	67 (71)	NS
Intern (PGY 1), *n* (%)	62 (42)	27 (29)	.042
Male provider, *n* (%)	43 (29)	41 (44)	.019

NS indicates not significant; PGY, postgraduate year.

ended; control: 21% open-ended; F = 6.3; $P = .002$). Furthermore, the proportion of open anticipatory guidance questions was much higher during CBD visits (CBD: 30%; control: 13%; F = 7.3; $P = .001$). Alternatively, orientation questions (transition statements, instructions, and directions) occurred more often during control visits (37 vs 28 utterances per visit; $P < .001$). After controlling for the proportion of physician speaking time between control and CBD periods, CBD visits were associated with greater use of partnership strategies (F = 26.5; $P = .001$). Patient-centeredness was highest during CBD visits with heavy use of CBD and lowest during control visits (F = 10.5; $P = .001$).

TABLE 3 **Control and CBD Cohort Communication Dynamics**

Category	*n*	Mean ± SD	ANOVA		
			F	*df*	*P*
Total utterances, no. per encounter					
Control	149	548 ± 241			
Low	40	588 ± 245	6.4	242	.002
High	54	691 ± 277			
Provider total utterances, no. per encounter					
Control	149	300 ± 129			
Low	40	339 ± 136	6.7	242	.002
High	54	376 ± 144			
Parent total utterances, no. per encounter					
Control	149	247 ± 127	5.1	242	.007
Low	40	248 ± 138			
High	54	314 ± 150			
Length of visit, min					
Control	149	27 ± 10			
Low	40	32 ± 10	6.6	242	.002
High	54	34 ± 10			
Density of doctor talk, utterances per min					
Control	149	11 ± 3			
Low	40	11 ± 4	0.5	242	.63
High	54	11 ± 3			
Density of patient talk, utterances per min					
Control	149	9 ± 3			
Low	40	8 ± 3	3.0	242	.05
High	54	9 ± 4			
Overall talk density, utterances per min					
Control	149	20 ± 6	1.8	242	.17
Low	40	18 ± 5			
High	54	20 ± 6			
Patient-centeredness score[a]					
Control	149	2.1 ± 0.7			
Low	40	2.5 ± 0.9	10.5	242	.001
High	54	2.8 ± 1.3			
Open/closed question ratio					
Control	148	0.2 ± 0.1			
Low	40	0.3 ± 0.2	6.3	242	.002
High	54	0.3 ± 0.2			

Control, encounter using paper-based documentation (during or after visit); low, encounter using computer-based documentation but with little typing/clicking during the visit; high, encounter using computer-based documentation extensively during the visit. *P* values were adjusted for repeated measures.

[a] Calculated on the basis of the sum of all patient and physician psychosocial categories plus all patient and physician emotional talk categories plus patient questions plus physician counseling, divided by the sum of physician closed-ended questions plus physician orientations plus patient biomedical information.

TABLE 4 **Control and CBD Interaction Domains: Provider Talk**

Category	*n*	No. of Utterances per Encounter, Mean ± SD	ANOVA		
			F	*df*	*P*
Open/closed anticipatory guidance					
Control	146	0.1 ± 0.2			
Low	39	0.3 ± 0.2	7.3	238	.001
High	53	0.3 ± 0.7			
Development counseling					
Control	149	28 ± 24			
Low	40	32 ± 27			
High	54	28 ± 28	0.3	242	.73
Lifestyle counseling					
Control	149	2 ± 4	1.2	242	.32
Low	40	1 ± 3			
High	54	3 ± 5			
Medical counseling					
Control	149	11 ± 10	1.4	242	.26
Low	40	10 ± 10			
High	54	14 ± 18			
Social development counseling					
Control	149	0.6 ± 4.0	8.4	242	.001
Low	40	4.8 ± 11.2			
High	54	1 ± 3.6			
All doctor questions					
Control	149	47 ± 23	0.5	242	.61
Low	40	48 ± 20			
High	54	50 ± 18			
Doctor biomedical questions					
Control	149	33 ± 18	0.002	242	.99
Low	40	33 ± 16			
High	54	33 ± 14			
Doctor psychosocial questions					
Control	149	11 ± 8	1.1	242	.34
Low	40	11 ± 8			
High	54	13 ± 9			
Doctor medical questions					
Control	149	36 ± 18	0.002	242	.99
Low	40	38 ± 17			
High	54	38 ± 14			
All anticipatory guidance					
Control	149	23 ± 12	0.62	242	.54
Low	40	26 ± 14			
High	54	24 ± 10			

Patient Education and Counseling

Table 4 shows associations between CBD visits and patient education/counseling dialogue. Visits associated with low CBD use had significantly more anticipatory guidance regarding social development than did other visits (low CBD use: 4.8 utterances per encounter; control: 0.65 utterances per encounter; $P < .001$) but had approximately the same amount of conversation related to anticipatory guidance in other areas (physical development, lifestyle, and medical counseling).

TABLE 5 Control and CBD Interaction Domains: Parent Talk

Category	*n*	Proportion of Total Parent Talk, Mean ± SD, %	ANOVA		
			F	*df*	*P*
Parent giving information about anticipatory guidance					
Control	149	22 ± 10	3	242	.05
Low	40	25 ± 11			
High	54	21 ± 9			
Parent questions					
Control	149	2 ± 2	2.5	242	.08
Low	40	2 ± 2			
High	54	2 ± 1			
Parent giving biomedical information					
Control	149	12 ± 9	0.22	242	.81
Low	40	13 ± 8			
High	54	12 ± 8			
Parent emotional statements					
Control	149	23 ± 6	1.7	242	.19
Low	40	21 ± 6			
High	54	23 ± 6			
Parent partnership statements					
Control	149	1 ± 1	0.42	242	.66
Low	40	1 ± 1			
High	54	1 ± 1			
Parent positive statements					
Control	149	25 ± 7	2.7	242	.07
Low	40	22 ± 6			
High	54	26 ± 7			
Parent social chit chat					
Control	149	1 ± 1	2.5	242	.09
Low	40	1 ± 1			
High	54	1 ± 2			
Parent disagreements and criticisms					
Control	149	0 ± 1	3.7	242	.03
Low	40	1 ± 0			
High	54	0 ± 1			
Parent orientations and transitions					
Control	149	2 ± 2	26.5	242	.001
Low	40	1 ± 1			
High	54	1 ± 1			
Uninterpretable utterance					
Control	149	3 ± 3	5.2	242	.006
Low	40	5 ± 4			
High	54	3 ± 4			
Parent psychosocial talk					
Control	149	9 ± 7	0.88	242	.42
Low	40	8 ± 6			
High	54	10 ± 7			

Responding to Patient Emotions

As shown in Table 4, CBD providers engaged in more social conversation than did their counterparts during control visits (F = 7.8, *df* = 242; *P* = .001.) There was a trend toward a significant difference in the amounts of emotional and positive (reinforcing) statements in CBD and control visits.

Parent Dialogue

Table 5 summarizes parent dialogue during control and CBD visits. After controlling for all parent conversation, low CBD-use visits were associated with the highest rate of anticipatory guidance information giving by parents (*P* = .05). During CBD visits, parents made fewer orienting statements; otherwise, there were no significant differences between the groups.

TABLE 6 Nonverbal Interactions

Characteristic	Proportion, %		*P*
	Control (*n* = 9)	CBD (*n* = 28)	
Chair facing patient	97	92	.53
Body leaning toward patient	8	19	.08
Body leaning toward doctor	4.6	5.5	.67
Eye contact with patient	56	51	.45
Eye contact with doctor	64	60	.58
Physician using mouse/keyboard	3.5	27	.003
Physician writing	18	7	.006
Physician using medical chart	9	11	.53

Nonverbal Interactions

Table 6 characterizes nonverbal interactions during control and CBD encounters. In general, apart from obvious differences in computer use versus writing, there were no significant differences in nonverbal communication between the 2 cohorts.

DISCUSSION

The use of a computer in an examination room during a routine pediatric visit presents opportunities and challenges for delivering care. This study is the first one examining the impact of CBD in that environment. It demonstrates some potential value in CBD, including improved use of open-ended questions, more dialogue about anticipatory guidance, and perhaps better responsiveness to patients, as exhibited by greater amounts of social development counseling. Other improvements included increased partnership-building and a trend toward more use of positive and emotional speech by providers. Parent dialogue also changed, with more anticipatory guidance discussion and a trend toward asking more questions. This last characteristic might have resulted from the higher number of open-ended questions in the CBD cohort. Visits associated with CBD were more patient-centered. This quality might have been attributable in part to the increase in open-ended questions associated with the templates provided by ClicTate. This result was substantiated by parent satisfaction data reported previously by our group.[23] For example, parents in the CBD group were more likely to agree that their physician encouraged them to talk about worries (adjusted odds ratio: 2.1). In that study, physicians perceived that they acted "less bossy" (adjusted odds ratio: 0.33), although they also thought that they did not explain issues and plans as well (adjusted odds ratio: 0.2).

The challenges of CBD also were evident in this study. CBD visits were, on average, 5 minutes longer, even after >6 months of continuous use. In addition, the fact that there was a "light-use" group indicates that many providers might have used alternative documentation

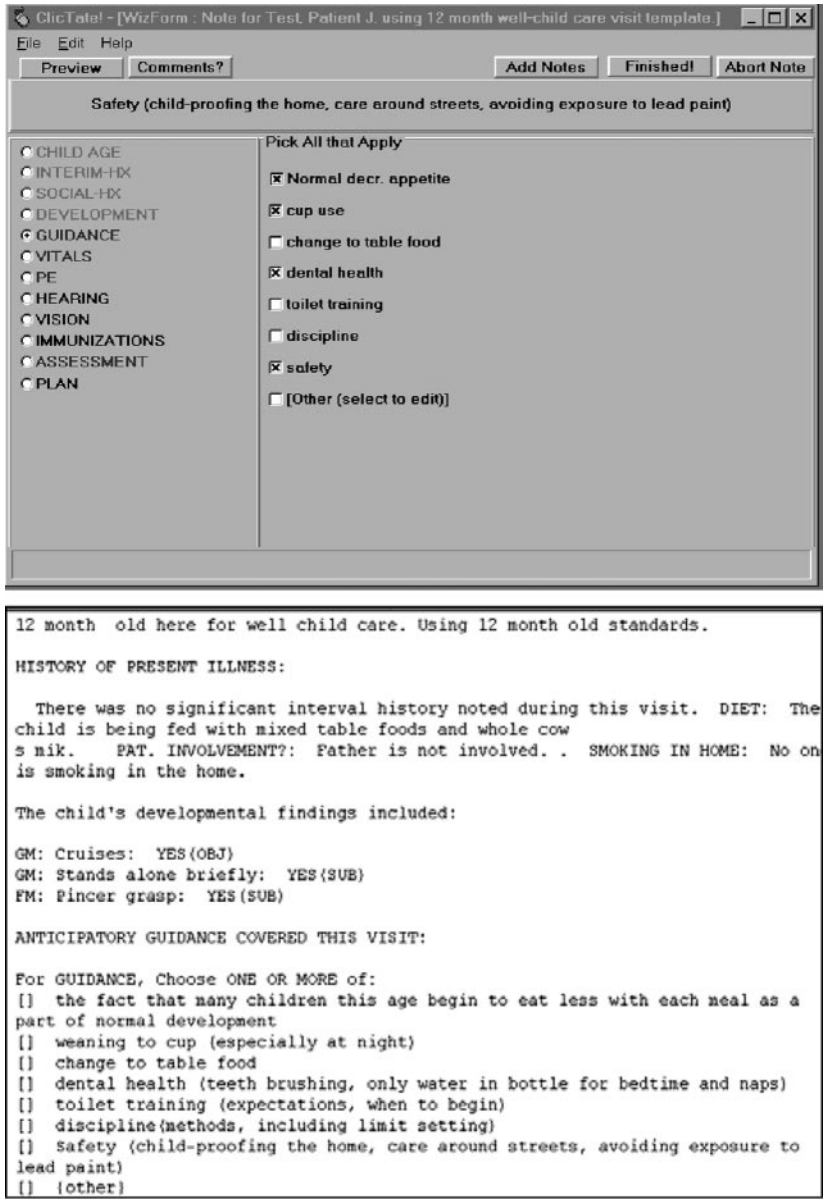

FIGURE 1
Screen image of a session with ClicTate and a preview of a note generated with ClicTate. Incomplete sections of the note contain prompts.

strategies during visits and transcribed notes into the system afterward. If this process is occurring, as was suggested in a previous study using CBD in this environment,[23] we could be underestimating the time impact of CBD in a setting with variable adoption but with mandatory entry of notes into an electronic system without scanning.

A few of our results were surprising. For example, ClicTate, like most CBD tools, provides prompts designed to improve visit completeness. Because these prompts are typically constructed with categorical responses, as shown in Fig 1, providers might be expected to ask more closed-ended questions. In fact, the opposite occurred. It is possible that, in an effort to maintain eye contact, providers glanced at the screen and formed a question around a key word being displayed. For example, when glancing at 5 questions pertaining to safety measures, they might have asked a more-general question so that they could listen and record responses, rather than going through each specific question. This theory presents a wonderful opportunity for evaluation in subsequent studies of CBD.

Studies by Greatbatch et al,[17] Patel et al,[33] and Rouf et al[34] noted a correlation between electronic health record experience and comfort integrating data capture with data recording. The current study focused on younger, less-experienced, health care providers (pediatric residents), who might be expected to choose a data-recording practice that minimizes their discomfort during an encounter. If the residents had been required to complete their documentation during visits, it is possible that our results would be more aligned with those of Warshawsky et al,[18] who noted a reduction in overall interactions. There also are data suggesting improvements in encounter quality when standardized, guided, documentation templates are used in areas other than pedi-

atric health maintenance. For example, Shiffman et al[1] noted improved adherence to asthma guidelines when providers used a personal digital assistant with specific tools for documenting and treating asthma exacerbations. Fielstein et al[35] demonstrated similar improvements in the quality of disability examinations for veterans. These results are complemented by our findings, in which communication quality was enhanced, rather than worsened, with the use of structured documentation templates at the point of care.

Another important difference between this study group and those described previously is the integration of a curriculum that teaches appropriate physician-parent interactions. Our control and CBD cohorts used similar curricula, taught by faculty members with the same levels of experience. However, the ability of providers to incorporate proper interviewing skills in an examination room containing a computer (even if it is used only to view information) may provide a better level of competency in using health information technology with patients. The impact of baseline skills and the potential to improve the effective use of computers in the examination room was described recently by Frankel et al[36] and is supported by our findings, which represent the interactions of a group with high baseline skill levels and malleable work habits. Given the current trend toward an increase in technology adoption, additional studies should be conducted to determine how best to provide training that incorporates good interviewing techniques with use of state-of-the-art electronic evidence and tools for data capture. Some health care systems have begun to include course matter on information technology in practice for their staff members, in conjunction with electronic health record training. A recent post on the Wall Street Journal Health Blog emphasizes this point, as noted by Michael Hochman, a medical resident in Boston, "Apologize to the patient at the start of the visit for turning away to face the computer. And at the end of the visit, turn away from the computer, face the patient and go over everything."[37]

There are several limitations to this study. First, because it used a before/after study design, there might be unmeasured confounders, including changes in the diagnostic acuity of patients enrolled in the clinic, that accounted for the differences we found. However, we would anticipate that patients in the CBD group would represent more-complex cases, given the nature of primary care medicine. In addition, the control group consisted of residents being studied for assessment of the quality of their injury prevention counseling, and it is possible that any awareness of this objective could have positively influenced the quality of their interactions with parents. Both of these limitations would have negatively affected the communication style in our CBD group, relative to the control group, which was not the case. It is possible that, without these limitations, the results would have favored CBD-based communication more dramatically. We have tried to avoid any notion of causality in this article. Second, the size of our sample was limited because of technical difficulties with a single tape recorder that produced random noise, thereby rendering analysis of some of our samples impossible. This event occurred randomly during the 2 years of the study and should not have biased our sample. Although we had sufficient power to assess our main hypotheses (open-ended question style and patient-centeredness), we had insufficient power to explore many details about many other types of information exchanged, relative to, for example, the age of the child. This question is an important one that deserves additional study, because the developmental stage of the child affects the ease with which parents and providers communicate and also changes the dynamics of the interaction (older children may be asked questions directly during encounters). Finally, the study population focused on residents in training at 1 academic medical center, which limits the generalizability of specific findings. However, we anticipated that residents might have more difficulty with interactions, given their relative lack of experience. The fact that our findings demonstrated many higher-quality interactions associated with CBD use suggests that we should have less concern about more-experienced clinicians adopting this technology.

CONCLUSIONS

This study addresses how using documentation tools during a patient encounter affects communication between providers and parents. The use of CBD during pediatric health maintenance encounters was not associated with a negative impact on the quality of physician-parent interactions; rather, we found that CBD use was associated with an increase in the patient-centeredness of interactions and a greater proportion of open-ended questions. These results should provide some reassurance to those who may have concerns about these issues, and they provide a basis for additional pediatric research. Moreover, these results support continued adoption of CBD, with additional study to assess the impact of CBD on visits with older children and adolescents, as well as in urgent care settings.

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